N00164.AR.002200
NSA CRANE
5090.3a

DRAFT FINAL TIER II SAMPLING AND ANALYSIS PLAN FOR SOLID WASTE MANAGEMENT UNIT 34 (SWMU 34) OLD GUN TUB STORAGE LOT AT NSA CRANE IN (DRAFT FINAL ACTING AS FINAL VERSION)

06/01/2012

TETRA TECH INC

DRAFT- FINAL

Tier II Sampling and Analysis Plan
for
SWMU 34 – Old Gun Tub Storage Lot
at

NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

Naval Facilities Engineering Command Midwest
Great Lakes, Illinois

Contract Number N62470-08-D-1001

Contract Task Order F27R

June 2012

Title and Approval Page

(UFP-QAPP Manual Section 2.1)

DRAFT- FINAL
TIER II SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
June 2012

SOIL CHARACTERIZATION INVESTIGATION FOR

OLD GUN TUB STORAGE LOT
NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

Prepared for:
Naval Facilities Engineering Command Midwest
201 Decatur Avenue, Building 1A
Great Lakes, Illinois 60088

Prepared by:
Tetra Tech, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406
610-491-9688

Prepared under:
Comprehensive Long-term Environmental Action Navy
Contract No. N62470-08-D-1001
Contract Task Order F27R

Review Signatures:

T. E. Johnston 6-6-12
Tom Johnston, PhD/CLEAN Quality Assurance Manager/Date
Tetra Tech, Inc.

Anthony P. Klimek June 6, 2012
Tony Klimek/Project Manager/Date
Tetra Tech, Inc.

Approval Signatures:

Tom Brent/Remedial Project Manager/Date

NAVFAC Chemist/Date
NAVFAC QA Review

Title and Approval Page

(UFP-QAPP Manual Section 2.1)

DRAFT
TIER II SAMPLING AND ANALYSIS PLAN
(Field Sampling Plan and Quality Assurance Project Plan)
April 2012

SOIL CHARACTERIZATION INVESTIGATION FOR

OLD GUN TUB STORAGE LOT
NAVAL SUPPORT ACTIVITY CRANE
CRANE, INDIANA

Prepared for:
Naval Facilities Engineering Command Midwest
201 Decatur Avenue, Building 1A
Great Lakes, Illinois 60088

Prepared by:
Tetra Tech, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406
610-491-9688

Prepared under:
Comprehensive Long-term Environmental Action Navy
Contract No. N62470-08-D-1001
Contract Task Order F27R

Review Signatures:

Tom Johnston, PhD/CLEAN Quality Assurance Manager/Date
Tetra Tech, Inc.

April 3, 2012

Tony Klimek/Project Manager/Date
Tetra Tech, Inc.

Approval Signatures:

Tom Brent/Remedial Project Manager/Date

NIELSEN.JANICE.L.1069943540 Digitally signed by NIELSEN.JANICE.L.1069943540
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USN, cn=NIELSEN.JANICE.L.1069943540
Date: 2012.06.06 07:41:47 -04'00'

NAVFAC Chemist/Date
NAVFAC QA Review

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) has prepared this Sampling and Analysis Plan (SAP) that encompasses Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) requirements for the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the Old Gun Tub Storage Lot (OGTSL) - Solid Waste Management Unit (SWMU) 34 at Naval Support Activity (NSA) Crane, Crane, Indiana. This SAP was prepared under Contract Task Order (CTO) F27R, Contract N62470-08-D-1001, Comprehensive Long-term Environmental Action Navy (CLEAN).

This SAP complies with applicable United States (U.S.) Department of the Navy (Navy), U. S. Environmental Protection Agency (USEPA) Region 5, and Indiana Department of Environmental Management (IDEM) requirements, regulations, guidance, and technical standards. This includes the Department of Defense (DoD), Department of Energy (DOE), and USEPA Intergovernmental Data Quality Task Force (IDQTF) environmental requirements regarding federal facilities.

The organization, project management, objectives, planned activities, measurement, data acquisition, assessment, oversight, and data review procedures associated with the planned investigations at SWMU 34 are documented in this SAP. Protocols for sample collection, handling and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are also addressed.

The primary purpose of the RFI described in this SAP is to better define the extent of site-related chemical contamination that has previously been detected in soil at SWMU 34 and quantify any associated risks that would result from exposure of human or ecological receptors to this contamination. The RFI will include the collection and analysis of surface and subsurface soil samples. These samples will be collected to provide data for use in human health and ecological risk screening and potentially for risk assessment, if necessary. This information will also be used in the remedial decision making process.

The sampling strategy for SWMU 34 is to collect and analyze only surface and subsurface soils, because potential contaminant releases would have been limited to the soil and the majority of residual soil contamination is expected to have remained at shallow depths. The soil samples will be analyzed for potentially site-related constituents. This requires analysis of samples for selected metals and polycyclic aromatic hydrocarbons (PAHs). In addition, it requires that some soil samples from SWMU 34 be analyzed for polychlorinated biphenyls (PCBs) and semivolatile organic compounds (SVOCs).

Investigation procedures will comply with site-specific field Standard Operating Procedures (SOPs), and laboratory analytical procedures will comply with the Department of Defense Quality Systems Manual for Environmental Laboratories (DOD QSM), version 4.1, April 2009. The field work and sampling are scheduled to begin in July 2012.

Field activities under this SAP will be conducted in accordance with the site-specific Health and Safety Plan (HASP) to be prepared for these activities.

SAP Sections **Page No.**

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

°C	Degree Celsius
%D	Percent Difference or Percent Drift
%R	Percent Recovery
BERA	Baseline Ecological Risk Assessment
bgs	Below Ground Surface
CA	Corrective Action
CAS	Chemical Abstract Service
CLEAN	Comprehensive Long-term Environmental Action Navy
COPC	Contaminant of Potential Concern
CMS	Corrective Measures Study
CSM	Conceptual Site Model
CTO	Contract Task Order
DAF	Dilution Attenuation Factor
DL	Detection Limit
DoD	Department of Defense
DOE	Department of Energy
DPT	Direct-Push Technology
DQI	Data Quality Indicator
DQO	Data Quality Objective
DU	Decision Unit
DVM	Data Validation Manager
Eco SSL	Ecological Soil Screening Level
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
ERA	Ecological Risk Assessment
ERSM	Environmental Restoration Site Manager
EU	Exposure Unit
FD	Field Duplicate
FOL	Field Operations Leader
FSP	Field Sampling Plan
FTMR	Field Task Modification Request
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
GEL	General Engineering Laboratories, LLC

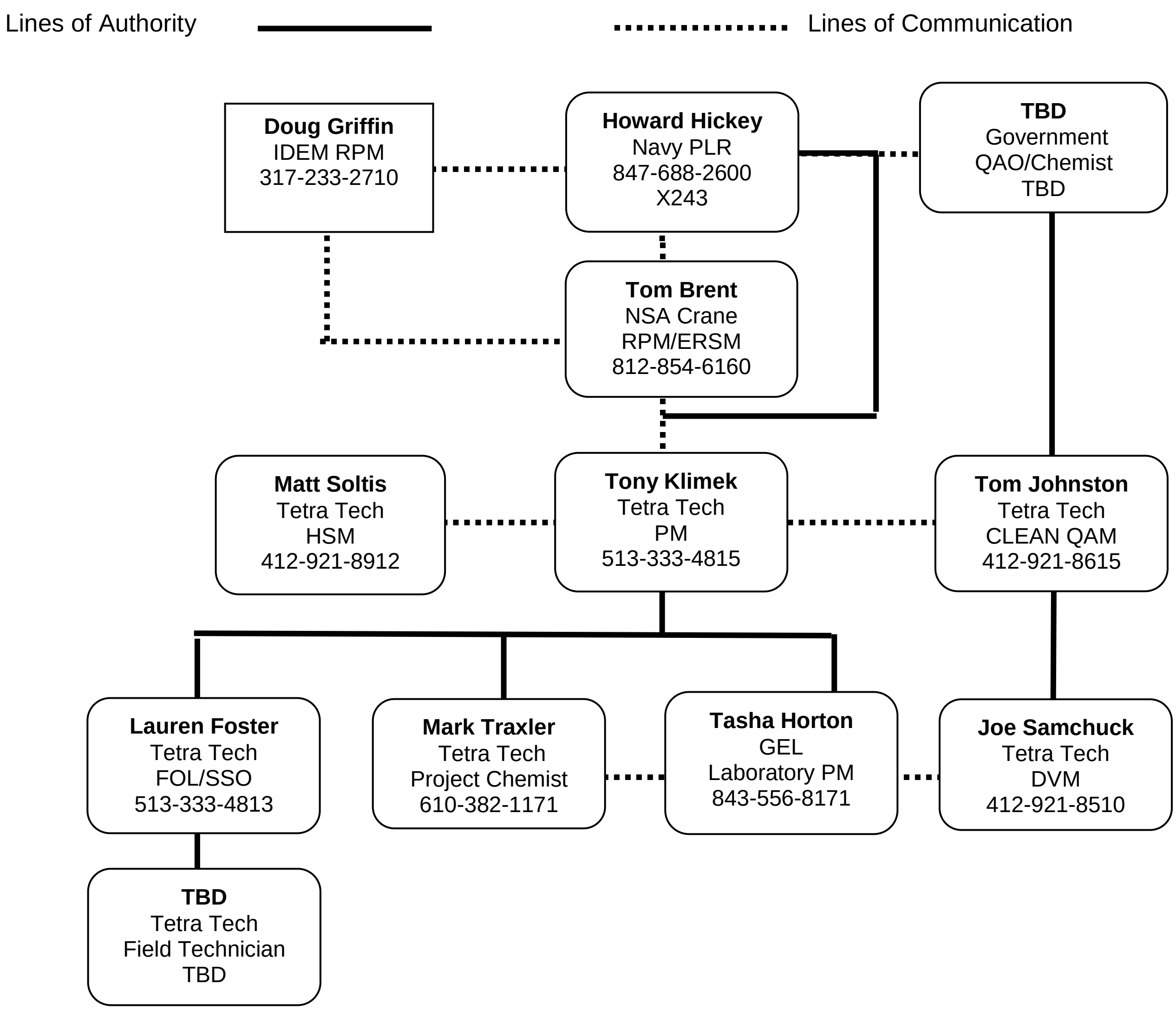
GPS	Global Positioning System
HASP	Health and Safety Plan
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
HSM	Health and Safety Manager
ICAL	Initial Calibration
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma - Mass Spectroscopy
I-DCL	Industrial Default Closure Level
IDEM	Indiana Department of Environmental Management
IDQTF	Intergovernmental Data Quality Task Force
IDW	Investigation-Derived Waste
ILCR	Incremental Lifetime Cancer Risk
IS	Internal Standard
IUPPS	Indiana Underground Plant Protection Services
LANL	Los Alamos National Laboratory
LBGR	Lower Bound of the Gray Region
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LLC	Limited Liability Corporation
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUC	Land Use Control
MCL	Maximum Contaminant Level
MD	Matrix Duplicate
mg/kg	Milligram per Kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not Applicable
NAD	North American Datum
NAVFAC	Naval Facilities Engineering Command
Navy	U. S. Department of the Navy
NC	No Criteria
NEDD	NIRIS Electronic Data Deliverable
NFA	No Further Action
NIRIS	Naval Installation Restoration Information Solution
NR	No Results

NSA	Naval Support Activity
OGTSL	Old Gun Tub Storage Lot
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
oz	Ounce
PAH	Polycyclic Aromatic Hydrocarbon
PAL	Project Action Limit
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PQLG	Project Quantitation Limit Goal
PSL	Project Screening Level
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
R5 ESL-S	USEPA Region 5 Ecological Screening Level, Soil
RBSSL	Risk-Based Migration-to-Groundwater Soil Screening Level
RCRA	Resource Conservation and Recovery Act
R-DCL	Residential Default Closure Level
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
R-RSL	Residential Regional Screening Level, Soil Direct Contact
RSD	Relative Standard Deviation
RT	Retention Time
SAP	Sampling and Analysis Plan
SIM	Selected Ion Monitoring
SLERA	Screening-Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SPCS	State Plane Coordinate System
SSL	Soil Screening Level
SSO	Site Safety Officer

SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TBD	To Be Determined
Tetra Tech	Tetra Tech, Inc.
U.S.	United States
USEPA	United States Environmental Protection Agency
UTL	Upper Tolerance Limit
VSP	Visual Sample Plan

1.0 -- Project Organizational Chart

(UFP-QAPP Manual Section 2.4.1 – Worksheet #5)



DVM Data Validation Manager

ERSM Environmental Restoration Site Manager

FOL Field Operation Leader

HSM Health and Safety Manager

IDEM Indiana Department of Environmental Management

LLC Limited Liability Corporation

NAVFAC Naval Facilities Engineering Command

NSA Naval Support Activity

PLR Product Line Representative

PM Project Manager

QAM Quality Assurance Manager

QAO Quality Assurance Officer

RPM Remedial Project Manager

SSO Site Safety Officer

TBD To Be Determined

Tetra Tech Tetra Tech, Inc.

GEL General Engineering Laboratories, LLC

2.0 -- Communication Pathways

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

The communication pathways for the Sampling and Analysis Plan (SAP) are shown below.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Regulatory Agency Interface	IDEM PM U.S. Department of the Navy (Navy) RPM	Doug Griffin Tom Brent	317-233-2710 812-854-6160	The Navy RPM will contact the regulatory agency via phone and/or e-mail within 24 hours of recognizing an issue whenever issues arise.
Field Progress Reports	Tetra Tech FOL Tetra Tech PM	Lauren Foster Tony Klimek	513-333-4813 513-333-4815	The Tetra Tech FOL will contact the Tetra Tech PM on a daily basis via phone, and every 1-2 days summarizing progress via e-mail.
Gaining site access	Tetra Tech FOL NSA Crane ERSM	Lauren Foster Tom Brent	513-333-4813 812-854-6160	The Tetra Tech FOL shall contact the NSA Crane ERSM verbally or via e-mail at least 3 days prior to commencement of field work to arrange for access to the site for all field personnel.
Obtaining utility clearances	Tetra Tech FOL	Lauren Foster	513-333-4813	The Tetra Tech FOL shall contact the Indiana Underground Plant Protection Services (IUPPS) verbally or via e-mail at least 3 days prior to commencement of field work to complete a utility clearance ticket for the areas under investigation.
Stop Work due to Safety Issues	Tetra Tech FOL/SSO Tetra Tech PM Tetra Tech HSM Navy RPM/ERSM	Lauren Foster Tony Klimek Matt Soltis Tom Brent	513-333-4813 513-333-4815 412-921-8612 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), the NSA Crane ERSM, and the identified Project Team members within 1 hour (verbally or by e-mail). If a subcontractor is the responsible party, the subcontractor PM must inform the Tetra Tech FOL

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
				within 15 minutes, and the Tetra Tech FOL will then follow the procedure listed above.
SAP Changes prior to Field/ Laboratory work	Tetra Tech FOL/SSO Tetra Tech PM Navy RPM/ERSM	Lauren Foster Tony Klimek Tom Brent	513-333-4813 513-333-4815 847-688-2600 x243 812-854-6160	The Tetra Tech PM will document the proposed changes via a Field Task Modification Request (FTMR) form within 5 days and send the Navy RPM a concurrence letter within 7 days of identifying the need for change if necessary. SAP amendments will be submitted by the Tetra Tech PM to the Navy RPM and NSA Crane ERSM for review and approval. The Tetra Tech PM will send scope changes to the Project Team via e-mail within 1 business day.
SAP Changes in the Field	Tetra Tech FOL/SSO Tetra Tech PM Navy RPMERSM	Lauren Foster Tony Klimek Tom Brent	513-333-4813 513-333-4815 812-854-6160	The Tetra Tech FOL will verbally inform the Tetra Tech PM on the day that the issue is discovered. The Tetra Tech PM will inform the Navy RPM and the NSA Crane ERSM (verbally or via e-mail) within 1 business day of discovery. The Navy RPM will issue a scope change (verbally or via e-mail), if warranted. The scope change is to be implemented before further work is executed. The Tetra Tech PM will document the change via an FTMR form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathway To/From, etc.)
Field Corrective Actions	Tetra Tech PM Tetra Tech QAM Navy RPM	Tony Klimek Tom Johnston Tom Brent	513-333-4815 412-921-8615 812-854-6160	The Tetra Tech QAM will notify the Tetra Tech PM verbally or by e-mail within 1 business day that the corrective action has been completed. The Tetra Tech PM will then notify the Navy RPM (verbally or by e-mail) within 1 business day.
Analytical Corrective Actions	GEL Laboratory PM Tetra Tech Project Chemist Tetra Tech DVM Tetra Tech PM Navy RPM	Tasha Horton Mark Traxler Joseph Samchuck Tony Klimek Tom Brent	843-556-8171 610-382-1171 412-921-8510 513-333-4815 812-854-6160	The Laboratory PM will notify (verbally or via e-mail) the Tetra Tech Project Chemist within 1 business day of when an issue related to laboratory data is discovered. The Tetra Tech Project Chemist will notify (verbally or via e-mail) the DVM and the Tetra Tech PM within 1 business day. Tetra Tech DVM or Project Chemist notifies Tetra Tech PM verbally or via e-mail within 48 hours of validation completion that a non-routine and significant laboratory quality deficiency has been detected that could affect this project and/or other projects. The Tetra Tech PM verbally advises the – Navy RPM within 24 hours of notification from the Tetra Tech Project Chemist or DVM. The Navy RPM takes corrective action appropriate for the identified deficiency. Examples of significant laboratory deficiencies include data reported that has a corresponding failed tune or initial calibration (ICAL) verification. Corrective actions may include a consult with the Navy QAO/Chemist.

3.0 -- Project Planning Session Participants Sheet

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

Project Name: Soil Characterization Investigation **Projected Date(s) of Sampling**: Spring/Summer 2012 **Project Manager**: Tony Klimek	**Site Name**: Solid Waste Management Unit (SWMU) 34 – Old Gun Tub Storage Lot (OGTSL) **Site Location**: Crane, Indiana

Date of Session: December 13, 2011
Scoping Session Purpose: Data Quality Objective (DQO) Scoping Meeting

Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
Tom Brent	RPM/ERSM	NSA Crane	812-854-6160	thomas.brent@navy.mil	Management
Doug Griffin	RPM	IDEM	317-233-2710	dgriffin@idem.in.gov	State RPM
Ralph Basinski	Crane Activity Coordinator	Tetra Tech	412-921-8308	ralph.basinski@tetratech.com	Management /Oversight
Tony Klimek	PM	Tetra Tech	513-333-4815	tony.klimek@tetratech.com	Management
John Trepanowski	Program Manager	Tetra Tech	610-382-1532	john.trepanowski@tetratech.com	Project Management
George Ten Eyck	Project Geologist	Tetra Tech	513-333-4822	george.teneyck@tetratech.com	Technical Support
Lauren Foster	Project Scientist	Tetra Tech	513-333-4813	lauren.foster@tetratech.com	Technical Support

Note: Tetra Tech prepared a conceptual site model (CSM), problem statement, and outline of the DQO process for SWMU 34 - OGTSL in preparation for the DQO Scoping Meeting. NSA Crane ERSM (Tom Brent) reviewed the documents prior to the meeting and copies were distributed to all meeting attendees.

Comments/Decisions:

The Navy has identified the need to obtain the following data to complete human health and ecological risk assessments and prepare a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for SWMU 34:

- SWMU 34 - OGTSL. At least 50 surface soil samples and 20 subsurface soil samples will be collected. Depending on sample location, analysis will include various combinations of select low level polycyclic aromatic hydrocarbons (PAHs), select metals, polychlorinated biphenyls (PCBs), and semi-volatile organic compounds (SVOCs).
- Data must be validated. Additional detail needs to be collected before completing the Human Health Risk Assessment (HHRA) and the Ecological Risk Assessment (ERA). Screening against risk-based criteria will be the basis for data evaluation. A RFI will be prepared to summarize the findings.

Action Items:

- Tetra Tech will prepare a draft and final Tier II SAP.
- Tetra Tech will prepare a draft and final Health and Safety Plan (HASP).

Consensus Decisions:

- Subsurface soil samples will be from a two-foot interval between 2 feet below ground surface (bgs) and bedrock, which is expected to be less than 10 feet bgs.
- Two surface soil samples near the location of a surface soil sample collected during a previous investigation that showed a PCBs concentration of 4.09 milligrams per kilogram (mg/kg) will be analyzed for PCBs. The sample locations will be adjusted slightly to better correlate with the original location.

4.0 -- Conceptual Site Model

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

This section presents general background information about SWMU 34 – OGTSL (site) and a CSM that describes potential contamination routes and possible exposure pathways. This CSM served as the basis for developing the sampling and analysis program.

4.1 PHYSICAL SITE DESCRIPTION

NSA Crane is located in the southern portion of Indiana, approximately 75 miles southwest of Indianapolis, 60 miles northwest of Louisville, Kentucky, and immediately east of Burns City and Crane Village, Indiana. NSA Crane encompasses approximately 62,463 acres or approximately 98 square miles of the northern portion of Martin County and smaller portions of Greene, Daviess, and Lawrence Counties. A location map of the NSA Crane facility is shown on Figure 4-1.

SWMU 34 is an open area in the north-central portion of NSA Crane (Figure 4-2). As shown on Figure 4-3, the site is roughly L-shaped. The east-west leg is approximately 900 feet long and 200 feet wide, and the north-south leg is approximately 700 feet long and 150 feet wide. The site is approximately six acres and is covered by gravel and grassed areas. As shown on Figure 4-4, the site is located on a topographic ridge and slopes down from the center in all directions. The hillsides located below the site are wooded and steep; runoff from SWMU 34 drains into the valleys adjacent to the site. Access is from two gravel roads that extend to the site from the west and southwest.

There are no permanent structures located on the site. The closest man-made structures are Buildings 3032 and 3226. Building 3032 is an active dog kennel located just west of the site. Building 3226 is located approximately 200 feet southwest of the site.

The site was, and continues to be, used as an outside storage facility. There were trailers, empty dumpsters, and other containers stored throughout the east-west leg of the site in the Autumn of 2011.

There are also separate piles of material in the woods just outside the cleared area used for storage – Pile A and Pile B. Pile A is located on the northeast corner of the site; it consists of a small pile of gravel (less than 10 feet in diameter and 18 inches high) and an adjacent area covered with gravel, the gravel appears to have been pushed or dumped in its current locations. Pile B is approximately 8 feet wide, 25 feet long and 2 feet high; it is a row of four adjacent piles of soil and gravel material that appears to have been dumped in their current locations.

SWMU 34 was divided into five subareas: Decision Unit (DU) 1 and DU 2, and three areas outside the DUs - the area around Building 3032 (Kennel Area), Pile A, and Pile B. As shown on Figure 4-4, the east-west leg of the site is DU 1, the north-south leg of the site is DU 2, the Kennel Area is located west of DU 2, Pile A is located northeast of DU 1, and Pile B is located northwest of DU 2.

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 generally mimics topography and is assumed to flow north, east, and south away from the site. Depth to groundwater at SWMU 34 is unknown, but based on similar sites at NSA Crane it is estimated to be approximately 20 feet bgs.

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. Most of NSA Crane is forested, including the areas to the north, east and south of the site. 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 SWMU 34. The nearest residence is located more than four miles to the west of the site, beyond the western boundary of the facility.

4.2 SITE HISTORY

SWMU 34 was primarily used for the outdoor storage of containers and equipment, including gun tubs which were used to house large caliber guns on Navy ships. Some of the containers and equipment were stored for long periods of time and were thus exposed to the elements and subject to weathering.

Storage at the site has varied. A brief summary of the history based on aerial photography is summarized below:

- **Figure 4-5 – 1952 Aerial Photo.** The west side of the east-west leg was used for storage. The north-south leg and the east side of the east-west leg were cleared but vacant.
- **Figure 4-6 - 1958 Aerial Photo.** Storage on the east-west leg was expanded to the east. The north-south leg and the far east side of the east-west leg remained vacant. Some of the adjacent wooded areas appeared to have been cleared.
- **Figure 4-7 – 1966 Arial Photo.** Storage was throughout the site except for the northeast area of the east-west leg.
- **Figure 4-8 – 1974 Aerial Photo.** There appeared to be storage throughout the site; however, due to the resolution of the photograph, storage on the site was not readily distinguishable.

- **Figure 4-9 – 2005 Aerial Photo.** Storage on the east-west leg was limited to the east end. Storage on the north-south leg included contractor trailers. During this period, construction contractors stored construction supplies in the trailers in the northern half of the north-south leg. The dog kennel (Building 3032) and fenced area are visible west of the site.

According to the NSA Crane Historian, storage during the 1950s and early 1960s consisted of combat ready materials (e.g., vehicles, bomb trailers, weatherproof containers of various hardware, light and heavy gun mounts, etc.). Gun tub storage began during the Vietnam era of the late 1960s. Gun tub storage ceased in 2001, when the gun tubs were dismantled and sold for scrap metal.

The site continues to be used for miscellaneous storage. Currently, empty metal dumpsters are being stored in the southeast area of the site. Tractor trailers were also stored in the central area of the east-west leg in April 2011, but were not present in June 2011. Security dogs from the nearby kennel are exercised and trained on the site. The origin and content of the material in Piles A and B are unknown.

4.3 PREVIOUS INVESTIGATIONS

Some limited surface soil sampling and analysis has been performed on the east-west leg of the OGTSL in 2002, 2005, and 2011. No surface soil samples were collected from the north-south leg. No groundwater samples have been collected from the site. Because of the ridge top topography, there are no streams or water bodies in the vicinity, therefore, no sediment or surface water samples have been collected from the site.

Twelve surface soil samples, including a field duplicate sample, were collected in July 2002 by NSA Crane personnel. Soil sampling locations were distributed across the east-west leg of SWMU 34 as shown on Figure 4-10. The samples were analyzed for potentially site-related SVOCs, PCBs, cadmium, chromium, and lead. There were sporadic detections of SVOCs at trace levels. Cadmium, chromium, and lead were also detected in the samples. Aroclor-1260 (a mixture of individual PCB congeners) was detected at a concentration of 4.09 mg/kg in one sample, which was located in the north-central area of the east-west leg of SWMU 34. Although the exact location of the PCBs detection is unknown, its general location is shown on Figure 4-10 at Sample Location 07. No planning document was prepared for this sampling and the data were not validated; therefore, it is not known whether the data are accurate representations of site conditions. Chemical analysis detection limits were also higher in 2002 than those currently achievable, which prevents readily comparing the results to more current data.

As described in the following paragraphs, analytical data from the 2005 and 2011 sampling is presented in Table 4-1 for all chemicals detected in at least one sample. Pages 1 and 3 of Table 4-1 are 2005 results plus data for one sample from 2011; pages 2 and 4 are 2011 results. Table 4-1 also includes a comparison of the analytical data to screening criteria, with black highlight indicating an exceedance of the corresponding screening value. Pages 1 and 2 compare the data to current risk-based criteria protective of human residents (labeled "HHRA"). Pages 3 and 4 compare the data to current risk-based ecological criteria (labeled "ERA"). The HHRA and ERA values shown in Table 4-1 are presented with references in **Section 9.0.**

In 2005, an Environmental Indicator Report was prepared by Tetra Tech for several sites, including the east-west leg of SWMU 34 (Tetra Tech, 2005). The report documented the status of each site regarding contaminant levels, the potential for contaminant migration, and human health risks potentially incurred from exposure to the sites. Five surface soil samples (OGTSLSS01 through OGTSLSS05) were collected at locations shown on Figure 4-4. The soil samples were analyzed for metals, PCBs, and SVOCs (including PAHs, which is a subset of the SVOCs); a summary of the analytical results is presented in Table 4-1. As shown in Table 4-1, aluminum, antimony, arsenic, cadmium, chromium, cobalt, iron, lead, manganese, nickel, Aroclor-1260, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene concentrations in 2005 exceed current human health screening criteria in at least one sample. Antimony, cadmium, chromium, copper, lead, manganese, nickel, vanadium, zinc, and Aroclor-1260 were detected in 2005 at levels that exceed current ecological screening criteria in at least one sample. Screening criteria, when exceeded, indicate that a potentially unacceptable human health or ecological risk exists, depending on whether the criterion exceeded is a human health or ecological risk criterion (see Table 4-1). The maximum arsenic concentration (9.9 mg/kg) was at the upper end of the typical NSA Crane background metal concentration range of non-detect to approximately 11.8 mg/kg in SWMU 34 surface soil (Tetra Tech, 2001).

In 2011, a Soil Characterization Investigation was performed by Tetra Tech at SWMU 34 to determine the extent of contamination at the site, and document the status at the site regarding contaminant levels (Tetra Tech, 2011). This investigation was performed primarily on the east-west leg of the site. The area was divided into eight quadrants (quadrant boundaries not shown). One soil sample was collected from each of the eight quadrants in June 2011. The soil samples (OGTSLSS006 through OGTSLSS013) were collected from locations deemed to be most likely impacted based on topography or visual evidence. The eight soil sample locations are shown on Figure 4-4. All eight samples were analyzed for PAHs, PCBs, and metals. As shown on Table 4-1, Aroclor-1260 and many of the same metals that exceeded the human health and ecological risk screening criteria in the 2005 sampling event also exceeded the screening criteria in the 2011 sampling. Benzo(a)anthracene, indeno(1,2,3-cd)pyrene, and naphthalene were also detected at concentrations in 2011 that exceed the current human health screening criteria.

4.4 CONCEPTUAL SITE MODEL

4.4.1 Potential Contamination Sources and Target Analytes

A comparison of all data collected at SWMU 34 through 2011 was made to current human health and ecological risk-based criteria which are presented in **Section 9.0**. The matrix below indicates for each subarea of SWMU 34, the chemical groups in which at least one chemical in the group exceeded either a human health or ecological criterion in surface or subsurface soil. Ecological criteria are applied only to surface soil because non-humans are typically considered not to incur exposure to subsurface contaminants (i.e., deeper than 2 feet bgs).

Matrix	**DU 1**		**DU 2**		**Kennel Area**		**Pile A and Pile B**	
	HHRA	*ERA*	*HHRA*	*ERA*	*HHRA*	*ERA*	*HHRA*	*ERA*
Surface Soil	Metals	Metals	Metals	Metals	NR	NR	NR	NR
	PCBs	PCBs	PCBs	PCBs	NR	NR	NR	NR
	PAHs	--	PAHs	--	NR	NR	NR	NR
	SVOCs	SVOCs	--	--	NR	NR	NR	NR
Subsurface Soil	NR	NR	NR	NR	NR	NR	NR	NR

NR – No Results

The 2002 data, although not validated, were included in the matrix above to ensure that all potentially site-related contamination would be identified. PAHs are a subset of SVOCs so if only PAHs were determined to exceed the criteria, this is indicated with "PAHs". PCBs analytical detection limits were orders of magnitude greater than current ecological risk-based criteria; therefore, the Project Team cannot determine how widespread the PCBs contamination could be relative to ecological criteria.

The list of target analytes for this 2012 investigation was selected from the list of Priority Pollutant chemicals and is based on the contaminants that were likely or potentially associated with the site. Based on historical information and personnel interviews, spills and releases from general site activities, and degradation and weathering of stored materials are likely sources of contamination at SWMU 34 as shown on Figure 4-11. Therefore, the contaminants expected at the site are those related to the storage of metallic objects, potentially leaking motorized vehicles, and related equipment.

4.4.2 Potential Migration and Exposure Pathways

After release to the surface soil, contamination may (1) result in a complete exposure pathway to human and ecological receptors, and/or (2) serve as a source of contamination to subsurface soil and result in a complete exposure pathway. Potential exposure pathways are illustrated on Figure 4-12 for human and ecological receptors. PCBs and heavy metals generally do not migrate rapidly into deeper soil but SVOCs are relatively mobile with a wide range of mobilities determined by their physicochemical properties.

4.4.3 Potential Receptors

Current receptors of greatest concern are humans and canines. The human receptors of immediate concern are typical NSA Crane occupational workers exposed to surface soils as a result of daily work activities and include dog handlers and construction workers; and potential trespassers. Because of the proximity of the active dog kennel and because the dogs are exercised and trained across the site, potential canine exposure to site-related chemical contaminants is a concern. The exposure to surface soils for all of these receptors could occur through dermal contact, incidental ingestion, or inhalation of soil particles suspended as dust in the air.

Figures 4-11 and 4-12 present the CSM which identifies plausible primary and secondary contaminant release mechanisms, contaminant migration pathways, the various receptors of interest, and their possible exposure pathways. In general, the greatest contaminant mass is expected to be in the surface soil. Therefore, contamination of groundwater is not currently a concern, and would only be a concern if site-related constituent concentrations are demonstrated to exceed concentrations in surface and subsurface soils that represent significant probability of migration to groundwater. Such concentrations are those that would exceed USEPA criteria for leaching of contaminants from soil to groundwater. Contaminant migration in surface soil runoff is a possibility, but because the area is relatively flat, runoff is not considered to be a significant migration pathway. Therefore, soil erosion is not a significant concern at this site.

Because future land use is unknown, it is common practice to evaluate the future use of a property as residential. A change of land use to residential use could result in exposure of more sensitive human receptors such as adult or child residents. Residential receptors may be exposed to different media based on their specific activities. These media include surface soil and subsurface soil.

Ecological receptors include animal and plant species that could be affected by the contaminants that are present at the site. This includes the dogs kept at the nearby kennel and exercised on the site. Typically, ecological receptors can be exposed only to surface media – surface soil, in this case. Exposure of ecological receptors to subsurface soil is not anticipated. The exposure media for ecological receptors is surface soil. Terrestrial plants, invertebrates, and vertebrates are exposed to surface soil by direct contact and ingestion of soil and other food items. Although terrestrial vertebrates may be exposed to chemicals found in the air via inhalation, this is not considered a significant pathway.

5.0 -- Data Quality Objectives/Systematic Planning Process Statements

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

The following text describes the development of DQOs using USEPA's DQO Systematic Planning Process (USEPA, 2006a).

5.1 PROBLEM STATEMENT

Site-related chemical contamination has been detected in soil at SWMU 34 DU1 and DU2, but the extent of this contamination is currently not well-defined for each of the three subareas of SWMU 34 described in the CSM. Furthermore, any associated risks that would result from exposure of human or ecological receptors to this contamination have not been quantified. Data must be collected at DU 1 and DU 2 to characterize the extent of contamination to support human health and ecological risk assessments. Based on these risk assessments, the Project Team must take action, as necessary, to ensure that human health and the environment are protected.

In addition to delineating contamination associated with DU 1 and DU 2, there is some uncertainty about the level of soil contamination that might be present within the Kennel Area and at Pile A, and Pile B. Therefore, surface soil in the Kennel Area and Pile A, and in surface and subsurface soil in Pile B must be investigated to determine whether contamination is present and whether continued investigation is necessary for these areas.

5.2 INFORMATION INPUTS

Data that are required to resolve the problems described in **Section 5.1** are as follows:

1. Chemical data: Concentrations of SVOCs (including low level PAHs), low level PAHs, PCBs, and metals in surface soil are needed to determine the nature and extent of potential contamination in SWMU 34 surface soil. PCBs are not expected to have migrated significantly to subsurface soils so data only for metals and PAHs are anticipated to be required to delineate the nature and extent of contamination in the vertical direction. The field sampling program and associated analyses for each sample is presented in **Section 8.5**. The complete list of target analytes in each analytical group is presented in **Section 9.0**.

2. Sample location data: Sample location horizontal coordinates and vertical depths must be measured for use in mapping each location so that data can be analyzed and presented in a spatial context. Horizontal coordinates may be measured using a global positioning system (GPS) with sub-meter

accuracy at the discretion of the Tetra Tech PM, because locations must only be known within 3 feet of accuracy. Data collection point coordinates must be documented in the State Plane Coordinate System (SPCS) North American Datum (NAD) 1983 Indiana West (U.S. survey feet). Depth intervals must be measured using a tape measure or other device with similar accuracy and precision.

3. Project Screening Levels (PSLs): The SWMU 34 RFI requires chemical data that can be compared to current USEPA and IDEM residential surface and subsurface soil risk-based screening criteria. The risk and regulatory criteria applicable to the SWMU 34 RFI include the IDEM Risk Integrated System of Closure (RISC) Default Closure Tables, Residential and Industrial Closure Levels (R-DCLs and I-DCLs) (IDEM, 2009); and USEPA Regional Screening Levels (R-RSLs) and risk-based migration-to-groundwater Soil Screening Levels (RBSSLs) for human health risk screening (USEPA, May 2012). ERA PSLs were selected by choosing the lowest value among USEPA Ecological Soil Screening Levels (Eco SSLs) for plant, invertebrate, mammalian and avian values (USEPA, 2005-2008). Ecological SSLs were used preferentially as soil screening values when SSLs were available; however, these Eco-SSLs are currently available for only a few analytes. USEPA Region 5 Ecological Screening Levels (ESLs) for soil (R5 ESL-S) (USEPA, 2003) were used for screening values for analytes that do not have an Eco SSL. The criterion for each analyte that represents the PSL for each environmental matrix is listed in **Section 9.0**.

   To conduct comparisons of site data to screening values for surface soil and subsurface soil, and to begin delineation of potential contamination, the selected laboratory(s) should be able to achieve Limits of Quantitation (LOQs) that are low enough to measure constituent concentrations that are less than the PSLs. In cases where conventional test methods are not able to achieve LOQs that are lower than the PSLs (such as for PCBs and selected SVOCs), rules for evaluating the data are required that help the Project Team determine with reasonable satisfaction whether the constituent poses a potentially unacceptable risk.

   The following laboratory data reporting conventions must be used: All results less than the Detection Limit (DL) will be considered nondetects and these values must be reported at the Limit of Detection (LOD) with a "U" qualifier; detections reported at concentrations between the DL and LOQ will be reported with a “J” qualifier.

   If a criterion for a target analyte is between the LOD and LOQ, the “J” flagged data will be accepted to achieve project goals; however, greater scrutiny will be applied in these cases to evaluate the effect of not being able to directly compare measured concentrations to PSLs. Additionally, the inability to quantify select analytes to PSL levels with confidence will be addressed in the risk screening uncertainty analysis. In cases where the laboratory LODs are greater than the PSLs, the LOD will be used as a surrogate value for the measured concentration in accordance with the USEPA Risk Assessment Guidance for Superfund, Part A (USEPA, 1989), if the analyte is not detected. An evaluation of these analytes will also be presented in the uncertainty section of the risk screening in the RFI Report by describing the impact this limitation places on decision making.

4. Background: The background data set for surface and subsurface soil metals at NSA Crane must 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 the upper tolerance limits (UTLs) documented in the *Final Base-Wide Background Soil Investigation Report for NSWC Crane* (Tetra Tech, 2001). An exceedance of a UTL is expected in 5 percent of cases in soil samples that have not been impacted by site activities, but the greater the exceedance, the less probable it is that the observed concentration represents a background concentration. For risk assessment purposes, in the event that an analyte concentration exceeds a PSL, but is less than or equal to an established UTL, the analyte will not be considered a Contaminant of Potential Concern (COPC). For delineation purposes, if a background concentration for a particular analyte is greater than the PSL for that analyte, then the background UTL will replace the PSL prior to decision-making.

5. Project Action Limits (PALs): PALs are necessary to make decision based on risk to identified receptors from exposure to surface soil and subsurface soil. The selected human health and ecological PALs are as follows:

   - Human Health Risk: An incremental lifetime cancer risk (ILCR) greater than 1×10^{-4} or a non-cancer Hazard Index (HI) greater than 1 (based on common target organs or effects) is considered to be unacceptable.

   - Ecological Risk: A Hazard Quotient (HQ) greater than 1 for any receptor in any medium will be used to identify contaminates for further evaluation as described in Section 5.4 to determine whether risks are unacceptable.

   If these risk levels are exceeded, the Project Team will take the next step in the RCRA process and evaluate remedial alternatives in a Corrective Measures Study (CMS). Decision rules for applying these criteria are presented in **Section 5.4**.

6. Risk Assessments: Previously collected surface soil data will be used with the newly collected surface and subsurface soil data to determine the nature and extent of COPCs and to assess risk to human and ecological receptors at SWMU 34. These risk assessments must be conducted in accordance with USEPA protocols and Navy guidance documents for HHRAs and ERAs.

5.3 STUDY AREA BOUNDARIES

The populations of interest for soil are the soils that have been contaminated either directly (by site operations) or indirectly (by subsequent migration of contaminants). The horizontal study boundary for the RFI encompasses each area that may have been impacted by site activities, based on the CSM and the results of previous investigations. Past investigations have indicated the types of contamination present in different areas of SWMU 34, so the target analytes vary by area (See **Section 8.5** for the location-specific chemical groups and **Section 9.0** for a complete list of target analytes), Lateral expansion of this horizontal study boundary may be necessary if there are unbounded PSL exceedances and COPCs are identified. Whether this is necessary or not will be determined by the Project Team in accordance with decision rules that are presented in **Section 5.4**.

For risk assessment, an exposure unit for human health was devised by subdividing the site into two approximately equivalent areas (DU 1 and DU 2) as shown on Figure 4-4. These areas are consistent in size to the area commonly used at NSA Crane to represent human exposure to soil contaminants. Incorporation of the Kennel Area and the two material piles into the human health risk assessment boundary cannot be determined until after the data are collected. If contaminant levels do not indicate a need for additional investigation, the Project Team will include Pile A with DU1, and the Kennel Area and Pile B with DU 2. For ecological receptors, (i.e., the entire site) is more suitable as an exposure unit for receptors such as avian and mammalian species that roam and forage over relatively large areas.

The vertical study boundary for the RFI is from the ground surface to the top of bedrock, which is expected to be less than 10 feet bgs. Groundwater occurs in bedrock at depths of approximately 15 to 25 feet bgs at similar sites within the NSA Crane facility boundary; therefore, groundwater is not within the scope of this soil investigation. Vertical expansion of this study vertical boundary may be necessary if COPCs are identified in the samples collected along this boundary. Whether this is necessary or not will be determined by the Project Team after considering the level of risk, the spatial distribution of contamination, and other factors that affect potential corrective actions.

The surface soil depth of interest is 0 to 2 feet bgs, as this is the interval most likely to contain contamination, if present, and is the interval to which select human and ecological receptors are exposed. Subsurface soil from 2 to 10 feet bgs (or bedrock) must be investigated to determine whether any vertical (downward) migration of surface contamination has occurred and it also represents an additional soil depth interval to which human receptors but not ecological receptors are potentially exposed.

Temporal boundaries – Target analyte concentrations are anticipated to be relatively unchanged (stable) over the course of time needed to conduct the RFI and into the foreseeable future; therefore, no temporal constraints exist.

Sediment, surface water, and groundwater are not currently environmental media of concern at this site.

5.4 ANALYTIC APPROACH

The analytic approach described below explains how the Project Team will use the chemical data for decision making at SWMU 34.

If the Project Team determines, based on a combination of the data from this sampling event and previous sampling events at SWMU 34, that the presence of COPCs has been adequately delineated in three dimensions in soil for each study area unit described in **Section 5.3**, then proceed with completing the human health and ecological risk assessments; otherwise, convene the Project Team to decide whether additional data collection is warranted to characterize the nature and extent of surface and subsurface soil COPCs. At a minimum, this evaluation must consider the following factors relative to the existing CSM in each environmental medium:

- Frequency of detection for each constituent;
- Frequency and magnitude of PSL exceedance for each constituent;
- Background concentrations of metals that exceed PSLs;
- Magnitude of concentrations and concentration gradients within, and on the perimeter of, the investigated areas; and
- Identities of COPCs and their estimated contributions to unacceptable levels of risk.

The tendency to collect more data will increase as spatial concentration patterns indicate that a potentially unacceptable risk exists outside the investigated areas, that the levels or distribution of contaminants are not known to a satisfactory degree of confidence, or that the data indicate that the CSM is in significant error.

<u>Human Health Risk Assessment</u>

If risks are unacceptable from exposure of the identified human receptors (see **Section 4.4.3**) to soil [i.e., hazard quotients or hazard indices are greater than 1, and/or ILCRs are greater than 1 x 10^{-4}], then proceed to a CMS to evaluate soil corrective action alternatives for the site; otherwise, recommend no further action (NFA) with respect to chemical contamination in soil for the affected area.

Ecological Risk Assessment

The goal of the ERA is to determine whether adverse ecological impacts are present as a result of exposure to chemicals released to the environment through historical activities. The ERA will be conducted in accordance with guidance presented in the following documents:

- Final Guidelines for Ecological Risk Assessment (USEPA, 1998).
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA, 1997).
- Navy Policy for Conducting Ecological Risk Assessments (Navy, 1999).

The ERA will consist of Steps 1, 2, and 3a of the eight step ERA process. The first two steps comprise the screening-level ecological risk assessment (SLERA), where conservative exposure estimates are compared to screening-level and threshold toxicity values. Step 3a is the first step of a baseline ecological risk assessment (BERA) and consists of refining the conservative assumptions (e.g., number of exceedances of screening criteria, magnitude of the exceedances of screening criteria, spatial distribution of data, home range, background concentrations, alternate benchmarks, etc.), following Steps 1 and 2 to further focus the ERA process on the chemicals of greatest concern at a site. The remaining steps of the ERA process beyond Step 3a would require a decision by the Project Team to develop an addendum to the RFI SAP or separate SAP prior to initiation and, therefore, are not included in this ERA methodology.

Ecological receptor exposure units (EUs) will be defined in the ERA based on the combined data from previous sampling events and the RFI. The decision rule to be applied for the ecological risk assessment is as follows:

If after completing an ERA through Step 3a, risks are acceptable, then recommend NFA; otherwise, continue the ERA process past Step 3a.

5.5 PERFORMANCE CRITERIA

Visual Sample Plan (VSP), Version 6.0 software was used to determine the number of soil samples to be collected across DU 1 and DU 2 (**Appendix A**). Sample size calculations were determined based on the results of previous investigations using PAH and metal compounds that exceeded PSLs in multiple sample locations, which may be biased high. PCBs data were not used because of the preponderance of PCBs nondetect values. The following key assumptions and decision performance criteria were used to determine the number of soil samples in a decision unit:

- For purposes of statistical analysis, the "null hypothesis" is that the site is "dirty" (i.e., the mean concentration at the site exceeds the action level selected for statistical analysis). By selecting this hypothesis to be the baseline condition that will be assumed to exist unless data demonstrate otherwise, the potential for overlooking an unacceptable level of risk is minimized.

- Sigma - The standard deviation of target analyte concentrations was calculated based on the 2005 and 2011 data.

- Delta - Delta is the difference between the PSL and the lower bound of the grey region (described below).

- Alpha - Alpha is 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 greater than the PSL was set at 15 percent.

- Beta - The tolerance for concluding that the site is "dirty" when the site is actually "clean" was set at 20 percent also considering the tolerance for incorrectly concluding that the site mean is greater than the PSL when it is actually less than the PSL. 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 PSL was set at 75 percent of the screening level.

The results of the statistical analysis are that a minimum of 30 locations should be sampled from each of the two DUs – surface soil and subsurface soil from across the north-south portion (DU 2) of the site and surface soil and subsurface soil from across the east-west portion (DU 1) of the site. The VSP outputs for the calculations of the sample sizes for these Decision Units are attached in **Appendix A**. The sampling design presented in **Section 7.0** is based on this recommended number of samples to determine the boundaries of contamination and potential remedial areas. All new analytical data collected per the sampling design is expected to meet the QA criteria established in this SAP and the prescribed detection limit requirements for each target analyte, as identified in **Section 9.0**.

Delineation of COPCs and Risk Assessment

Generally, sample locations in the DUs were determined randomly with the aid of VSP; two sample locations in DU 1 were biased based on the results of previous investigations. Also, the soil samples in the Kennel Area, and at Pile A and Pile B are biased locations. Samples will be collected from the Kennel Area to determine if contaminants from other areas have contaminated the Kennel Area.

The essentially random selection of sample locations in the DUs supports the use of quantitative statistics to objectively 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). The combined quantity of samples to be collected between the initial screening investigations and the current sampling round is deemed sufficient by the Project Team to determine whether unacceptable environmental conditions are present.

The Project Team will use the data from this sampling event, plus validated data from previous investigations at SWMU 34, to determine whether the amount and type of data collected are sufficient to support the project objectives, which include the delineation of COPCs to support risk assessment calculations for human health and ecological receptors. This process may involve an evaluation of contaminant concentrations and uncertainty for contaminants that have PSLs which are below the LODs to ensure that contaminants are likely to have been detected, if present.

If all data have been collected as planned and no data points are missing or rejected for quality reasons, then the investigation will be considered satisfactory. If any data gaps are identified, including missing or rejected data, then the Project Team will assess whether the project objectives have been obtained. This assessment will depend on the number and type of identified data gaps; therefore, a more detailed strategy cannot be presented at this time. All stakeholders, including the IDEM RPM, the Navy RPM and ERSM, and the Tetra Tech PM will be involved in rendering the final conclusion by consensus regarding adequacy of the data. All analytical data collected per the sampling design should meet the QA criteria established in this SAP and the prescribed detection limit requirements for each target analyte.

If the alpha and beta specifications are achieved, the data set will be considered to be sufficient for making the decisions identified in **Section 5.4**. Otherwise, the Project Team will meet to assess the effect of data gaps on attaining project objectives. The tendency will be to collect data to fill data gaps if any missing or rejected data are identified, unless the Project Team can demonstrate qualitatively or quantitatively that the deficiencies do not prevent attainment of project objectives. Although biased, previously collected data will be treated as randomly collected data for determining whether alpha and beta specifications are achieved because there is a significant element of randomness to the way contaminants may have been released.

5.6 SAMPLING DESIGN AND RATIONALE

The plans for obtaining data along with the sampling designs and rationales are described in detail in **Section 7.0** and **Section 8.5**.

6.0 -- Field Quality Control Samples

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

Quality Control (QC) Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPCs)	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
Equipment Rinsate Blank	All analytical groups	One per 20 samples per matrix per sampling equipment[1].	Bias/ Contamination	No analytes ≥ ½ LOQ, except common laboratory contaminants, which must be < LOQ.	S & A
Field Duplicate (FD)	All analytical groups	One per 20 field samples.	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) ≤50 (solids)[1,2].	S & A
Cooler Temperature Indicator	All analytical groups	One per cooler.	Representativeness	Temperature must be above freezing and less than or equal to 6 degrees Celsius (°C).	S

1 – If duplicate values for non-metals are < 5x LOQ, absolute difference should be < 2x LOQ.
2 – If duplicate values for metals are < 5x LOQ, absolute difference should be < 4x LOQ.

7.0 -- Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1 – Worksheet #17)

Sampling is required in five areas at SWMU 34 - DU 1, DU 2, the Kennel Area, Pile A and Pile B. (see Figure 7-1), to determine the boundaries of contamination and potential areas of corrective action as described in the problem statement. The quantity and location of samples was determined using the VSP for statistical analysis as described in **Section 5.5**. The sampling design is a primarily random design with some sample locations biased based on the results of previous investigations.

Sample locations at DU 1 and DU 2 were randomly selected using VSP. However, two samples locations in the north-central portion of DU 1 were adjusted to better correlate with the location of a 2002 PCBs exceedance. Sample locations in the Kennel Area, and at Pile A and Pile B are also biased (based on site use) and are designed to provide the greatest chance of detecting contamination if it is present.

7.1 OGTSL SOIL SAMPLING DESIGN AND RATIONALE

Sampling will be performed as shown on Figure 7-1, summarized in **Section 7.2**, and described below:

DU 1 - To date, 11 surface soil samples have been collected in DU 1. Previous investigations indicate that the surface soil in DU 1 is contaminated with residual PAHs and metals. The results of a 2002 sampling event also indicate that surface soil in the north-central portion of DU 1 may be contaminated with residual PCBs. Nineteen additional surface soil samples and 10 subsurface soil samples will be collected in DU 1. All surface and subsurface soil samples in DU 1 will be analyzed for low level PAHs and select metals. Two surface soil samples located in the north-central portion of DU 1 will also be analyzed for PCBs. Previous PCBs analytical detection limits were orders of magnitude greater than current ecological risk-based criteria; therefore, it is unknown whether lower level PCB contamination is more widespread than is indicated by comparisons to the human health criteria alone.

DU 2 - To date, two surface soil samples have been collected in DU 2. Previous investigations indicate that the surface soil at SWMU 34 has been contaminated with residual PAHs, metals, and PCBs. Twenty-eight additional surface soil samples and 10 subsurface soil samples will be collected in DU 2. All surface soil samples in DU 2 will be analyzed for low level PAHs, select metals, and PCBs. All subsurface soil samples in DU 2 will be analyzed for low level PAHs and select metals.

Kennel Area - No samples have been collected in the Kennel Area to date. Three surface soil samples will be collected and analyzed for SVOCs (including low level PAHs), PCBs, and select metals.

Pile A – No samples have been collected from Pile A to date. The material in the pile appears to be gravel and may have originated from other areas of SWMU 34. Based on the size of the pile, surface soil samples will be collected from two locations at Pile A. One location will be from the surface soil under the gravel pile, and one will be from the surface soil just below the adjacent gravel area. The surface soil samples will be from the natural soil just below the gravel. Both samples will be analyzed for SVOCs (including low level PAHs), PCBs, and selected metals.

Pile B – No samples have been collected from Pile B to date. The material in the pile appears to be primarily soil with some gravel and may have originated from other areas of SWMU 34. Based on the size of the pile, soil samples will collected from two locations at Pile B; two soil samples will be collected from each location. At each sampling location, one soil sample will be collected from the soil within the pile and one soil sample from surface of the natural soil immediately below the pile. All surface and subsurface samples will be analyzed for SVOCs (including low level PAHs), PCBs, and selected metals.

The quantity of PCBs potentially released at SWMU 34 is anticipated to have been limited. Based on their chemical and physical properties PCBs also are not expected to migrate rapidly into deeper soil after a surface release, especially if the released quantities are small. Therefore, analysis of subsurface soil samples for PCBs is not planned and will not be conducted unless analyses indicate that PCBs contamination is insufficiently bounded in the vertical direction.

Fifty-four surface soil samples and 22 subsurface soil samples will be collected at SWMU 34. Subsurface soil sample locations will be horizontally aligned with surface soil sample locations. Sampling areas are illustrated on Figure 7-1 for SWMU 34. A matrix table of samples is provided in **Section 8.5**.

Surface soil samples will be collected from the top two feet of soil. Surface soil samples will typically be collected from 0 to 2 feet below ground surface (bgs) but will vary in areas where a surface gravel layer is present. In areas where a gravel surface layer is present, the top of the surface soil sample will begin at the bottom of the gravel layer. Depth of the gravel and the top of the surface soil will be determined in the field based on visual observations. The top of the soil layer soil will begin when more than two-thirds of the material volume is soil based on visual observations and will typically be rounded to the nearest foot. The sampling depth for each subsurface soil sample will be 4 to 6 feet bgs except for the two subsurface soil samples from Pile B; the subsurface soil samples from Piles B will be collected from in the natural soil approximately 2 to 4 feet bgs. If visual or olfactory observations indicate that a subsurface interval above or below the 4 to 6 foot bgs sample has potential for contamination, an additional subsurface sample may be collected. The additional subsurface sample may be collected from a 2-foot interval from 2 feet bgs to bedrock, which is expected to be less than 10 feet bgs. Sampling and other field task methodologies are described in **Section 8.2**.

Turnaround time for laboratory analysis of SWMU 34 samples will be standard (28 days).

7.2 PROPOSED SAMPLING PROGRAM SUMMARY TABLE

Decision Unit	Number of Existing Surface Soil Samples (1)	Number of Proposed RFI Surface Soil Samples	Total Number of Surface Soil Samples for RFI	Number of Existing Subsurface Soil Samples	Number of Proposed RFI Subsurface Soil Samples	Total Number of Subsurface Soil Samples for RFI	Analysis
1	11	19	**30**	0	10	**10**	**Select metals and low level PAHs in all surface and subsurface soil, and PCBs in two surface soil samples.**
2	2	28	**30**	0	10	**10**	**Select metals, PCBs, and low level PAHs in surface soil and select metals and low level PAHs in subsurface soil.**
Kennel Area	0	3	**3**	0	0	**0**	**Select metals, PCBs, and SVOCs (including low level PAHs).**
Pile A	0	2	**2**	0	0	**0**	**Select metals, PCBs, and SVOCs (including low level PAHs).**
Pile B	0	2	**2**	0	2	**2**	**Select metals, PCBs, and SVOCs (including low level PAHs).**
Total	13	54	**67**	0	22	**22**	

1 These numbers represent only the 2005 and 2011 results that have been validated.

8.0 -- Field Project Implementation (Field Project Instructions)

(UFP-QAPP Manual Section 5.2.3 – Sections #14, 18, 19, 20, 21, and 30)

8.1 PROJECT AND FIELD OBJECTIVES

The objective of the field work is to obtain soil data needed to meet the project objectives. Soil analytical data will be used to determine the nature and extent of chemical contamination that has been previously detected at SWMU 34 and to characterize the extent of contamination to support human health and ecological risk assessments. Project objectives are described in more detail in **Section 5.1**.

8.2 FIELD PROJECT TASKS

(UFP-QAPP Manual Section 2.8.1 – Section #14)

Project-specific Standard Operating Procedures (SOPs) and Field Forms for field tasks referenced in this section are identified by title in **Section 8.4**. Site-specific SOPs have been developed for field activities at NSA Crane and are located in **Appendix B**. Field tasks are summarized below with a short description for each task.

- Mobilization/Demobilization
- Utility Clearance
- Site-Specific Health and Safety Training
- Sample Collection and Handling
- Surface and Subsurface Soil Sampling
- GPS Locating
- Investigation-Derived Waste (IDW) Management
- Field Decontamination Procedures
- Field Documentation Procedures
- Quality Control Tasks

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. The Tetra Tech FOL or designee will coordinate with the NSA Crane ERSM to identify appropriate locations for the storage of equipment and supplies. Site-specific health and safety training for all Tetra Tech field personnel and 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. Demobilization includes the cleanup and removal of waste generated during the performance of the investigation.

Utility Clearance

One week prior to the commencement of any subsurface intrusive activities, the Tetra Tech FOL or designee will contact IUPPS to complete a utility clearance ticket for the areas under investigation. The Tetra Tech FOL will be responsible for coordinating these activities.

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 Occupational Safety and Health Administration (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.

Sample Collection and Handling

The sampling and analysis program is outlined in **Section 7.0** and **Section 8.5**. Sample collection will be in accordance with the site-specific SOPs and provided in **Appendix B**. The sampling requirements for each type of analysis (i.e., bottleware, preservation, holding time) are listed in **Section 8.6**. Field and laboratory QC samples will also be collected as outlined in **Section 8.7**. Methods and requirements for sample handling will be in accordance with **SOP-03** (Sample Custody and Documentation of Field Activities). Sample containers will be provided certified-clean (I-Chem 300 or equivalent) from GEL. Sample labeling will be in accordance with **SOP-01** (Sample Labeling), and the sample numbering scheme will be in accordance with **Section 8.5** and **SOP-02** (Sample Identification and Nomenclature). The selection of sample containers, sample preservation, packaging, and shipping will be in accordance with **Section 8.6** and **SOP-04** (Sample Preservation, Packaging, and Shipping).

Surface and Subsurface Soil Sampling

Soil samples will be collected in accordance with **SOP-05** (Borehole Advancement and Soil Coring Using Direct PT and Hand Auger Techniques). Surface soil samples (from 0 to 2 feet bgs) will be collected with a hand auger, backhoe, or direct push technology (DPT), depending on site conditions. Sample jars will be filled using either a decontaminated stainless steel trowel or dedicated disposable plastic trowel. Subsurface soil samples will be collected using a DPT rig, DPT rig with auger, or backhoe, and stainless steel or disposable trowel. The soil samples will be described by the field personnel in accordance with **SOP-06** (Soil Sample Logging). Any qualitative visual signs of potential contamination (such as soil staining) will be noted on the soil boring log. The soil samples will be collected in accordance with **SOP-07** (Surface and Subsurface Soil Sampling).

Global Positioning System Locating

A GPS unit will be used to survey the locations of all soil sampling points in accordance with **SOP-09** (Global Positioning System). The GPS equipment will be checked on control monuments before and after each day's use; 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. Data collection point coordinates must be documented in the SPCS NAD 1983 Indiana West (US survey feet).

Investigation-Derived Waste Management

Solid or semi-solid IDW in the form of soil will be generated during field activities. Soil will be replaced into the boring from which it was removed.

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

Field Decontamination Procedures

Decontamination of sampling equipment will not be necessary for dedicated and disposable hand trowels. Decontamination of reusable sampling equipment (e.g., non-disposable hand trowels, hand augers) 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-08** (Decontamination of Field Sampling Equipment).

Field Documentation Procedures

Field documentation will be performed in accordance with **SOP-03** (Sample Custody and Documentation of Field Activity).

Quality Control Tasks

QA/QC samples will be collected at frequencies listed in **Section 6.0**.

8.3 ADDITIONAL PROJECT-RELATED TASKS

Additional project-related tasks include:

- Analytical tasks
- Data management
- Data review
- Project reports

Analytical Tasks

Chemical analyses will be performed by GEL, which is a Department of Defense (DoD) Environmental Laboratory Approval Program (ELAP)-accredited laboratory. A copy of the laboratory accreditation for GEL is included in **Appendix C**. Analyses will be performed in accordance with the analytical methods identified in **Section 8.6**. GEL will meet the PSLs specified in **Section 9.0** and will perform the chemical analyses following laboratory-specific SOPs (see **Section 8.6** and **Section 10.0**) developed based on the methods listed in **Section 8.6**. Laboratory SOPs are not included in this SAP, but have been reviewed to ensure they are suitable for use on this project. Copies of the Laboratory SOPs are available to the Project Team upon request.

All soil results will be reported by the laboratory on an adjusted dry-weight basis. Results of percent moisture will be reported in each analytical data package and associated electronic data files. This information will also be captured in the project database, which will eventually be uploaded to the Naval Installation Restoration Information Solution (NIRIS) database. Percent moisture information will also be captured in the site investigation report.

The analytical data packages provided by GEL will be in a Contract Laboratory Program-like format and 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 QC [results, recoveries, RPDs, relative standard deviations (RSD), and/or percent differences (%D), etc.].

Data Management

The principal data generated for this project will be from field data and laboratory analytical data. Field sampling log sheets will be organized by date and environmental 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 GEL will meet the requirements of the laboratory technical specifications. Electronic data results will be automatically downloaded into the Tetra Tech database in accordance with proprietary Tetra Tech processes.

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 GEL. Upon receipt of the data packages from GEL, the Tetra Tech Project Chemist will monitor the data validation effort, which includes verifying that the data packages are complete and results for all samples have been delivered by GEL.

- **Data Storage, Archiving, and Retrieval**. The data packages received from GEL are tracked in the data validation log. After the data are validated, the data packages are entered into the Tetra Tech Comprehensive Long-term Environmental Action 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. 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.

- **Electronic Data**. All electronic data will be compiled into a NIRIS Electronic Data Deliverable (NEDD) and loaded into NIRIS.

- **Data Review**. This review comprises data verification, validation, and a usability assessment. The data verification and validation processes and requirements are described in **Section 12.0**. The data usability assessment will, at a minimum, constitute evaluation of the following characteristics to ensure that the amount, type, and quality of data are sufficient to achieve project objectives. The means of conducting these evaluations will vary depending on the nature of the data. Examples include:

- Comparing actual to intended sampling locations and verifying that the correct datum was used to delineate contamination
- Evaluating trends across sample delivery groups or sampling events
- Identifying and investigating the representativeness of potential errant or outlier data points
- Assessing planning assumption validity
- Evaluating the potential for contamination of samples by samplers

Data quality indicators to be evaluated during this assessment include:

1. **Precision.** A semi-quantitative estimate of the uncertainty in contaminant concentrations.

2. **Accuracy.** Accuracy data will be evaluated to ensure sampling and measurement accuracy is within or exceeds analytical method specifications and may depend in part on the data validation findings.

3. **Representativeness.** This evaluation will assess whether the data are adequately representative of intended populations based on the sample collection and data generation requirements specified in this SAP.

4. **Completeness.** Failure to obtain critical data from planned locations will be documented. Minor variations in actual versus intended sampling locations (or depths) that do not adversely affect the attainment of project objectives will not be documented.

5. **Comparability.** This will be accomplished by comparing overall precision and bias among data sets for each matrix and analytical fraction for each sampled area.

6. **Sensitivity.** The Tetra Tech Project Chemist will determine whether project sensitivity goals were achieved by comparing non-detect values to PSLs.

If significant data quality deficiencies are detected that prevent the attainment of project objectives, the limitations on the affected data will be described in the project report. The Tetra Tech PM will bring these deficiencies to the attention of the project team for their evaluation and the team will determine an appropriate corrective action depending on the circumstances.

Project Reports

A Draft RFI Report will be prepared and submitted to the Project Team for review. The report will include a summary of the work performed in accordance with the approved SAP; field modifications as documented by the Tetra Tech FOL; summary and analysis of analytical results; updated CSMs, HHRAs and ERAs, as appropriate, based on the risk screening evaluations, decision rules; and conclusions and recommendations for each site. Tetra Tech will respond to comments received on the Draft RFI Report, and submit a final version of the report that incorporates the agreed-upon responses to comments. The final version of the RFI Report will be submitted in hardcopy and electronic format to the Project Team and the Administrative Record.

8.4 FIELD SOPS REFERENCE TABLE

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

Reference Number	Title, Revision Date, and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-01	Sample Labeling, 05/11, Revision 0.	Tetra Tech	Not Applicable (NA)	N	Contained in **Appendix B**
SOP-02	Sample Identification Nomenclature, 01/12, Revision 1.	Tetra Tech	NA	Y	Contained in **Appendix B**
SOP-03	Sample Custody and Documentation of Field Activities, 05/11, Revision 0.	Tetra Tech	Field logbook, sample log sheets, boring logs	N	Contained in **Appendix B**
SOP-04	Sample Preservation, Packaging, and Shipping, 05/11, Revision 0.	Tetra Tech	NA	N	Contained in **Appendix B**
SOP-05	Borehole Advancement and Soil Coring Using Direct-Push Technology (DPT) and Hand Auger Techniques, 05/11, Revision 0.	Tetra Tech	DPT rig, stainless steel augers, extension rods, and T-handle	N	Contained in **Appendix B**
SOP-06	Soil Sample Logging, 05/11, Revision 0.	Tetra Tech	NA	N	Contained in **Appendix B**
SOP-07	Surface and Subsurface Soil Sampling, 05/11, Revision 0.	Tetra Tech	Stainless steel auger bucket, extension rods, and T-handle, photoionization detector (PID)	N	Contained in **Appendix B**
SOP-08	Decontamination of Field Sampling Equipment, 05/11, Revision 0.	Tetra Tech	Decontamination equipment, scrub brushes, 5-gallon buckets, spray bottles, phosphate free detergent, de-ionized water	N	Contained in **Appendix B**
SOP-09	Global Positioning System, 05/11, Revision 0.	Tetra Tech	GPS unit	N	Contained in **Appendix B**
SOP-10	Management of Investigation-Derived Waste, 05/11, Revision 0.	Tetra Tech	NA	N	Contained in **Appendix B**

8.5 SAMPLE DETAILS TABLE

(UFP-QAPP Manual Section 3.1.1 and 3.5.2.3 – Worksheet #18)

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)	Sampling Rationale
OGTSLSB014	Decision Unit 1	OGTSLSS0140002 and OGTSLFDXXXXXX01(2)	Soil	0 – 2	Low Level PAHs	2	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	2		
		OGTSLSB0140406 and OGTSLFDXXXXXX02(2)	Soil	4 – 6	Low Level PAHs	2		
					Metals	2		
OGTSLSB015	Decision Unit 1	OGTSLSS0150002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB016	Decision Unit 1	OGTSLSS0160002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB017	Decision Unit 1	OGTSLSS0170002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0170406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB018	Decision Unit 1	OGTSLSS0180002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
OGTSLSB019	Decision Unit 1	OGTSLSS0190002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0190406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB020	Decision Unit 1	OGTSLSS0200002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
OGTSLSB021	Decision Unit 1	OGTSLSS0210002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
		OGTSLSB0210406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB022	Decision Unit 1	OGTSLSS0220002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0220406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB023	Decision Unit 1	OGTSLSS0230002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
OGTSLSB024	Decision Unit 1	OGTSLSS0240002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0240406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB025	Decision Unit 1	OGTSLSS0250002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
OGTSLSB026	Decision Unit 1	OGTSLSS0260002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0260406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB027	Decision Unit 1	OGTSLSS0270002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
OGTSLSB028	Decision Unit 1	OGTSLSS0280002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0280406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)	Sampling Rationale
OGTSLSB029	Decision Unit 1	OGTSLSS0290002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
OGTSLSB030	Decision Unit 1	OGTSLSS0300002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0300406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB031	Decision Unit 1	OGTSLSS0310002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
		OGTSLSB0310406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB032	Decision Unit 1	OGTSLSS0320002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
OGTSLSB033	Decision Unit 2	OGTSLSS0330002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB034	Decision Unit 2	OGTSLSS0340002 and OGTSLFDXXXXXX03(2)	Soil	0 – 2	Low Level PAHs	2	SOP-05, SOP-06, SOP-07	
					Metals	2		
					PCBs	2		
OGTSLSB035	Decision Unit 2	OGTSLSS0350002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB036	Decision Unit 2	OGTSLSS0360002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
OGTSLSB037	Decision Unit 2	OGTSLSS0370002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
					PCBs	1		
		OGTSLSB0370406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB038	Decision Unit 2	OGTSLSS0380002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB039	Decision Unit 2	OGTSLSS0390002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0390406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB040	Decision Unit 2	OGTSLSS0400002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB041	Decision Unit 2	OGTSLSS0410002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB042	Decision Unit 2	OGTSLSS0420002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[(1)]	Sampling Rationale
OGTSLSB043	Decision Unit 2	OGTSLSS0430002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
					PCBs	1		
		OGTSLSB0430406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB044	Decision Unit 2	OGTSLSS0440002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB045	Decision Unit 2	OGTSLSS0450002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0450406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB046	Decision Unit 2	OGTSLSS0460002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB047	Decision Unit 2	OGTSLSS0470002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0470406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB048	Decision Unit 2	OGTSLSS0480002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
OGTSLSB049	Decision Unit 2	OGTSLSS0490002	Soil	0 – 2	Low Level PAHs	1	**SOP-05, SOP-06, SOP-07**	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
					PCBs	1		
		OGTSLSB0490406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB050	Decision Unit 2	OGTSLSS0500002	Soil	0 – 2	Low Level PAHs	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB051	Decision Unit 2	OGTSLSS0510002	Soil	0 – 2	Low Level PAHs	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
		OGTSLSB0510406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB052	Decision Unit 2	OGTSLSS0520002	Soil	0 – 2	Low Level PAHs	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB053	Decision Unit 2	OGTSLSS0530002	Soil	0 – 2	Low Level PAHs	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
		OGTSLSB0530406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB054	Decision Unit 2	OGTSLSS0540002 and OGTSLFDXXXXXX04[2]	Soil	0 – 2	Low Level PAHs	2	**SOP-05, SOP-06, SOP-07**	
					Metals	2		
					PCBs	2		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
OGTSLSB055	Decision Unit 2	OGTSLSS0550002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	Surface and subsurface soil required to define the extent of chemical contamination detected in OGTSL soil and to support risk assessments.
					Metals	1		
					PCBs	1		
OGTSLSB056	Decision Unit 2	OGTSLSS0560002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB057	Decision Unit 2	OGTSLSS0570002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0570406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB058	Decision Unit 2	OGTSLSS0580002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
OGTSLSB059	Decision Unit 2	OGTSLSS0590002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0590406	Soil	4 – 6	Low Level PAHs	1		
					Metals	1		
OGTSLSB060	Decision Unit 2	OGTSLSS0600002	Soil	0 – 2	Low Level PAHs	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Sampling Rationale
OGTSLSB061	Kennel Area	OGTSLSS0610002 and OGTSLFDXXXXXX05[2]	Soil	0 – 2	SVOCs (Including Low Level PAHs)	2	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB062	Kennel Area	OGTSLSS0620002	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB063	Kennel Area	OGTSLSS0630002	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB064	Pile A	OGTSLSS0640002	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB065	Pile A	OGTSLSB0640204	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
OGTSLSB066	Pile B	OGTSLSS0650002	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	**SOP-05, SOP-06, SOP-07**	
					Metals	1		
					PCBs	1		
		OGTSLSB0650204	Soil	2 - 4	SVOCs (Including Low Level PAHs)	1		

Sampling Location	Study Area	ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference(1)	Sampling Rationale
					Metals	1		
					PCBs	1		
OGTSLSB067	Pile B	OGTSLSS0660002	Soil	0 – 2	SVOCs (Including Low Level PAHs)	1	SOP-05, SOP-06, SOP-07	
					Metals	1		
					PCBs	1		
		OGTSLSB0660204	Soil	2 - 4	SVOCs (Including Low Level PAHs)	1		
					Metals	1		
					PCBs	1		

1. SOP that describes the sample collection procedures (**Section 8.4**).
2. Field duplicate locations may change in the field based on visual and olfactory observations, and “XXXXXX” represents date collected.

Metals – Metals listed in **Section 9.0**. To be analyzed by SW-846 Method 6010C or 6020A.
Low Level PAHs – Low Level Polycyclic aromatic hydrocarbons listed in **Section 9.0**. To be analyzed by SW-846 Method 8270D-Selected Ion Monitoring (SIM).
PCBs – Polychlorinated biphenyls as Aroclors (listed in **Section 9.0**) – To be analyzed by SW-846 Method 8082A.
SVOCs (Including Low Level PAHs)- Semivolatile organic compounds (including low level PAHs) listed in **Section 9.0**. To be analyzed by SW-846 Method 8270D/8270D-SIM.

8.6 ANALYTICAL SOP REQUIREMENTS AND ANALYTICAL SERVICES TABLE

(UFP-QAPP Manual Section 3.1.1 - Worksheets #19 and 30)

Laboratory point of contact, e-mail address, and phone number: Tasha Horton, tasha.horton@gel.com, (843) 556-8171, extension 4482
Laboratory Name and Address: GEL Laboratories, LLC, 2040 Savage Road, Charleston, SC 29407
Data Package Turnaround time: 28 days
Tentative Sampling Dates: June 2012

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)
Soil	SVOCs and Low Level PAHs	SW-846 3550C/ 8270D/8270D-SIM, GEL SOP-GL-OA-E-010/GL-OA-E-009	One 4-ounce (oz) glass jar with a Teflon-lined lid	30 grams (g)	Cool to ≤ 6 °C (do not freeze)	14 days until extraction, 40 days to analysis
Soil	Low Level PAHs	SW-846 3550C/ 8270D/8270D-SIM, GEL SOP-GL-OA-E-010/GL-OA-E-009	One 4-oz glass jar with a Teflon-lined lid	30 g	Cool to ≤ 6 °C (do not freeze)	14 days until extraction, 40 days to analysis
Soil	PCBs	SW-846 / 3550C/8082A, GEL SOP-GL-OA-E-010/GL-OA-E-040	One 4-oz glass jar	30 g	Cool to ≤ 6 °C (do not freeze)	None
Soil	Metals	SW-846 3050B/ 6010C/6020A, GEL SOP-GL-MA-E-009/GL-MA-E-013/GL-MA-E-014	One 4-oz glass jar	1 to 2 g	Cool to ≤ 6 °C (do not freeze)	180 days to analysis

Notes:
[1]Specify the appropriate reference letter or number from the Analytical SOP References table (**Section 10.0**).

8.7 FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP-QAPP Manual Section 3.1.1 - Worksheet #20)

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs[(1)]	No. of Equipment Rinsate Blanks	Total No. of Samples to Lab
Surface Soil	SVOCs (including Low Level PAHs)	6	1	1/1	1	8
	Low Level PAHs	50	3	3/3	3	56
	PCBs	36	2	2/2	2	40
	Metals	53	3	3/3	3	59
Subsurface Soil	SVOCs (including Low Level PAHs)	3	0	0	0	3
	Low Level PAHs	20	1	2/2	1	22
	Metals	23	1	2/2	1	22
	PCBs	3	0	0	0	3

1 Although Matrix Spike/Matrix Spike Duplicates (MS/MSDs) are not typically considered field QC samples, they are included here because location determination will be established in the field. The MS/MSDs are not included in the total number of samples sent to the laboratory. For metals, a matrix duplicate (MD) will be collected in place of an MSD.

9.0 -- Reference Limits and Evaluation Tables

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

Matrix: Soil

Analyte	CAS Number	HHRA / ERA PSL (mg/kg)	HHRA / ERA PSL Reference[(1)]	PQLG (mg/kg)	GEL		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
SVOCs (including Low Level PAHs, which are listed separately below)							
1,2,4,5-Tetrachlorobenzene	**95-94-3**	**0.12 /** 2.02	**RBSSL /** R5 ESL-S	**0.040**	**0.333**	**0.1332**	**0.0999**
1,3,5-Trinitrobenzene	99-35-4	34 / 0.376	RBSSL/ R5 ESL-S	0.12	0.333	0.1332	0.0999
1,3-Dinitrobenzene	**99-65-0**	**0.028** / 0.655	**RBSSL** / R5 ESL-S	**0.0093**	**0.33**	**0.1332**	**0.0999**
1,4-Naphthoquinone	130-15-4	NC / 1.67	None / R5 ESL-S	0.55	0.333	0.1332	0.0999
1,4-Phenylenediamine	106-50-3	15.8 / 6.16	RBSSL / R5 ESL-S	2.1	0.33	0.333	0.1665
1-Naphthylamine	134-32-7	NC / 9.34	None/ R5 ESL-S	3.1	0.333	0.1998	0.0999
2,2'-Oxybis(1-chloropropane)	**108-60-1**	**0.0022** / 19.9	**RBSSL** / R5 ESL-S	**0.00073**	**0.333**	**0.1332**	**0.0999**
2,3,4,6-Tetrachlorophenol	**58-90-2**	22 / **0.199**	RBSSL / **R5 ESL-S**	**0.066**	**0.333**	**0.1332**	**0.0999**
2,4,5-Trichlorophenol	95-95-4	66 / 14.1	RBSSL / R5 ESL-S	4.7	0.333	0.1332	0.0999
2,4,6-Trichlorophenol	**88-06-2**	**0.070** / 9.94	**R-DCL**/ R5 ESL-S	**0.023**	**0.333**	**0.1332**	**0.0999**
2,4-Dichlorophenol	120-83-2	0.82 / 87.5	RBSSL / R5 ESL-S	0.27	0.333	0.1332	0.0999
2,4-Dimethylphenol	**105-67-9**	6.4 / **0.01**	RBSSL / **R5 ESL-S**	**0.0033**	**0.333**	**0.2331**	**0.0999**
2,4-Dinitrophenol	**51-28-5**	0.29 / **0.0609**	R-DCL / **R5 ESL-S**	**0.020**	**0.666**	**0.25308**	**0.0999**
2,4-Dinitrotoluene	**121-14-2**	**0.0056** / 1.28	**RBSSL** / R5 ESL-S	**0.0018**	**0.333**	**0.0666**	**0.0999**
2,6-Dichlorophenol	87-65-0	NC / 1.17	None / R5 ESL-S	0.39	0.333	0.1998	0.0999
2,6-Dinitrotoluene	**606-20-2**	0.40 / **0.0328**	RBSSL / **R5 ESL-S**	**0.011**	**0.333**	**0.0666**	**0.0999**
2-Acetylaminofluorene	**53-96-3**	**0.0013** / 0.596	**RBSSL** / R5 ESL-S	**0.00043**	**0.333**	**0.1998**	**0.0999**
2-Chloronaphthalene	**91-58-7**	42 / **0.0122**	R-DCL / **R5 ESL-S**	**0.0040**	**0.333**	**0.021978**	**0.00999**
2-Chlorophenol	**95-57-8**	0.75 / **0.243**	R-DCL / **R5 ESL-S**	**0.081**	**0.333**	**0.1332**	**0.0999**
2-Methylphenol	95-48-7	12 / 40.4	RBSSL / R5 ESL-S	4.0	0.333	0.1332	0.0999
2-Naphthylamine	**91-59-8**	**0.0034** / 3.03	**RBSSL** / R5 ESL-S	**0.0011**	**0.333**	**0.21978**	**0.0999**
2-Nitroaniline	88-74-4	0.67 / 74.1	R-DCL / R5 ESL-S	0.22	0.333	0.1332	0.0999
2-Nitrophenol	88-75-5	1.6 / 1.6	RBSSL/ R5 ESL-S	0.53	0.333	0.1332	0.0999
2-Picoline	109-06-8	NC / 9.9	None / R5 ESL-S	3.3	0.333	0.1332	0.0999

Analyte	CAS Number	HHRA / ERA PSL (mg/kg)	HHRA / ERA PSL Reference[(1)]	PQLG (mg/kg)	GEL		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
3&4-Methylphenol	108-39-4 / 106-44-5	1.1 / 163	R-DCL / R5 ESL-S	0.37	0.333	0.1998	0.0999
3,3'-Dichlorobenzidine	**91-94-1**	**0.014** / 0.646	**RBSSL** / R5 ESL-S	**0.0047**	**0.333**	**0.1998**	**0.0999**
3,3'-Dimethylbenzidine	**119-93-7**	**0.00074 / 0.104**	**RBSSL / R5 ESL-S**	**0.00025**	**0.33**	**0.1998**	**0.0999**
3-Methylcholanthrene	**56-49-5**	**0.0052 / 0.0779**	**RBSSL / R5 ESL-S**	**0.0017**	**0.333**	**0.21978**	**0.0999**
3-Nitroaniline	99-09-2	NC / 3.16	None/ R5 ESL-S	1.1	0.333	0.1332	0.0999
4,6-Dinitro-2-methylphenol	**534-52-1**	**0.040** / 0.144	**RBSSL** / R5 ESL-S	**0.013**	**0.333**	**0.1332**	**0.0999**
4-Aminobiphenyl	**92-67-1**	**0.00026 / 0.00305**	**RBSSL / R5 ESL-S**	**0.000086**	**0.333**	**0.1332**	**0.0999**
4-Bromophenyl phenyl ether	101-55-3	NC / NC	None / None	NC	0.333	0.1332	0.0999
4-Chloro-3-methylphenol	59-50-7	26 / 7.95	RBSSL / R5 ESL-S	2.65	0.333	0.1332	0.0999
4-Chloroaniline	**106-47-8**	**0.0026** / 1.1	**RBSSL** / R5 ESL-S	**0.00086**	**0.333**	**0.1332**	**0.0999**
4-Chlorophenyl phenyl ether	7005-72-3	NC / NC	None/ None	NC	0.333	0.1332	0.0999
4-Nitroaniline	**100-01-6**	**0.028** / 21.9	**RBSSL** / R5 ESL-S	**0.0093**	**0.333**	**0.1998**	**0.0999**
4-Nitrophenol	100-02-7	NC / 5.12	None / R5 ESL-S	1.7	0.333	0.21978	0.0999
4-Nitroquinoline-1-oxide	**56-57-5**	NC / **0.122**	None / **R5 ESL-S**	**0.041**	**0.333**	**0.1998**	**0.0999**
5-Nitro-o-toluidine	**99-55-8**	**0.078** / 8.73	**RBSSL** / R5 ESL-S	**0.026**	**0.333**	**0.1332**	**0.0999**
7,12-Dimethylbenz(a)anthracene	**57-97-6**	**0.0017** / 16.3	**RBSSL** / R5 ESL-S	**0.00057**	**0.333**	**0.1998**	**0.0999**
a,a-Dimethylphenethylamine	**122-09-8**	NC / **0.3**	None / **R5 ESL-S**	**0.10**	**0.33**	**0.21978**	**0.0999**
Acetophenone	98-86-2	9.0 / 300	RBSSL / R5 ESL-S	3.0	0.333	0.1332	0.0999
Aniline	**62-53-3**	**0.078 / 0.0568**	**RBSSL / R5 ESL-S**	**0.019**	**0.333**	**0.1998**	**0.0999**
Aramite	140-57-8	0.60 / 166	RBSSL / R5 ESL-S	0.20	0.333	0.21978	0.0999
Benzyl alcohol	100-51-6	7.4 / 65.8	RBSSL / R5 ESL-S	2.4	0.333	0.1998	0.0999
Bis(2-chloroethoxy)methane	**111-91-1**	**0.22 / 0.302**	**RBSSL / R5 ESL-S**	**0.073**	**0.333**	**0.1332**	**0.0999**
Bis(2-chloroethyl)ether	**111-44-4**	**0.000062** / 23.7	**RBSSL** / R5 ESL-S	**0.000021**	**0.333**	**0.1332**	**0.0999**
Bis(2-ethylhexyl)phthalate	117-81-7	0.34 / 0.925	RBSSL / R5 ESL-S	0.11	0.333	0.1332	0.0999
Butyl benzyl phthalate	**85-68-7**	4.0 / **0.239**	RBSSL / **R5 ESL-S**	**0.078**	**0.333**	**0.1332**	**0.0999**
Chlorobenzilate	**510-15-6**	**0.018** / 5.05	**RBSSL** / R5 ESL-S	**0.0058**	**0.333**	**0.1998**	**0.0999**
Diallate	**2303-16-4**	**0.014** / 0.452	**RBSSL** / R5 ESL-S	**0.0045**	**0.333**	**0.1332**	**0.0999**
Dibenzofuran	132-64-9	2.2 / 6.1	RBSSL / LANL	0.73	0.333	0.1332	0.0999
Diethyl phthalate	84-66-2	94 / 24.8	RBSSL / R5 ESL-S	8.2	0.333	0.1332	0.0999
Dimethoate	**60-51-5**	**0.014 / 0.218**	**RBSSL / R5 ESL-S**	**0.0046**	**0.333**	**0.1332**	**0.0999**
Dimethyl phthalate	131-11-3	240 / 734	RBSSL / R5 ESL-S	240	0.333	0.1332	0.0999

Analyte	CAS Number	HHRA / ERA PSL (mg/kg)	HHRA / ERA PSL Reference[(1)]	PQLG (mg/kg)	GEL		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Di-n-butyl phthalate	**84-74-2**	34 / **0.15**	RBSSL / **R5 ESL-S**	**0.050**	**0.333**	**0.1332**	**0.0999**
Di-n-octyl phthalate	117-84-0	2000 / 709	R-DCL / R5 ESL-S	240	0.333	0.1332	0.0999
Diphenylamine	122-39-4	8.8 / 1.01	RBSSL / R5 ESL-S	0.33	0.333	0.1332	0.0999
Disulfoton	**298-04-4**	**0.014 / 0.0199**	**RBSSL / R5 ESL-S**	**0.0047**	**0.333**	**0.1998**	**0.0999**
Ethyl methane sulfonate	62-50-0	NC / NC	None/ None	NC	0.333	0.1332	0.0999
Famphur	**52-85-7**	NC / **0.0497**	None / **R5 ESL-S**	**0.016**	**0.333**	**0.1332**	**0.0999**
Hexachlorobenzene	**118-74-1**	**0.011** / 0.199	**RBSSL** / R5 ESL-S	**0.0037**	**0.333**	**0.1332**	**0.0999**
Hexachlorobutadiene	**87-68-3**	**0.010 / 0.0398**	**RBSSL / R5 ESL-S**	**0.0033**	**0.333**	**0.1332**	**0.0999**
Hexachlorocyclopentadiene	77-47-4	1.4 / 0.755	RBSSL / R5 ESL-S	0.25	0.333	0.1332	0.0999
Hexachloroethane	**67-72-1**	**0.0096** / 0.596	**RBSSL** / R5 ESL-S	**0.0032**	**0.333**	**0.1332**	**0.0999**
Hexachlorophene	**70-30-4**	**1.8 / 0.199**	**R-RSL / R5 ESL-S**	**0.063**	**16.5**	**7.7256**	**3.8628**
Hexachloropropene	1888-71-7	NC / NC	None/ None	NC	0.333	0.1332	0.0999
Isodrin	**465-73-6**	NC / **0.00332**	None / **R5 ESL-S**	**0.0011**	**0.333**	**0.1332**	**0.0666**
Isophorone	78-59-1	0.44 / 139	RBSSL / R5 ESL-S	0.14	0.333	0.1332	0.0999
Isosafrole	120-58-1	NC / 9.94	None / R5 ESL-S	3.3	0.333	0.1332	0.0999
Methapyrilene	91-80-5	NC / 2.78	None / R5 ESL-S	0.92	0.333	0.21978	0.0999
Methyl methane sulfonate	**66-27-3**	**0.0028 / 0.315**	**RBSSL / R5 ESL-S**	**0.00093**	**0.333**	**0.1332**	**0.0999**
Methyl parathion	**298-00-0**	**0.11 / 0.000292**	**RBSSL / R5 ESL-S**	**0.000097**	**0.333**	**0.1332**	**0.0999**
Nitrobenzene	**98-95-3**	**0.0016** / 1.31	**RBSSL** / R5 ESL-S	**0.00053**	**0.333**	**0.1332**	**0.0999**
N-Nitrosodiethylamine	**55-18-5**	**0.0000010 / 0.0693**	**RBSSL / R5 ESL-S**	**3.3E-07**	**0.333**	**0.1332**	**0.0999**
N-Nitrosodimethylamine	**62-75-9**	**0.0000020 / 0.0000321**	**RBSSL / R5 ESL-S**	**6.6E-07**	**0.33**	**0.1332**	**0.0999**
N-Nitroso-di-n-butylamine	**924-16-3**	**0.000096 / 0.267**	**RBSSL / R5 ESL-S**	**0.000032**	**0.333**	**0.1332**	**0.0999**
N-Nitroso-di-n-propylamine	**621-64-7**	**0.00014** / 0.544	**RBSSL** / R5 ESL-S	**0.000046**	**0.333**	**0.1332**	**0.0999**
N-Nitrosodiphenylamine	86-30-6	1.1 / 0.545	RBSSL / R5 ESL-S	0.18	0.333	0.1332	0.0999
N-Nitrosomethylethylamine	**10595-95-6**	**0.000017 / 0.00166**	**RBSSL / R5 ESL-S**	**5.8E-06**	**0.333**	**0.1332**	**0.0999**
N-Nitrosomorpholine	**59-89-2**	**0.000050 / 0.0706**	**RBSSL / R5 ESL-S**	**0.000016**	**0.333**	**0.1332**	**0.0999**
N-Nitrosopiperidine	**100-75-4**	**0.000076 / 0.00665**	**RBSSL / R5 ESL-S**	**0.000025**	**0.333**	**0.1332**	**0.0999**
N-Nitrosopyrrolidine	**930-55-2**	**0.00024 / 0.0126**	**RBSSL / R5 ESL-S**	**0.000080**	**0.333**	**0.1332**	**0.0999**

Analyte	CAS Number	HHRA / ERA PSL (mg/kg)	HHRA / ERA PSL Reference[(1)]	PQLG (mg/kg)	GEL		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
o,o,o-Triethylphosphorothioate	126-68-1	NC / 0.818	None/ R5 ESL-S	0.27	0.333	0.1332	0.0999
o-Toluidine	95-53-4	NC / 2.97	None / R5 ESL-S	0.99	0.33	0.1998	0.0999
Parathion (ethyl parathion)	**56-38-2**	6.6 / **0.00034**	RBSSL / **R5 ESL-S**	**0.00011**	**0.333**	**0.1332**	**0.0999**
Pentachlorobenzene	608-93-5	0.34 / 0.497	RBSSL / R5 ESL-S	0.11	0.333	0.1332	0.0999
Pentachloronitrobenzene	**82-68-8**	**0.026** / 7.09	**RBSSL** / R5 ESL-S	**0.0086**	**0.333**	**0.1332**	**0.0999**
Phenacetin	**62-44-2**	**0.17** / 11.7	**RBSSL** / R5 ESL-S	**0.057**	**0.333**	**0.1332**	**0.0999**
Phenol	108-95-2	52 / 120	RBSSL / R5 ESL-S	17	0.333	0.1332	0.0999
Phorate	**298-02-2**	**0.0052 / 0.000496**	**RBSSL / R5 ESL-S**	**0.00017**	**0.333**	**0.1332**	**0.0999**
Pronamide	**23950-58-5**	18 / **0.0136**	RBSSL / **R5 ESL-S**	**0.0045**	**0.333**	**0.1332**	**0.0999**
Pyridine	**110-86-1**	**0.106** / 1.03	**RBSSL** / R5 ESL-S	**0.035**	**0.333**	**0.1332**	**0.0999**
Safrole	**94-59-7**	**0.00076** / 0.404	**RBSSL** / R5 ESL-S	**0.00025**	**0.333**	**0.1332**	**0.0999**
Solvent Yellow (p-Dimethylaminoazobenzene)	**60-11-7**	**0.0036 / 0.04**	**RBSSL / R5 ESL-S**	**0.0012**	**0.33**	**0.1332**	**0.0999**
Sulfotep	**3689-24-5**	**0.078** / 0.596	**RBSSL** / R5 ESL-S	**0.026**	**0.333**	**0.1332**	**0.0999**
Thionazin	297-97-2	NC / 0.799	None / R5 ESL-S	0.26	0.333	0.1332	0.0999
Low Level PAHs							
1-Methylnaphthalene	90-12-0	0.10 / 29	RBSSL / Eco-SSL	0.033	0.00666	0.00333	0.001665
2-Methylnaphthalene	91-57-6	2.8 / 29	RBSSL / Eco-SSL	0.93	0.00666	0.00333	0.001665
Acenaphthene	83-32-9	82 / 29	RBSSL / Eco-SSL	9.7	0.00666	0.00333	0.001665
Acenaphthylene	208-96-8	18 / 29	R-DCL / Eco-SSL	6.0	0.00666	0.00333	0.001665
Anthracene	120-12-7	840 / 29	RBSSL / Eco-SSL	9.7	0.00666	0.00333	0.001665
Benzo(a)anthracene	56-55-3	0.15 / 1.1	R-RSL / Eco-SSL	0.050	0.00666	0.00333	0.001665
Benzo(a)pyrene	50-32-8	0.015 / 1.1	R-RSL / Eco-SSL	0.0050	0.00666	0.00333	0.001665
Benzo(b)fluoranthene	205-99-2	0.15 / 1.1	R-RSL / Eco-SSL	0.050	0.00666	0.00333	0.001665
Benzo(g,h,i)perylene	191-24-2	170 / 1.1	R-RSL / Eco-SSL	0.37	0.00666	0.00333	0.001665
Benzo(k)fluoranthene	207-08-9	1.5 / 1.1	R-RSL / Eco-SSL	0.37	0.00666	0.00333	0.001665
Chrysene	218-01-9	15 / 1.1	R-RSL / Eco-SSL	0.37	0.00666	0.00333	0.001665
Dibenzo(a,h)anthracene	53-70-3	0.015 / 1.1	R-RSL / Eco-SSL	0.0050	0.00666	0.00333	0.001665
Fluoranthene	206-44-0	230 / 29	R-RSL / Eco-SSL	9.7	0.00666	0.00333	0.001665
Fluorene	86-73-7	80 / 29	RBSSL / Eco-SSL	9.7	0.00666	0.00333	0.001665
Indeno(1,2,3-cd)pyrene	193-39-5	0.15 / 1.1	R-RSL / Eco-SSL	0.050	0.00666	0.00333	0.001665
Naphthalene	91-20-3	0.0094 / 29	RBSSL / Eco-SSL	0.0031	0.00666	0.00333	0.001665

Analyte	CAS Number	HHRA / ERA PSL (mg/kg)	HHRA / ERA PSL Reference[1]	PQLG (mg/kg)	GEL		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
Phenanthrene	85-01-8	13 / 29	R-DCL / Eco-SSL	4.3	0.00666	0.00333	0.001665
Pyrene	129-00-0	170 / 1.1	R-RSL / Eco-SSL	0.37	0.00666	0.00333	0.001665
PCBs							
Aroclor-1016	**12674-11-2**	0.39 / **3.32E-04**	R-RSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1221	**11104-28-2**	0.0015 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1232	**11141-16-5**	0.0015 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1242	**53469-21-9**	0.11 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1248	**12672-29-6**	0.10 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1254	**11097-69-1**	0.11 / **3.32E-04**	R-RSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1260	**11096-82-5**	0.22 / **3.32E-04**	R-RSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1262	**37324-23-5**	0.22 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Aroclor-1268	**11100-14-4**	0.22 / **3.32E-04**	RBSSL / **R5 ESL-S**	**0.00011**	**0.003333**	**0.0021978**	**0.0010989**
Metals							
Aluminum	7429-90-5	7700 / NC	R-RSL / None	17	20	13.6	6.8
Antimony	**7440-36-0**	3.1 / **0.27**	R-RSL / **Eco-SSL**	**0.090**	**1.0**	**0.66**	**0.33**
Arsenic	**7440-38-2**	**0.026** / 18	**RBSSL** / Eco-SSL	**0.0086**	**3.0**	**1.0**	**0.5**
Barium	7440-39-3	1500 / 330	R-RSL / Eco-SSL	110	0.5	0.2	0.1
Cadmium	**7440-43-9**	7.0 / **0.36**	R-RSL / **Eco-SSL**	**0.12**	**0.5**	**0.2**	**0.1**
Chromium	**7440-47-3**	**0.012** / 26	**RBSSL** / Eco-SSL	**0.0040**	**0.5**	**0.3**	**0.15**
Cobalt	7440-48-4	2.3 / 13	R-RSL / Eco-SSL	0.77	0.5	0.3	0.15
Copper	7440-50-8	310 / 28	R-RSL / Eco-SSL	9.3	1.0	0.6	0.3
Iron	7439-89-6	5400 / NC	RBSSL / NC	1800	25	16	8
Lead	7439-92-1	81 / 11	R-DCL / Eco-SSL	3.7	1.0	0.66	0.33
Manganese	7439-96-5	180 / 220	R-RSL / Eco-SSL	60	1.0	0.4	0.2
Nickel	7440-02-0	150 / 38	R-RSL / Eco-SSL	12	0.5	0.3	0.15
Selenium	**7782-49-2**	5.2 / **0.52**	R-DCL / **Eco-SSL**	**0.17**	**3.0**	**1.0**	**0.5**
Vanadium	7440-62-2	39 / 7.8	R-RSL / Eco-SSL	2.6	0.5	0.2	0.1
Zinc	7440-66-6	2300 / 46	R-RSL / Eco-SSL	15	1.0	0.8	0.4

Notes:

CAS Chemical Abstracts Service

DL	Detection Limit
Eco-SSL	USEPA Eco-SSL (Eco-SSL documents are available on-line at http://www.epa.gov/ecotox/ecossl/); lower of the plant, soil invertebrate, bird, or mammal screening level.
IDEM R-DCL	The guidelines are from IDEM's RISC Default Closure Tables 2006 (Revised May 1, 2009) available online at: http://www.in.gov/idem/files/risctech_appendix1_2006_r1.pdf.
LANL	Los Alamos National Laboratory , 2009 (December.). ECORISK Database (Release 2.4). LA-UR-04-7834. ER ID 107524. Environmental Programs Directorate, Los Alamos National Laboratory, Los Alamos, NM.
LOD	Limit of Detection
LOQ	Limit of Quantitation
NA	Not applicable.
NC	No Criteria
ORNL-pl	Efroymson, R.A., M.E. Will, and G.W. Suter II. 1997. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory. November. ES/ER/TM-126/R2.
R5 ESL-S	USEPA, 2003. Ecological Screening Levels, Soil. USEPA Region 5 (http://www.epa.gov/reg5rcra/ca/edql.htm). August.
R-RSL/RBSSL	The soil direct contact residential regional screening level (R-RSL) and migration to groundwater risk-based soil screening level (RBSSL) values are from the USEPA Regional Screening Levels Table, May, 2012, available online at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_MAY2012.pdf. The R-RSL tables are based on a target hazard quotient of 1 for non-carcinogens (denoted with an "N" flag), or an ILCR of 1E-6 for carcinogens (denoted with a "C" flag). For risk screening purposes, the R-RSL for non-carcinogens is adjusted by dividing by 10, equivalent to a target hazard quotient of 0.1, and the R-RSL for carcinogens (not adjusted) is equivalent to an ILCR of 1E-6. If available, the Maximum Contaminant Level (MCL)-Based RBSSL is presented; if an MCL-Based RBSSL is not available, then the risk-based RBSSL is presented. The RBSSL is adjusted for a dilution attenuation factor (DAF) of 20.
PQLG	Project Quantitation Limit Goal
PSL	Project Screening Level

Bolded rows indicate that the PSL is between the laboratory LOQ and LOD. The Project Team has agreed to accept this data for decision making if results below the LOQ are "J" qualified and the results are discussed in the uncertainties section of the Risk Assessment.

Bolded and Shaded rows indicate the PSL is less than the LOD; the Project Team has agreed to report non-detected results at the LOD and any limitations on data use that result from having detection limits that are greater than PSLs will be described in the RFI Report.

10.0 -- Analytical SOP References Table

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

LAB SOP NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	MATRIX AND ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	VARIANCE TO QSM? (Y/N)	MODIFIED FOR PROJECT WORK? (Y/N)
GEL SOP GL-MA-E-009	Acid Digestion of Sediment, Sludges and Soils (Revision 21, 03/2011)	Definitive	Soil, Metals Digestion	NA/Preparation	GEL	NA	N
GEL SOP GL-MA-E-006	Acid Digestion of Total Recoverable or Dissolved Metals in Surface and Groundwater Samples for Analysis by ICP or ICP-MS (Revision 9, 03/2004)	Definitive	Aqueous, Metals Digestion	NA/Preparation	GEL	NA	N
GEL SOP GL-MA-E-013	Determination of Metals by ICP (Revision 20, 09/2009)	Definitive	Aqueous and Soil, Metals	Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES)	GEL	N	N
GEL SOP GL-MA-E-014	Determination of Metals by ICP-MS (Revision 24, 12/2011)	Definitive	Aqueous and Soil, Metals	Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	GEL	N	N
GEL SOP GL-OA-E-009	Analysis of Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (Revision 27, 10/2011)	Definitive	Aqueous and Soil, SVOCs (Including Low Level PAHs) and Low Level PAHs	Gas Chromatography/ Mass Spectrometry (GC/MS)	GEL	N	N
GEL SOP GL-OA-E-040	The Analysis of Polychlorinated Biphenyls by GC/ECD (Revision 17, 11/2011)	Definitive	Aqueous and Soil, PCBs	Gas Chromatography/ Electron Capture Detector (GC/ECD)	GEL	N	N

LAB SOP NUMBER	TITLE, REVISION DATE, AND/OR NUMBER	DEFINITIVE OR SCREENING DATA	MATRIX AND ANALYTICAL GROUP	INSTRUMENT	ORGANIZATION PERFORMING ANALYSIS	VARIANCE TO QSM? (Y/N)	MODIFIED FOR PROJECT WORK? (Y/N)
GEL SOP GL-OA-E-010	The Extraction of Semivolatile and Nonvolatile Organic Compounds from Soil, Sludge, and Other Miscellaneous Solid Samples (Revision 20, 12/2010)	Definitive	Soil, SVOCs/ Low Level PAHs and PCBs Extraction	NA/ Extraction	GEL	NA	N
GEL SOP GL-OA-E-013	Extraction of Semivolatile and Nonvolatile Organic Compounds from Groundwater, Wastewater, and Other Aqueous Samples (Revision 24, 07/2011)	Definitive	Aqueous, SVOCs/ Low Level PAHs and PCBs Extraction	NA/ Extraction	GEL	NA	N

11.0 -- Laboratory QC Samples Table

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

Matrix	**Soil**
Analytical Group	**SVOCs and Low Level PAHs**
Analytical Method / SOP Reference	**SW-846 8270D/ 8270D-SIM GEL SOP GL-OA-E-009**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparatory batch of 20 or fewer samples of similar matrix.	All target analytes must be ≤ ½ LOQ or < LOD, whichever is lower, except common lab contaminants, which must be < LOQ.	Investigate source of contamination. Rerun method blank prior to analysis of samples if possible. Evaluate the samples and associated QC: if blank results are above LOQ, report sample results that are < LOQ or > 10X the blank concentration. Reanalyze blank and samples >LOQ and < 10X the blank.	Analyst, Supervisor	Bias/ Contamination	Same as QC Acceptance Limits
Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD) (not required)	One per preparatory batch of 20 or fewer samples of similar matrix.	Percent Recoveries (%Rs) must meet the DoD Quality Systems Manual (QSM) Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C). RPD must be ≤ 30% (for LCS/LCSD, if LCSD is performed).	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to DoD QSM Version 4.1 Table G-1 for number of marginal exceedances allowed. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
MS/MSD	One per preparatory batch of 20 or fewer samples of similar matrix.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C). The RPD between MS and MSD should be ≤ 30%.	CA will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met, unless RPDs indicate obvious extraction/ analysis difficulties, then re-prepare and reanalyze MS/MSD.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits

Matrix	**Soil**
Analytical Group	**SVOCs and Low Level PAHs**
Analytical Method / SOP Reference	**SW-846 8270D/ 8270D-SIM GEL SOP GL-OA-E-009**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Internal Standard (IS)	Every field sample, standard, and QC sample - six per sample 1,4-Dichlorobenzene-d_4 Naphthalene-d_8 Acenaphthene-d_{10} Phenanthrene-d_{10} Chrysene-d_{12} Perylene-d_{12}.	Retention Times (RTs) must be within ± 30 seconds and the response areas must be within -50% to +100% of the ICAL midpoint standard for each IS.	Re-analyze affected samples.	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits
Surrogates	All field and QC samples - six per sample 2-Fluorophenol Phenol-d_5 Nitrobenzene-d_5 2-Fluorobiphenyl 2,4,6-Tribromophenol p-Terphenyl-d_{14}.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C).	(1) Check chromatogram for interference; if found, then flag data. (2) If not found, then check instrument performance; if problem is found, then correct and reanalyze sample. (3) If still out, then re-extract and reanalyze sample. (4) If reanalysis is out, then flag data.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
Results between DL and LOQ	NA.	Apply “J” qualifier to results detected between DL and LOQ.	NA.	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits

Matrix	**Soil**
Analytical Group	**PCBs**
Analytical Method / SOP Reference	**SW-846 8082A GEL SOP GL-OA-E-040**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparatory batch of 20 or fewer samples of similar matrix.	All target analytes must be ≤ ½ LOQ or < LOD, whichever is lower.	Investigate source of contamination. Evaluate the samples and associated QC: i.e., if the blank results are above the LOQ, then report sample results that are <LOQ or > 10X the blank concentration. Otherwise, re-prepare a blank and samples >LOQ and <10X LOQ.	Analyst, Supervisor	Bias/ Contamination	Same as QC Acceptance Limits
LCS	One per preparatory batch of 20 or fewer samples of similar matrix. PCBs: Spike with Aroclor 1016/1260 mix.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C).	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to DOD QSM Version 4.1 Table G-1 for number of marginal exceedances allowed. Contact Client if samples cannot be re-prepared within hold time.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
MS/MSD	One per preparatory batch of 20 or fewer samples of similar matrix. (spike same as LCS).	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C). The RPD between MS and MSD should be ≤ 30%.	Evaluate the samples and associated QC and if the LCS results are acceptable, then narrate. If both the LCS and MS/MSD are unacceptable, then re-prepare the samples and QC.	Analyst, Supervisor	Accuracy/ Bias/ Precision	Same as QC Acceptance Limits

Matrix	**Soil**
Analytical Group	**PCBs**
Analytical Method / SOP Reference	**SW-846 8082A GEL SOP GL-OA-E-040**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Surrogates	All field and QC samples - two per sample. Tetrachloro-m-xylene Decachlorobiphenyl.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM where available or laboratory statistically-derived control limits (Appendix C).	No corrective will be taken when one surrogate is within criteria. If surrogates recoveries are high and sample is <LOQ, then no CA is taken. If surrogates recoveries are low, then the affected samples are re-extracted and reanalyzed.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
Second Column Confirmation	All positive results must be confirmed.	Results between primary and second column must be RPD ≤ 40%. For Method 8082, report the higher of the two concentrations, unless there is interference.	None. Apply "J" flag if RPD >40% and discuss in the case narrative.	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits
Results between DL and LOQ	NA.	Apply "J" qualifier to results between DL and LOQ.	NA.	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits

Matrix	**Soil**
Analytical Group	**Metals**
Analytical Method / SOP Reference	**SW-846 6010C/6020A GEL SOP GL-MA-E-013/GL-MA-E-014**

QC Sample	**Frequency / Number**	**Method / SOP QC Acceptance Limits**	**CA**	**Person(s) Responsible for CA**	**DQI**	**MPC**
Method Blank	One per preparatory batch of 20 or fewer samples of similar matrix.	All target analytes must be ≤ ½ LOQ or < LOD, whichever is lower.	If the blank value > LOQ, then report sample results. If the blank value < LOQ or > 10x the blank value, then redigest. If blank value is less than negative LOQ, then report sample results. If > 10x the absolute value of the blank result, then redigest and reanalyze.	Analyst, Supervisor	Bias/ Contamination	Same as QC Acceptance Limits
LCS	One per preparatory batch of 20 or fewer samples of similar matrix.	%R must be within 80-120% of true value.	Evaluate and reanalyze, if possible. If the LCS recoveries are high, but the sample results are < LOQ, then narrate. Otherwise, re-digest and reanalyze all associated samples for failed target analyte(s).	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
MS	One per preparatory batch of 20 or fewer samples of similar matrix.	%R should be within 80-120% of true value (if sample is < 4x spike added).	Flag results for affected analytes for all associated samples.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
Sample Duplicate	One per preparatory batch of 20 or fewer samples of similar matrix.	The RPD should be ≤ 20% for duplicate samples for both water and soils.	Narrate any results that are outside control limits.	Analyst, Supervisor	Precision	Same as QC Acceptance Limits
Serial Dilution	One per preparatory batch with sample concentration(s) >50x LOD.	The 5-fold dilution result must agree within ±10%D of the original sample result if result is >50x LOD.	Perform post spike addition.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits

Matrix	**Soil**
Analytical Group	**Metals**
Analytical Method / SOP Reference	**SW-846 6010C/6020A GEL SOP GL-MA-E-013/GL-MA-E-014**

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Post Digestion Spike	One is performed when serial dilution fails or target analyte concentration(s) in all samples are < 50x 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.	Flag results for affected analytes for all associated samples with “J”.	Analyst, Supervisor	Accuracy/ Bias	Same as QC Acceptance Limits
Results between DL and LOQ	NA.	Apply “J” qualifier to results between DL and LOQ.	NA.	Analyst, Supervisor	Accuracy	Same as QC Acceptance Limits

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

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

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
Chain of Custody Forms	The Tetra Tech FOL or designee will review and sign the chain-of-custody form to verify that all samples listed are included in the shipment to the laboratory and the sample information is accurate. The forms will be signed by the sampler and a copy will be retained for the project file, the Tetra Tech PM, and the Tetra Tech Data Validators. The Tetra Tech FOL or designee will review the chain-of-custody form to verify that all samples listed in the SAP have been collected. All deviations should be documented in the report.	Sampler and FOL, Tetra Tech	Internal
Chain of Custody Forms	1 - The Laboratory Sample Custodian will review the sample shipment for completeness and integrity, and sign accepting the shipment. 2- The Tetra Tech Data Validators 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.	1 - Laboratory Sample Custodian, GEL 2 - Data Validators, Tetra Tech	1 – External 2 - External
Chain of Custody Forms and SAP	Ensure that the custody and integrity of the samples was maintained from collection to analysis and the custody records are complete and any deviations are recorded. Review that the samples were shipped and stored at the required temperature and preservation conditions for chemically-preserved samples meet the requirements listed in the SAP. Ensure that the analyses were performed within the holding times listed in the SAP.	Data Validators, Tetra Tech	External
Sample Log Sheets, Chain of Custody Forms, SAP, and Laboratory Sample Login Documentation	Verify that information recorded in the log sheets is accurate and complete. 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. Document any discrepancies in the final report.	PM, FOL, or designee, Tetra Tech	Internal

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
SAP, Analytical SOPs, and Analytical Data Packages	Ensure that all laboratory SOPs were followed. Verify that the correct analytical methods/SOPs were applied. 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 verbally or via e-mail for guidance prior to report preparation.	Laboratory QAM, GEL	Internal
SAP/ Chain-of-Custody Forms	Check that all field QC samples determined necessary were collected as required.	FOL or designee, Tetra Tech	Internal
Analytical Data Package	Verify all analytical data packages for completeness. The Laboratory QAM will sign the case narrative for each data package.	Laboratory QAM, GEL	Internal
Electronic Data Deliverables (EDDs)/ Analytical Data Packages	Check each EDD against the chain-of-custody and hard copy data package for accuracy and completeness. Compare laboratory analytical results to the electronic analytical results to verify accuracy. Evaluate sample results for laboratory contamination and qualify false detections using the laboratory method/preparation blank summaries. Qualify analyte concentrations between the DL and the LOQ as estimated. Remove extraneous laboratory qualifiers from the validation qualifier.	Data Validators, Tetra Tech	External
Analytical Data Package	Verify each data package for completeness. Request missing information from the Laboratory PM.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that the laboratory QC samples were analyzed and that the MPCs listed were met for all field samples and QC analyses. Check that specified field QC samples were collected and analyzed and that the analytical QC criteria set up for this project were met.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Check the field sampling precision by calculating RPDs for field duplicate samples. Check laboratory precision by reviewing the RPD or percent difference values from laboratory duplicate analyses; MS/MSDs; and LCS/LCSD, if available. Ensure compliance with the methods and project MPCs accuracy goals listed in the SAP.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Check that the laboratory recorded the temperature at sample receipt and the pH of samples preserved with acid or base to	Data Validators, Tetra Tech	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
	ensure sample integrity from sample collection to analysis.		
SAP/ Laboratory Data Packages/ EDDs	Review the chain-of-custody forms generated in the field to ensure that the required analytical samples have been collected, appropriate sample identifications have been used, and correct analytical methods have been applied. The Tetra Tech Data Validator will verify that elements of the data package required for validation are present, and if not, the laboratory will be contacted and the missing information will be requested. Check that all data have been transferred correctly and completely to the Tetra Tech SQL database.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that the project LOQs listed in SAP were achieved.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Discuss the impact on DLs that are elevated because of matrix interferences. Be especially cognizant of and evaluate the impact of sample dilutions on low-concentration analytes when the dilution was performed because of the high concentration of one or more other contaminants. Document this usability issue and inform the Tetra Tech PM. Review and add PALs to the laboratory EDDs. Flag samples and notify the Tetra Tech PM of samples that exceed PALs listed in the SAP.	Data Validators, Tetra Tech	External
SAP/ Laboratory Data Packages/ EDDs	Ensure that all QC samples specified in the SAP were collected and analyzed and that the associated results were within prescribed SAP acceptance limits. Ensure that QC samples and standards prescribed in analytical SOPs were analyzed and within the prescribed control limits. If any significant QC deviations occur, the Laboratory QAM shall have contacted the Tetra Tech PM.	Data Validators, Tetra Tech	External

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ External
SAP/ Laboratory Data Packages/ EDDs	Summarize deviations from methods, procedures, or contracts in the Data Validation Report. Determine the impact of any deviation from sampling or analytical methods and SOPs requirements and matrix the interferences effect on the analytical results. Qualify data results based on method or QC deviation and explain all the data qualifications. Print a copy of qualified data stored in the project database to depict data qualifiers and data qualifier codes that summarize the reason for data qualifications. Determine if the data met the MPCs and determine the impact of any deviations on the technical usability of the data.	Data Validators, Tetra Tech	External

12.1 VALIDATION SUMMARY

Analytical Group	Validation Criteria	**Data Validator** (title and organizational affiliation)
Soil - SVOCs (including Low Level PAHs), Low Level PAHs, PCBs	Full data validation will be performed using criteria for SW-846 Method 8270D, 8270D-SIM, and 8082A listed in **Sections 6.0**, **9.0**, and **11.0** and the current DoD QSM. If not included in the aforementioned, then the logic outlined in the "USEPA CLP National Functional Guidelines for Organic Data Review" USEPA-540/R-99-008, (USEPA, October 1999) will be used to apply qualifiers to data.	Data Validation Specialist, Tetra Tech
Soil - Metals	Full data validation will be performed using criteria for SW-846 Method 6010C and 6020A listed in **Sections 6.0**, **9.0**, and **11.0** and the current DoD QSM. If not included in and the aforementioned, then the logic outlined in the "USEPA CLP National Functional Guidelines for Inorganic Data Review", USEPA 540-R-04-004, (USEPA, October 2004) will be used to apply qualifiers to data.	Data Validation Specialist, Tetra Tech

REFERENCES

IDEM (Indiana Department of Environmental Management), 2009. *RISC Residential Closure Levels for Soil. Appendix 1, Default Closure Level Tables*. Version 1.2. May.

Tetra Tech, 2001. Basewide Background Soil Investigation Report, Naval Surface Warfare Center, Crane, Crane, Indiana, January.

Tetra Tech, 2005. Environmental Indicator Investigation for SWMU 18 (Load and Fill Area Buildings), SWMU 19 (Pyrotechnic Test Area), SWMU 20 (Crane Army Ammunition Activity Quality Assurance/Quality Control Test Area), and the Old Gun Tub Storage Lot, Naval Surface Warfare Center Crane, Crane, Indiana, June.

Tetra Tech, 2011. Soil Characterization Technical Memorandum. NSA Crane SWMU 34 – Old Gun Tub Storage Lot Investigation. Naval Support Activity Crane. Crane, Indiana. September.

USEPA, 1997. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments.* EPA 540-R-97-006, OSWER Directive 9285.7-25. Office of Solid Waste and Emergency Response, Washington, DC. June.

USEPA, 1999. *Contract Laboratory Program National Functional Guidelines for Organics Data Review*. EPA540/R-99/008. Office of Emergency and Remedial Response, Washington, DC. October.

USEPA. 2002a. Guidance for Quality Assurance Project Plans (EPA QA/G-5). EPA/240/R-02/009. USEPA Office of Environmental Information, Washington DC. December.

USEPA. 2002b. Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan (EPA QA/G-5S). EPA/240/R-02/005. USEPA Office of Environmental Information, Washington DC. December.

USEPA. 2003. Guidance for Developing Ecological Soil Screening Levels, Office of Solid Waste and Emergency Response, Directive 9285.7-55. November.

USEPA, 2004. *Contract Laboratory Program National Functional Guidelines for Inorganics Data Review.* EPA 540-R-04-004. OSWER 9240.1-45. Office of Superfund Remediation and Technology Innovation (OSRTI), October.

USEPA. 2005b. Resource Conservation and Recovery Act Corrective Action Ecological Screening Levels. August.

USEPA, 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA QA/G-4.* EPA/240/B-06/001. Office of Environmental Information, Washington DC. February.

USEPA. 2012. Regional Screening Levels for Chemical Contaminants at Superfund Sites. RSL Table Update. May.

FIGURES

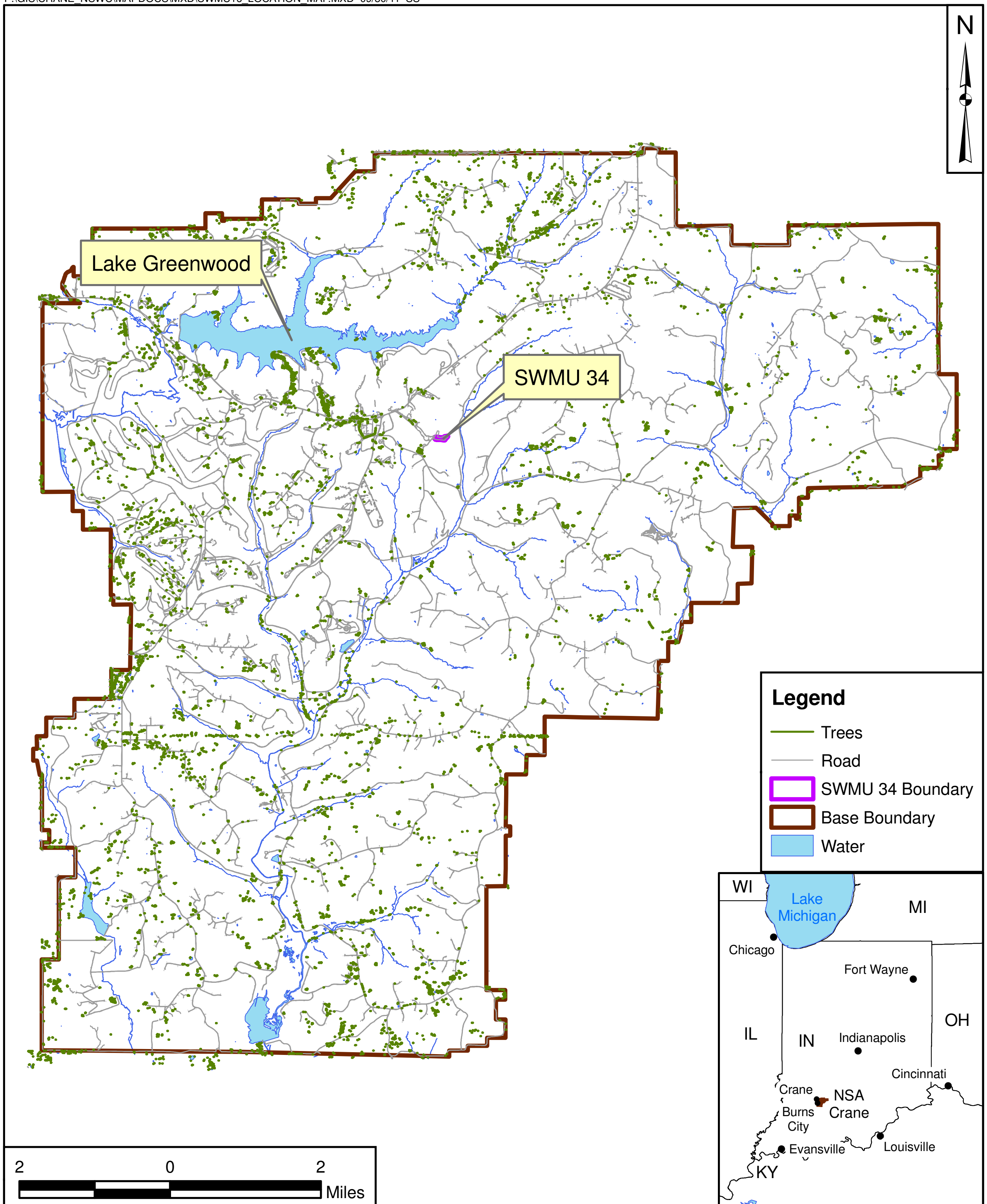
PGH P:\GIS\CRANE_NSWC\MAPDOCS\MXD\GENERAL_LOCATION.MXD 09/13/11 SS

DRAWN BY	DATE
J. ENGLISH	03/10/11
CHECKED BY	DATE
K. LOSEKAMP	09/30/11
REVISED BY	DATE
SCALE AS NOTED	

GENERAL LOCATION MAP
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	CTO NUMBER
____	F27R
APPROVED BY	DATE
____	____
APPROVED BY	DATE
____	____
FIGURE NO. FIGURE 4-1	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU16_LOCATION_MAP.MXD 09/30/11 SS



DRAWN BY K. MOORE	DATE 09/26/08	TETRA TECH	CONTRACT NUMBER CTO F27R	
CHECKED BY K. LOSEKAMP	DATE 09/30/11	SITE LOCATON MAP SWMU 34 - OLD GUN TUB STORAGE LOT NSA CRANE CRANE, INDIANA	OWNER NO. ___	
REVISED BY S. STROZ	DATE 09/30/11		APPROVED BY ___	DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 4-2	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\OGTSL_SITE_1.MXD 09/30/11 SS

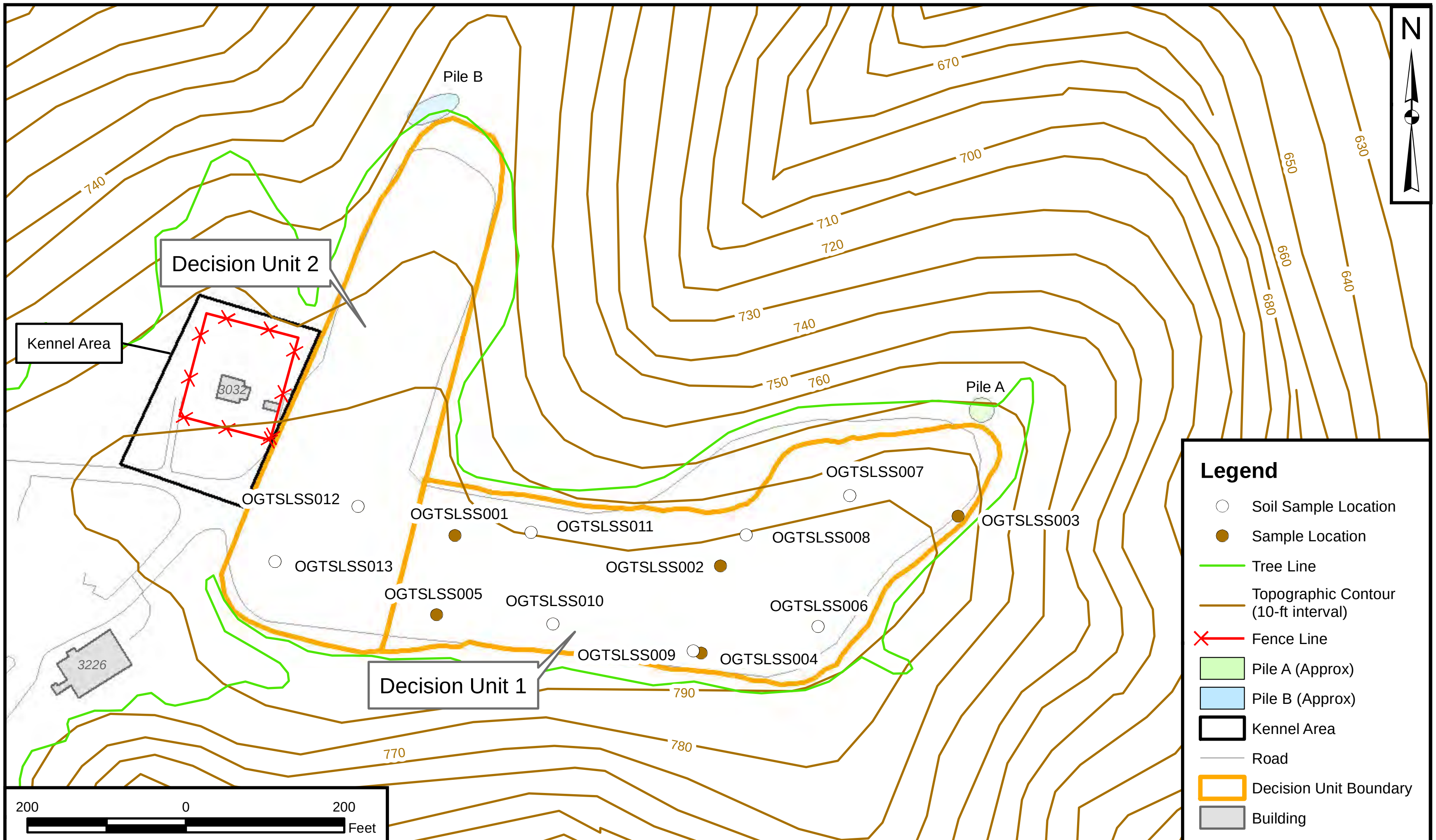
DRAWN BY S. STROZ	DATE 09/30/11
CHECKED BY K. LOSEKAMP	DATE 09/29/11
REVISED BY ___	DATE ___
SCALE AS NOTED	

NAVFAC

SITE LAYOUT
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

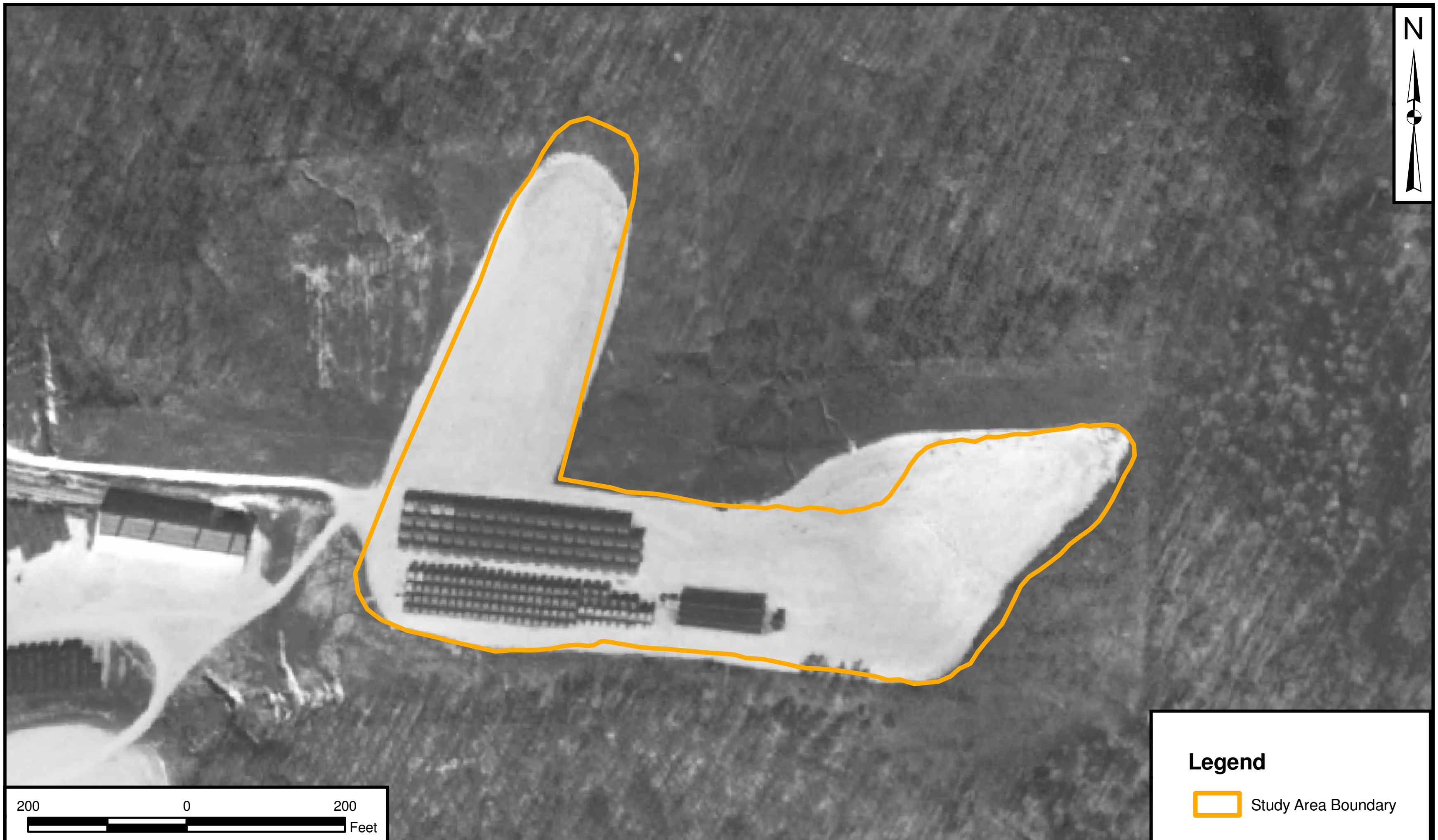
CONTRACT NUMBER ___	CTO NUMBER F27R
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. 4-3	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\OGTSL_SITE_SAMP_LOCS_1.MXD 03/19/12 JN



DRAWN BY S. STROZ	DATE 09/28/11	HISTORICAL SOIL CHARACTERIZATION SAMPLING LOCATIONS SWMU 34 - OLD GUN TUB STORAGE LOT NSA CRANE CRANE, INDIANA	CONTRACT NUMBER —— / CTO NUMBER F27R
CHECKED BY K. LOSEKAMP	DATE 03/19/12		APPROVED BY — DATE —
REVISED BY J. NOVAK	DATE 03/19/12		APPROVED BY — DATE —
SCALE AS NOTED	NAVFAC		FIGURE NO. 4-4 / REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU34_1952_AERIAL.MXD 09/30/11 SS



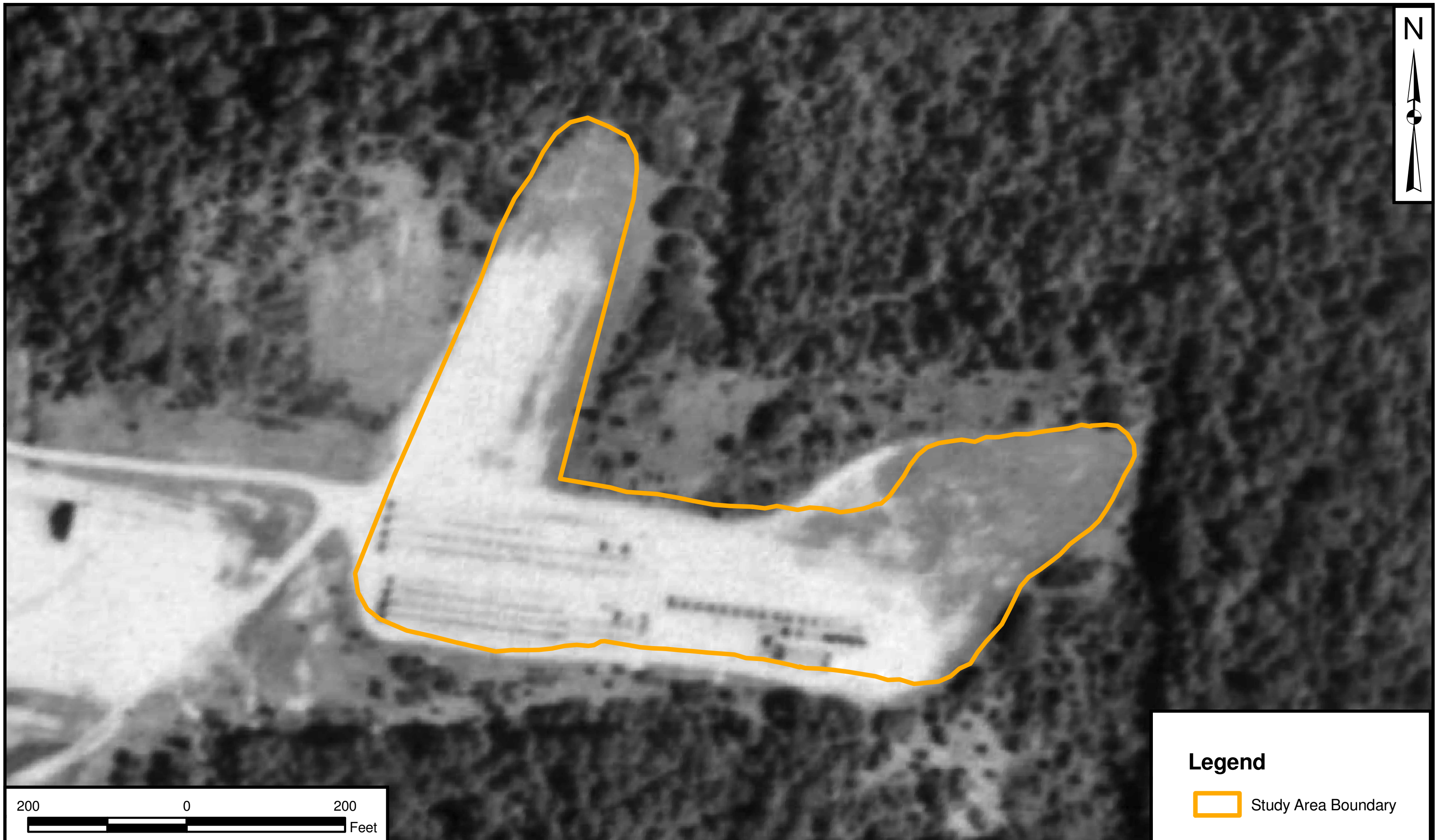
DRAWN BY	DATE
S. STROZ	09/29/11
CHECKED BY	DATE
K. LOSEKAMP	09/30/11
REVISED BY	DATE
___	___
SCALE AS NOTED	

NAVFAC

1952 AERIAL PHOTOGRAPH
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

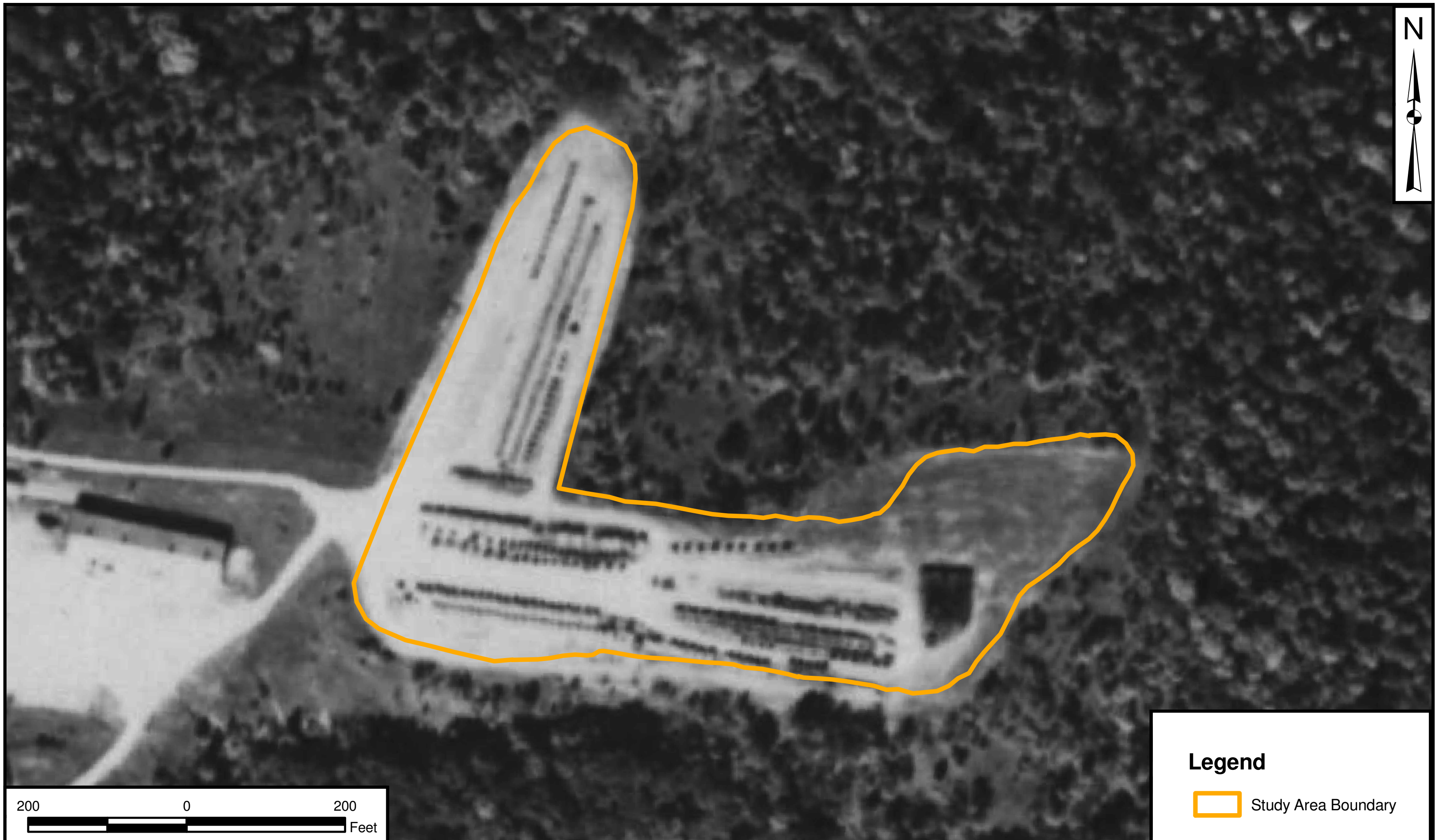
CONTRACT NUMBER	CTO NUMBER
___	F27R
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. 4-5	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU34_1958_AERIAL.MXD 09/30/11 SS



DRAWN BY S. STROZ	DATE 09/29/11	NAVFAC	1958 AERIAL PHOTOGRAPH SWMU 34 - OLD GUN TUB STORAGE LOT NSA CRANE CRANE, INDIANA	CONTRACT NUMBER ___	CTO NUMBER F27R
CHECKED BY K. LOSEKAMP	DATE 09/30/11			APPROVED BY ___	DATE ___
REVISED BY ___	DATE ___			APPROVED BY ___	DATE ___
SCALE AS NOTED				FIGURE NO. 4-6	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU34_1966_AERIAL.MXD 09/30/11 SS



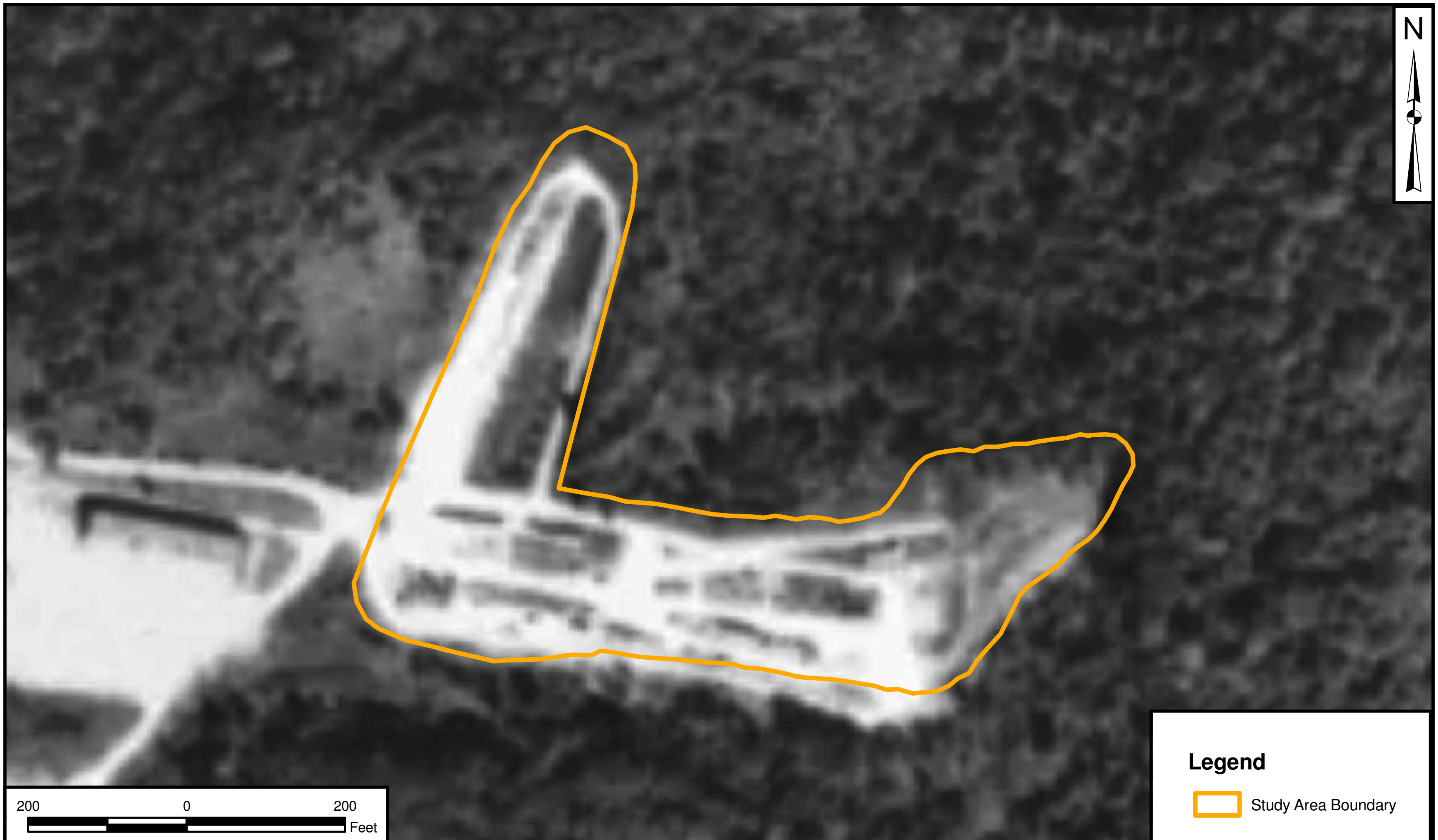
DRAWN BY	DATE
S. STROZ	09/29/11
CHECKED BY	DATE
K. LOSEKAMP	09/30/11
REVISED BY	DATE
___	___
SCALE	
AS NOTED	

NAVFAC

1966 AERIAL PHOTOGRAPH
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	CTO NUMBER
___	F27R
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO. 4-7	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU34_1974_AERIAL.MXD 09/30/11 SS

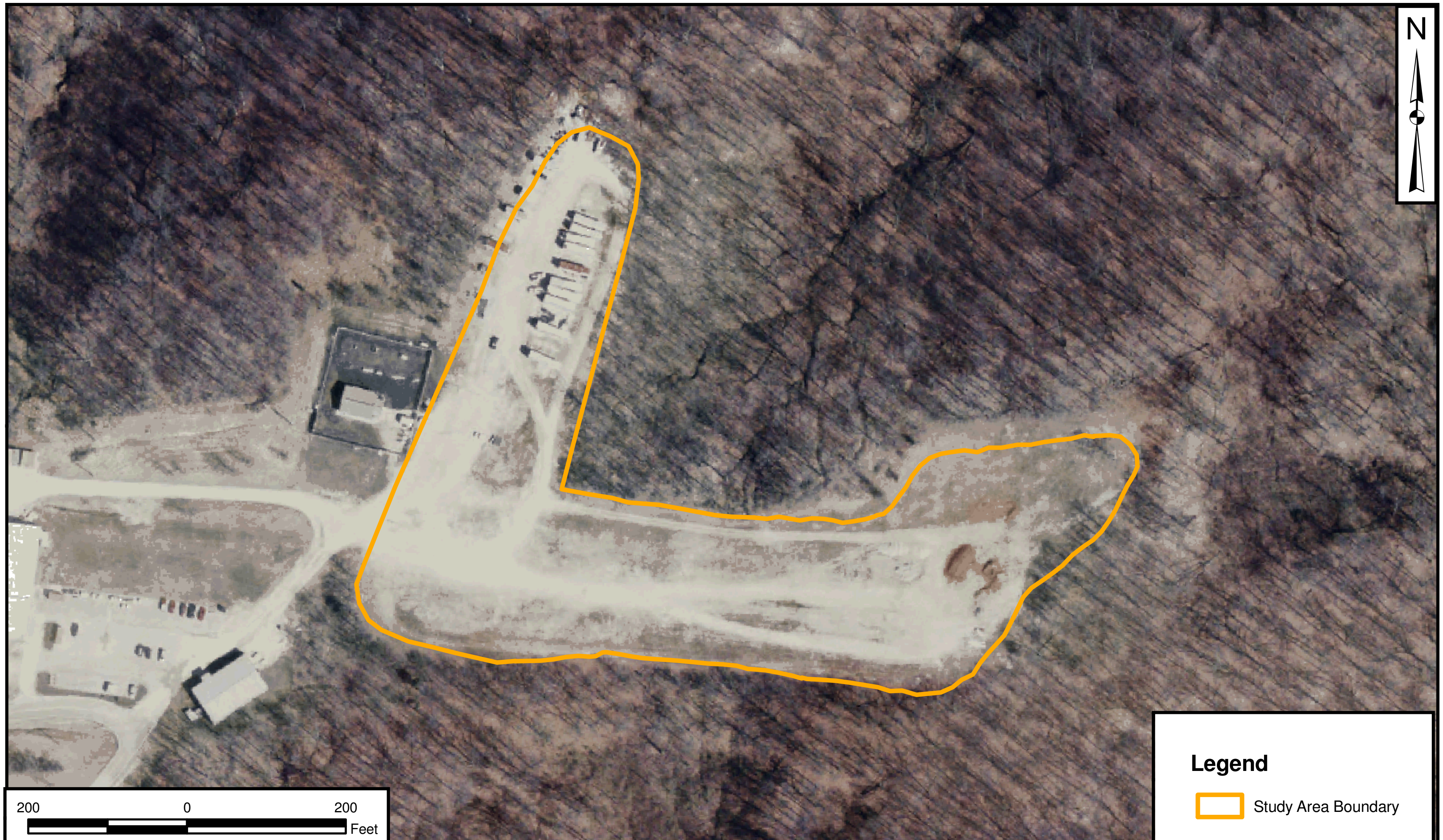


DRAWN BY	DATE
S. STROZ	09/29/11
CHECKED BY	DATE
K. LOSEKAMP	09/30/11
REVISED BY	DATE
___	___
SCALE AS NOTED	

1974 AERIAL PHOTOGRAPH
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	CTO NUMBER
___	F27R
APPROVED BY ___	DATE ___
APPROVED BY ___	DATE ___
FIGURE NO. 4-8	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\SWMU34_2005_AERIAL.MXD 09/30/11 SS

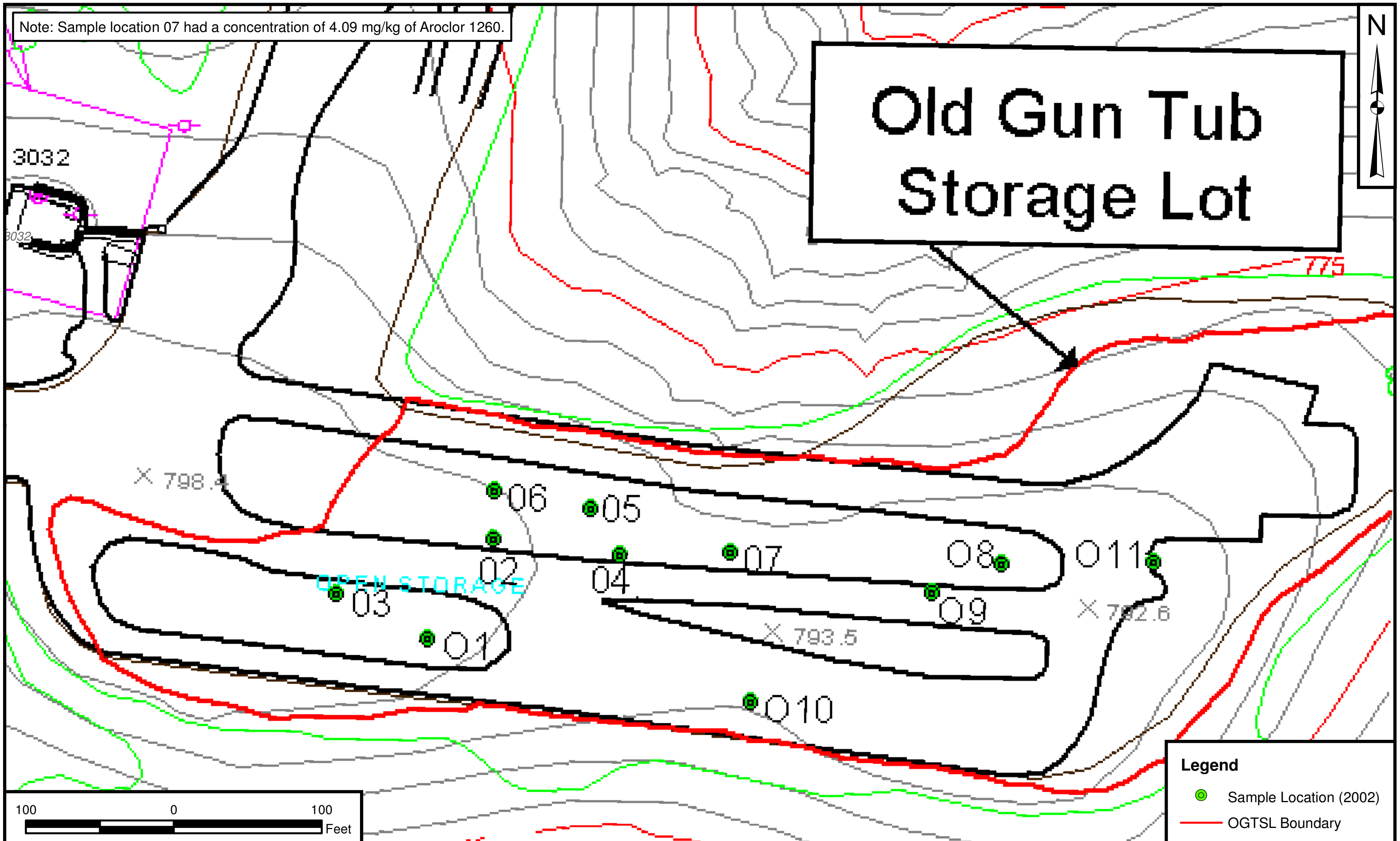


DRAWN BY	DATE
S. STROZ	09/29/11
CHECKED BY	DATE
K. LOSEKAMP	09/30/11
REVISED BY	DATE
___	___
SCALE	
AS NOTED	

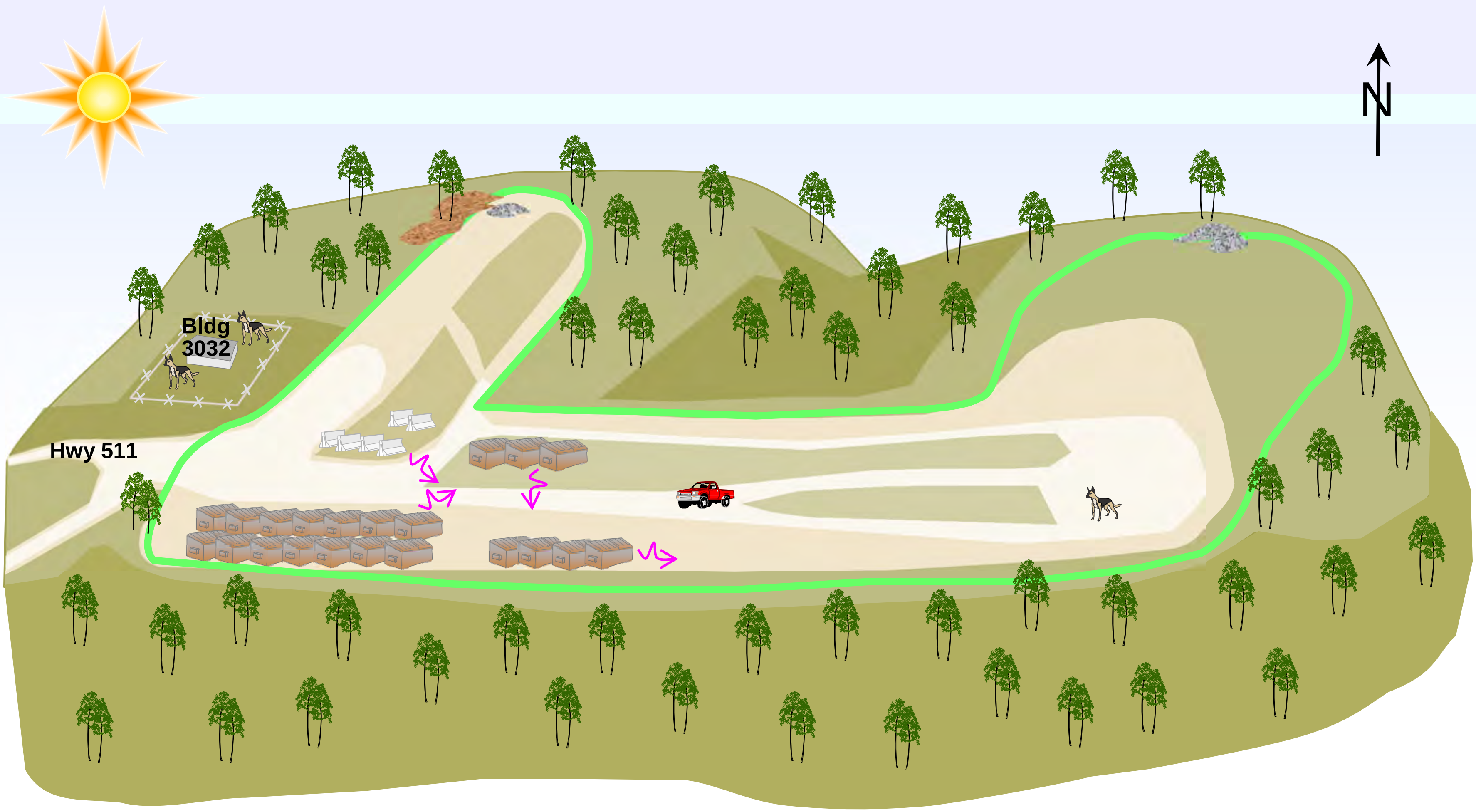
2005 AERIAL PHOTOGRAPH
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER	CTO NUMBER
___	F27R
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO. 4-9	REV 0

P:\GIS\CRANE_NSWC\MAPDOCS\MXD\OGTSL_SAMP_LOCS_2002.MXD 01/09/12 SP



DRAWN BY S. PAXTON	DATE 01/05/12	NAVFAC	2002 SAMPLING LOCATIONS SWMU 34 - OLD GUN TUB STORAGE LOT NSA CRANE CRANE, INDIANA	CONTRACT NUMBER ___ / CTO NUMBER F276
CHECKED BY L. FOSTER	DATE 01/09/12			APPROVED BY __ / DATE __
REVISED BY S. PAXTON	DATE 01/09/12			APPROVED BY __ / DATE __
SCALE AS NOTED				FIGURE NO. 4 - 10 / REV 0



LEGEND

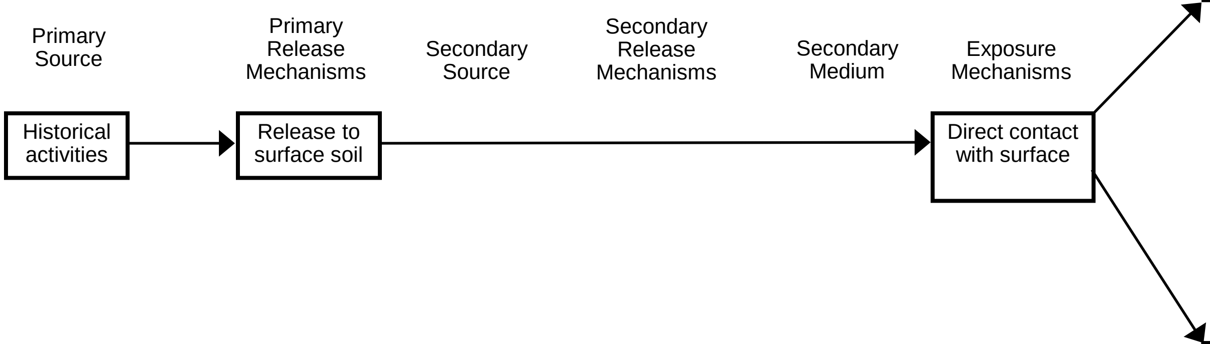
- Study Area Boundary
- Potential Release to surface soil
- Fence Line
- Native Trees
- Material Piles

DRAWN BY C. PENNINGTON	DATE 9-28-11	NAVFAC	CONCEPTUAL SITE MODEL	CONTRACT NO.
CHECKED BY	DATE		SWMU 34	OWNER NO.
REVISED BY J. B. WEIDNER	DATE 2012.03.15		NSA CRANE	APPROVED BY / DATE
SCALE NOT TO SCALE			CRANE, INDIANA	DRAWING NO. FIGURE 4-11 / REV.

Figure 4-12
HUMAN AND ECOLOGICAL CONCEPTUAL EXPOSURE MODEL DIAGRAM
SMWU 34
NSA CRANE
Crane, Indiana

POTENTIAL HUMAN RECEPTORS

EXPOSURE ROUTES	Construction Worker	Maintenance Worker	Occupational Worker	Recreational User	Trespasser	Hypothetical Resident
Dermal Contact	■	■	■	■	■	■
Incidental Ingestion	■	■	■	■	■	■
Inhalation	■	■	■	■	■	■

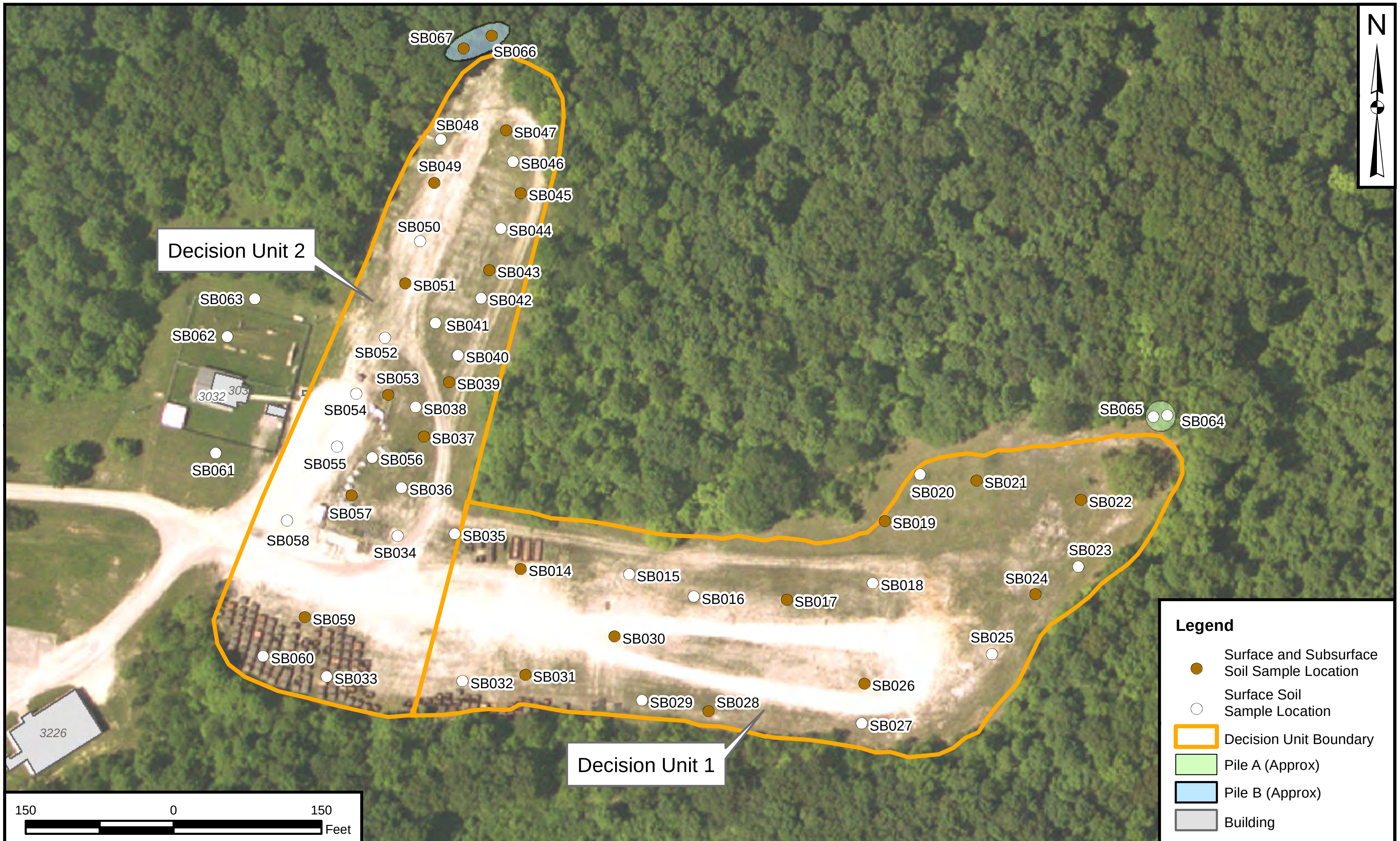


POTENTIAL ECOLOGICAL RECEPTORS

EXPOSURE ROUTES	Terrestrial Plants	Soil Invertebrates	Terrestrial Vertebrates	Aquatic Vertebrates
Direct Contact	■	■	■	
Ingestion of Soil		■	■	
Ingestion of Food			■	

■ = Potentially complete exposure pathway

PGH P:\GIS\CRANE_NSWC\MAPDOCS\MXD\OGTSL_DEC_UNITS.MXD 04/04/12 JN



DRAWN BY S. STROZ	DATE 09/28/11
CHECKED BY K. LOSEKAMP	DATE 04/04/12
REVISED BY J. NOVAK	DATE 04/04/12
SCALE AS NOTED	

NAVFAC

PROPOSED SOIL SAMPLE LOCATIONS
SWMU 34 - OLD GUN TUB STORAGE LOT
NSA CRANE
CRANE, INDIANA

CONTRACT NUMBER ___	CTO NUMBER F27R
APPROVED BY __	DATE __
APPROVED BY __	DATE __
FIGURE NO. 7 - 1	REV 0

APPENDIX A

VISUAL SAMPLE PLAN

Random sampling locations for comparing a median with a fixed threshold (nonparametric - MARSSIM)

Summary

This report summarizes the sampling design used, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design developed.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean or median to a fixed threshold
Type of Sampling Design	Nonparametric
Sample Placement (Location) in the Field	Simple random sampling
Working (Null) Hypothesis	The median(mean) value at the site exceeds the threshold
Formula for calculating number of sampling locations	Sign Test - MARSSIM version
Calculated total number of samples	62

Primary Sampling Objective

The primary purpose of sampling at this site is to compare a site median or mean value with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the median(mean) value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the median(mean) value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach

A nonparametric random sampling approach was used to determine the number of samples and to specify sampling locations. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that typical parametric assumptions may not be true.

Both parametric and non-parametric equations rely on assumptions about the population. Typically, however, non-parametric equations require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than if a non-parametric equation was used.

Locating the sample points randomly provides data that are separated by many distances, whereas systematic samples are all equidistant apart. Therefore, random sampling provides more information about the spatial structure of the potential contamination than systematic sampling does. As with systematic sampling, random sampling also provides information regarding the mean value, but there is the possibility that areas of the site will not be represented with the same frequency as if uniform grid sampling were performed.

Number of Total Samples: Calculation Equation and Inputs

The equation used to calculate the number of samples is based on a Sign test (see PNNL 13450 for discussion). For this site, the null hypothesis is rejected in favor of the alternative one if the median(mean) is sufficiently smaller than the threshold. The number of samples to collect is calculated so that if the inputs to the equation are true, the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = \frac{(Z_{1-\alpha} + Z_{1-\beta})^2}{4(SignP - 0.5)^2}$$

where

$$SignP = \Phi\left(\frac{\Delta}{s_{total}}\right)$$

$\Phi(z)$ is the cumulative standard normal distribution on $(-\infty,z)$ (see PNNL-13450 for details),
n is the number of samples,
S_{total} is the estimated standard deviation of the measured values including analytical error,
Δ is the width of the gray region,
α is the acceptable probability of incorrectly concluding the site median(mean) is less than the threshold,
β is the acceptable probability of incorrectly concluding the site median(mean) exceeds the threshold,
$Z_{1-\alpha}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is $1-\alpha$,
$Z_{1-\beta}$ is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is $1-\beta$.

Note: MARSSIM suggests that the number of samples should be increased by at least 20% to account for missing or unusable data and uncertainty in the calculated value of n. VSP allows a user-supplied percent overage as discussed in MARSSIM (EPA 2000, p. 5-33).

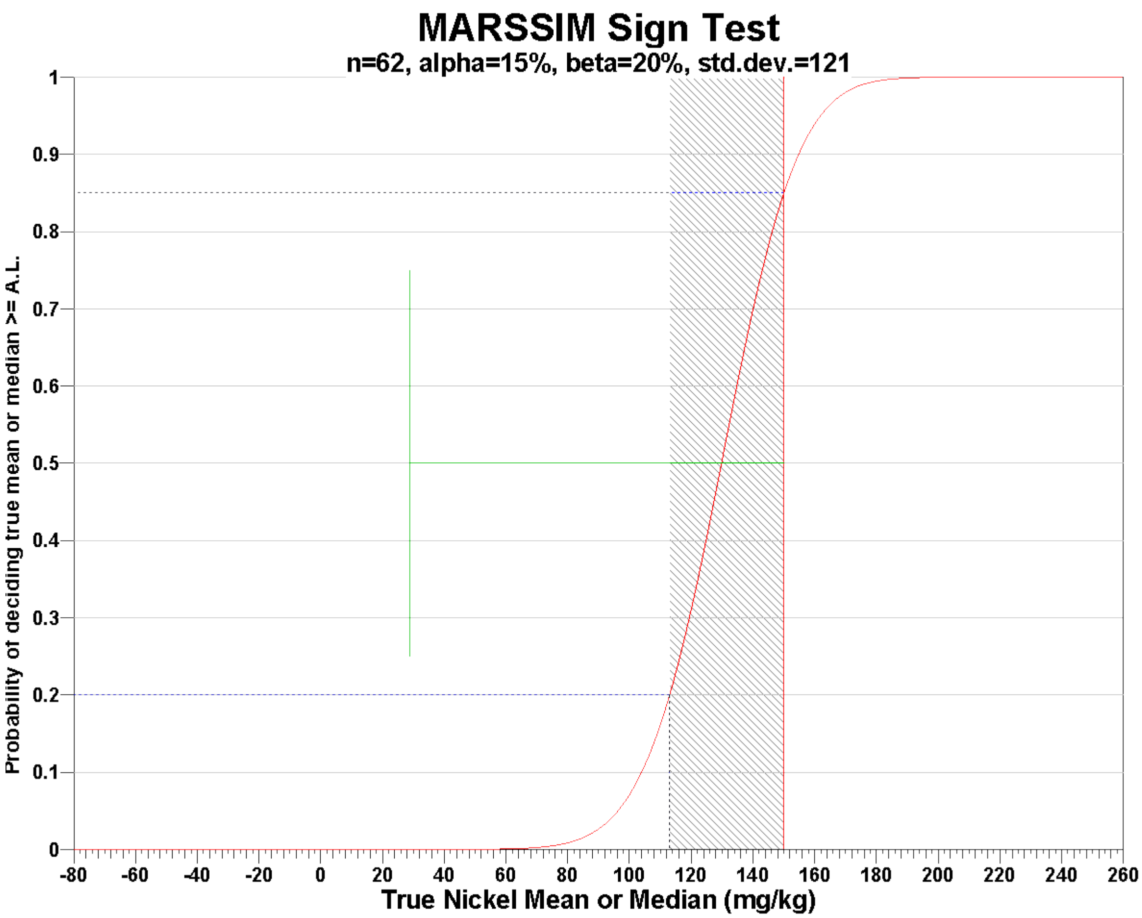
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	**n**	**Parameter**					
		S	**Δ**	**α**	**β**	**$Z_{1-\alpha}$** [a]	**$Z_{1-\beta}$** [b]
Benzo(a)anthracene	29	81 ug/kg	37 ug/kg	0.15	0.2	1.03643	0.841621
Indeno(1,2,3-cd)pyrene	29	81 ug/kg	37 ug/kg	0.15	0.2	1.03643	0.841621
Nickel	62	121 mg/kg	37 mg/kg	0.15	0.2	1.03643	0.841621
Cadmium	27	3.7 mg/kg	1.75 mg/kg	0.15	0.2	1.03643	0.841621

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true median(mean) values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at $1-\alpha$ on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at $1-\alpha$. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the computed sign test statistic is normally distributed,
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected randomly.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the sample locations were selected using a random process.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
AL=150		**α=10**		**α=15**		**α=20**	
		s=242	**s=121**	**s=242**	**s=121**	**s=242**	**s=121**
LBGR=90	**β=15**	2200	553	1760	442	1444	363
	β=20	1846	464	1444	363	1160	292
	β=25	1567	394	1199	301	941	237
LBGR=80	**β=15**	553	141	442	113	363	92
	β=20	464	118	363	92	292	74

	β=25	394	100	301	77	237	60
LBGR=70	**β=15**	247	64	198	52	163	42
	β=20	208	54	163	42	131	34
	β=25	176	46	135	35	106	28

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site median(mean) value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

APPENDIX B

FIELD STANDARD OPERATION PROCEDURES

APPENDIX B

FIELD STANDARD OPERATING PROCEDURES

TABLE OF CONTENTS

STANDARD OPERATING PROCEDURE
SOP-01

SAMPLE LABELING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used for labeling sample containers. Sample labels are used to document the sample identification number (ID), date, time, analysis to be performed, preservative, matrix, sampler, and the analytical laboratory. A sample label will be attached to each sample container.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Disposable medical-grade gloves (e.g. latex, nitrile)
Sample log sheets
Required sample containers: All sample containers for analysis by fix-based laboratories will be supplied and deemed certified-clean by the laboratory.
Sample labels
Chain-of-custody records
Sealable polyethylene bags
Heavy-duty cooler
Ice

3.0 PROCEDURES

3.1 The following information will be electronically printed on each sample label prior to mobilizing for field activities. Additional “generic” labels will also be printed prior to mobilization to be used for field QC and backups.

- Project Number
- Sample Location ID
- Contract Task Order Number (CTO F276)
- Sample ID

- Sample Matrix
- Preservative
- Analysis to be Performed
- Laboratory Name

3.2 Select the container(s) that are appropriate for a given sample. Select the sample-specific ID label(s), complete date, time, and sampler name, and affix to the sample container(s).

3.3 Fill the appropriate containers with sample material. Securely close the container lids without overtightening.

3.4 Place the sample container in a sealable polyethylene bag and place in a cooler containing ice.

Example of a sample label is attached at the end of this SOP.

4.0 ATTACHMENTS

1. Sample Label

ATTACHMENT 1

SAMPLE LABEL

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

STANDARD OPERATING PROCEDURE
SOP-02

SAMPLE IDENTIFICATION NOMENCLATURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish a consistent sample nomenclature system that will facilitate subsequent data management at the Naval Support Activity (NSA) Crane. The sample nomenclature system has been devised such that the following objectives can be attained.

- Sorting of data by site, location, or matrix
- Maintenance of consistency (field, laboratory, and database sample numbers)
- Accommodation of all project-specific requirements
- Accommodation of laboratory sample number length constraints
- Ease of sample identification

The NSA Crane Environmental Protection Department must approve any deviations from this procedure.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Sample tags
Sample container labels

3.0 SAMPLE IDENTIFICATION NOMENCLATURE

3.1 Environmental Samples

All environmental samples will be properly labeled with a sample label affixed to the sample container. Each sample will be assigned a unique sample tracking number.

3.1.1 Environmental Sample Numbering Scheme

The sample tracking number will consist of a four- or five-segment alpha-numeric code that identifies the sample's associated Solid Waste Management Unit (SWMU) number, SWMU subarea letter (if applicable), sample type, location, and for soil or sediment samples, where applicable, sample depth, and for aqueous samples, where applicable, whether a sample is filtered. For soil samples, the final four tracking numbers will identify the depth in units of feet below ground surface (bgs) at which the sample was collected (rounded to the nearest foot). For sediment samples, the final four tracking numbers will identify the depth in units of inches bgs at which the sample was collected.

The alphanumeric coding to be used is explained in the following diagram and subsequent definitions:

AAAAA	**AA**	**NNN**	**NNNN (Soils)**
Site Name	Matrix	Sample Location Number	Sequential depth interval from freshly exposed surface

Character Type:

A = Alpha
N = Numeric

Site Name (AAAA):

OGTSL = Old Gun Tub Storage Lot

Matrix Code (AA):

SS = Surface Soil Sample
SB = Subsurface Soil Sample

Depth Interval (NNNN):

This code section will be used for soil samples. The depth code is used to note the depth below ground surface (bgs) at which a soil sample is collected. The first two numbers of the four-number code specify the top interval, and the third and fourth numbers specify the bottom interval of the sample depth. The depths will be noted in whole numbers only; further detail, if needed, will be recorded on the sample log sheet, boring log, logbook, etc.

Depth (for soil, in feet bgs)

0002 = soil collected from 0 to 2 feet bgs

3.1.2 Examples of Sample Nomenclature

A soil sample collected from soil boring location 006 at the Old Gun Tub Storage Lot, at a depth of 0- to 2-feet bgs would be labeled as “OGTSLSS0060002”.

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

Field QA/QC samples, as applicable, are described in the UFP-SAP. They will be designated using a different coding system than the one used for regular field samples.

3.2.1 QC Sample Numbering

The QC code will consist of a four-segment alpha-numeric code that identifies the SWMU number, sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AAAAA	AA	NNNNNN	NN
Site Name	QC Type	Date	Sequence Number (per day)

The QC types are identified as:

TB = Trip Blank
RB = Rinsate Blank
FD = Field Duplicate
SB = Source Water Blank

The sampling time recorded on the Chain-of-Custody Form, labels, and tags for duplicate samples will be “0000” so that the samples are "blind" to the laboratory. Notes detailing the sample number, time, date, and type will be recorded on the sample log sheets and will document the location of the duplicate sample (sample log sheets are not provided to the laboratory).

3.2.2 Examples of Field QA/QC Sample Nomenclature

The first trip blank associated with samples collected on June 16, 2011 from the Old Gun Tub Storage Lot would be designated as “OGTSL-TB-061611-01”.

STANDARD OPERATING PROCEDURE
SOP-03

SAMPLE CUSTODY AND DOCUMENTATION OF FIELD ACTIVITIES

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedures for sample custody and documentation of field sampling and field analyses activities.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

The following logbooks, forms, labels, and equipment are required.

Writing utensil (preferably black pen with indelible ink)
Site logbook
Field logbook
Sample label
Chain-of-Custody Form
Custody seals
Equipment calibration log
Soil Boring Log
Soil and Sediment Sample Log Sheet
Surface Water Sample Log Sheet

3.0 PROCEDURES

This section describes custody and documentation procedures. All entries made into the logbooks, custody documents, logs, and log sheets described in this SOP must be made in indelible ink (black is preferred). No erasures are permitted. If an incorrect entry is made, the entry will be crossed out with a single strike mark, initialed, and dated.

3.1 Site Logbook

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

- All field personnel present
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of sampling activities
- Daily on-site activities performed each day
- Sample pickup information
- Health and safety issues
- Weather conditions

The site logbook is initiated at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Entries are to be made for every day that on-site activities take place.

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

- Project name
- Project number
- Book number
- Start date
- End date

Information recorded daily in the site logbook need not be duplicated in other field notebooks but must summarize the contents of these other notebooks and refer to specific page locations in these notebooks for detailed information (where applicable). At the completion of each day's entries, the site logbook must be signed and dated by the Tetra Tech Field Operations Leader (FOL).

3.2 Field Logbooks

The field logbook is a separate, dedicated notebook used by field personnel to document his or her activities in the field. This notebook is hardbound and paginated. At a minimum, the following activities and events will be recorded (daily) in the field logbooks:

- Field personnel for activities in the field logbook
- Arrival/departure of site visitors
- Arrival/departure of equipment
- Start or completion of sampling activities
- Daily on-site activities performed each day
- Sample pickup information
- Health and safety issues
- Weather conditions

Entries are to be made for every day that on-site activities take place.

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

- Project name
- Project number
- Book number
- Start date
- End date

3.3 Sample Labels

Adhesive sample container labels must be completed and applied to every sample container. Information on the label includes the project name, location, sample number, date, time, preservative, analysis, matrix, sampler's initials, and the name of the laboratory performing the analysis. Sample labeling and nomenclature are described in SOP-01 and SOP-02, respectively.

3.4 Chain-of-Custody Form

The Chain-of-Custody Form (COC) is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as it is transferred from person to person. This form must accompany any samples collected for laboratory chemical analysis. Each COC will be uniquely numbered. A copy of a blank COC form is attached at the end of this SOP.

The FOL must include the name of the laboratory in the upper right hand corner section to ensure that the samples are forwarded to the correct location. If more than one COC is necessary for any cooler, the FOL will indicate "Page __ of __" on each COC. The original (top) signed copy of the COC will be placed inside a sealable polyethylene bag and taped inside the lid of the shipping cooler. Once the samples are received at the laboratory, the sample custodian checks the contents of the cooler(s) against the enclosed COC(s). Any problems are noted on the enclosed COC Form (bottle breakage, discrepancies between the sample labels, COC form, etc.) and will be resolved through communication between the laboratory point-of-contact and the Tetra Tech Project Manager (PM). The COC form is signed and retained by the laboratory and becomes part of the sample’s corresponding analytical data package.

3.5 Custody Seal

The custody seal is an adhesive-backed label and is part of the chain-of-custody process. Custody seals are used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transit to the laboratory. Custody seals will be signed and dated by the samplers and affixed across the opening edges of each cooler (two seals per cooler on opposite sides) containing environmental samples. The laboratory sample custodian will examine the custody seal for evidence of tampering and will notify the Tetra Tech PM if evidence of tampering is observed.

3.6 Equipment Calibration Log

The Equipment Calibration Log is used to document calibration of measuring equipment used in the field. The Equipment Calibration Log documents that the manufacturer's instructions were followed for calibration of the equipment, including frequency and type of standard or calibration device. An Equipment Calibration Log must be maintained for each electronic measuring device requiring calibration. Entries must be made for each day the equipment is used.

3.7 Sample Log Sheets

The Soil and Sediment Sample Log Sheets are used to document the sampling of soil and sediment. Copies of the sample log sheets are attached at the end of the SOP. A sample log sheet will be prepared for each sample collected and submitted for laboratory analysis.

4.0 ATTACHMENTS

1. Chain-of-Custody Record
2. Equipment Calibration Log
3. Soil and Sediment Sample Log

ATTACHMENT 1

CHAIN-OF-CUSTODY RECORD

CHAIN OF CUSTODY | NUMBER ____ | PAGE ____ OF ____

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

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

DATE YEAR	TIME	SAMPLE ID	MATRIX	GRAB (G) COMP (C)	No. OF CONTAINERS	CONTAINER TYPE PLASTIC (P) or GLASS (G) / PRESERVATIVE USED / TYPE OF ANALYSIS								COMMENTS

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

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

FORM NO. TtNUS-001 3/99

ATTACHMENT 2

EQUIPMENT CALIBRATION LOG

EQUIPMENT CALIBRATION LOG

PROJECT NAME : ______________ INSTRUMENT NAME/MODEL: ______________

SITE NAME: ______________ MANUFACTURER: ______________

PROJECT No.: ______________ SERIAL NUMBER: ______________

Date of Calibration	Instrument I.D. Number	Person Performing Calibration	Instrument Settings Pre-calibration	Instrument Settings Post-calibration	Instrument Readings Pre-calibration	Instrument Readings Post-calibration	Calibration Standard (Lot No.)	Remarks and Comments

ATTACHMENT 3

SOIL AND SEDIMENT SAMPLE LOG SHEET

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: ____________________
Project No.: ____________________

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: ____________________
[] QA Sample Type: ____________________

Sample ID No.: ____________
Sample Location: ____________
Sampled By: ____________
C.O.C. No.: ____________

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE
SOP-04

SAMPLE PRESERVATION, PACKAGING, AND SHIPPING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures for sample preservation, packaging, and shipping to be used in handling soil, sediment, and aqueous samples.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Shipping labels
Custody seals
Chain-of-custody (COC) form(s)
Sample containers with preservatives: All sample containers for analysis by fixed-base laboratories will be supplied, with preservatives added (if required) and deemed certified clean by the laboratory.
Sample shipping containers (coolers): All sample shipping containers are supplied by the laboratory.
Packaging material: Bubble wrap, sealable polyethylene bags, strapping tape, etc.

3.0 PROCEDURES FOR SAMPLE PRESERVATION, PACKAGING, AND SHIPPING

3.1 The laboratory provides sample containers with preservative already included (as required) for the analytical parameter for which the sample is to be analyzed. All samples will be held, stored, and shipped at 4 degrees Celsius (°C). This will be accomplished through refrigeration (used to hold samples prior to shipment) and/or ice.

3.2 The sampler shall maintain custody of the samples until the samples are relinquished to another custodian or to the common carrier.

3.3 Check that each sample container is properly labeled, the container lid is securely fastened, and the container is sealed in a polyethylene bag.

3.4 If the container is glass, place the sample container into a bubble-out shipping bag and seal the bag using the self-sealing, pressure sensitive tape supplied with the bag.

3.5 Inspect the insulated shipping cooler. Check for any cracks, holes, broken handles, etc. If the cooler has a drain plug, make certain it is sealed shut, both inside and outside of the cooler. If the cooler is questionable for shipping, the cooler must be discarded.

3.6 Line the cooler with large plastic bag, and line the bottom of the cooler with a layer of bubble wrap. Place the sample containers into the shipping cooler in an upright position (containers will be upright, with the exception of any 40-milliliter vials). Continue filling the cooler with ice until the cooler is nearly full and the movement of the sample containers is limited.

3.7 Wrap the large plastic bag closed and secure with tape.

3.8 Place the original (top) signed copy of the COC form inside a sealable polyethylene bag. Tape the bag to the inside of the lid of the shipping cooler.

3.9 Close the cooler and seal the cooler with approximately four wraps of strapping tape at each end of the cooler. Prior to wrapping the last wrap of strapping tape, apply a signed and dated custody seal to each side of the cooler (one per side). Cover the custody seal with the last wrap of tape. This will provide a tamper evident custody seal system for the sample shipment.

3.10 Affix shipping labels to each of the coolers, ensuring all of the shipping information is filled in properly. Overnight (e.g., FedEx Priority Overnight) courier services will be used for all sample shipments.

3.11 All samples will be shipped to the laboratory no more than 72 hours after collection. Under no circumstances should sample hold times be exceeded.

STANDARD OPERATING PROCEDURE
SOP-05

BOREHOLE ADVANCEMENT AND SOIL CORING USING DIRECT-PUSH TECHNOLOGY AND HAND AUGER TECHNIQUES

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures for collecting surface and subsurface soil cores from unconsolidated overburden materials using direct-push technology (DPT) and hand augering techniques at the NSA Crane facility.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Cut-resistant non-latex Impermeable Gloves
Cotton gloves
Disposable medical-grade gloves (e.g., latex, nitrile)
Writing utensil
Boring log sheets: A copy of this form is included in SOP-06.
DPT Equipment:
- **DPT Probe Rig**
- **Geoprobe® Macrocore Sampler or equivalent**
- **Geoprobe® Sampling Kit or equivalent**
- **Clear acetate liners:** one new liner for each soil core

Hand Auger Equipment:
- **Stainless Steel Auger Buckets**
- **Stainless Steel Extension Rods**
- **Cross Handle**

Required decontamination materials (see SOP-08)
Bentonite pellets

3.0 BOREHOLE ADVANCEMENT AND SOIL SAMPLING USING A DPT

DPT refers to sampling tools and sensors that are driven directly into the ground without the use of conventional rotary drilling equipment. DPT typically utilizes hydraulic pressure and/or percussion hammers to advance the sampling tools. Geoprobe® is a manufacturer of a hydraulically powered, percussion/probing machine utilizing DPT to collect subsurface environmental samples.

3.1 Clear the area to be sampled of any surface debris (herbaceous vegetation, twigs, rocks, litter, etc.).

3.2 Place a new clear acetate liner in the detachable sampling core barrel, and attach the coring device to the DPT rig.

3.3 Drive the sampler (lined with an acetate sleeve) into the ground to the desired depth using hydraulic pressure.

3.4 Retract the sampler from the borehole, and remove the acetate liner and the soil core from the sampler barrel.

3.5 Attach the metal trough from the sampling kit firmly to a suitable surface.

3.6 Place the acetate liner containing the soil core in the trough.

3.7 While wearing cut-resistant gloves (constructed of non-latex over cotton), cut the acetate liner through its entire length using the double-bladed knife that accompanies the Geoprobe® Sampling Kit. Then remove the strip of acetate from the trough to gain access to the collected soils. **CAUTION:** Do not attempt to cut the acetate liner while holding it in your hand.

3.8 Log the soil core on the Boring Log Sheet (see SOP-06).

3.09 Place the soil core in a stainless-steel mixing bowl, thoroughly homogenize, and collect the remainder of the soil sample aliquots, as described in SOP-07.

3.10 Repeat steps 3.2 through 3.11 for the next depth intervals.

3.11 Upon completion of the boring, backfill the borehole with the soil from the location. If insufficient soil is available to fill the hole to the ground surface, then bentonite pellets mixed with the soil will be used to backfill the hole. If soil materials from the boring are suspected of being contaminated, the soil boring will be backfilled with bentonite pellets up to the ground surface.

The contaminated material will be securely staged until arrangements are made for proper off-site disposal.

3.12 Decontaminate all soil sampling equipment in accordance with SOP-08 before collecting the next sample.

4.0 BOREHOLE ADVANCEMENT AND SOIL SAMPLING USING A HAND AUGER

Hand augers will be employed to collect soil cores. A hand augering system generally consists of a variety of all stainless steel bucket bits (i.e. cylinders 6-1/2" long and 2-3/4", 3-1/4", and 4" in diameter), a series of extension rods (available in 2', 3', 4' and 5' lengths), a cross handle. A larger diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then withdrawn. In turn, the larger diameter bit is replaced with a smaller diameter bit, lowered down the hole, and slowly turned into the soil at the completion depth or refusal. The apparatus is then withdrawn and the soil sample collected.

The hand auger can be used in a wide variety of soil conditions. It can be used to sample soil, both from the surface, or to depths in excess of 12 feet. However, the presence of rock layers and the collapse of the borehole normally contribute to its limiting factors.

4.1 Attach a properly decontaminated bucket bit into a clean extension rod and further attach the cross handle to the extension rod.

4.2 Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.)

4.3 Begin augering to the desired sample depth (periodically removing accumulated soils from the bucket bit into a properly decontaminated stainless steel mixing bowl), and add additional rod extensions as necessary. Discard the top of the core (approximately 1"), which represents any loose material collected by the bucket bit before penetrating the sample material.

4.4 Log the soil core each time soil is placed into the mixing bowl on the Boring Log Sheet (see SOP-06). Also, note (in a field notebook or on standardized data sheets) the changes in the color, texture or odor of the soil.

4.5 After reaching the desired sample depth, slowly and carefully withdraw the apparatus from the borehole.

4.6 Utilizing a properly decontaminated stainless steel trowel or disposable trowel, remove the last of the sample material from the bucket bit and place into the properly decontaminated stainless steel mixing bowl and thoroughly homogenize the sample material prior to filling the sample containers, as described in SOP-07.

4.12 Excess soil core materials will be returned to the hole and tamped. If insufficient soil is available to fill the hole to the ground surface, then bentonite pellets mixed with the soil will be used to backfill the hole.

4.13 If soil materials from the boring are suspected of being contaminated, the soil boring will be backfilled with bentonite pellets up to the ground surface.

4.14 Decontaminate all soil sampling equipment in accordance with SOP-08 before collecting the next sample.

STANDARD OPERATING PROCEDURE

SOP-06

SOIL SAMPLE LOGGING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the standard procedures and technical guidance on the logging of soil samples.

2.0 FIELD FORMS AND EQUIPMENT

Knife
Ruler (marked in tenths and hundredths of feet)
Boring Log: An example of this form is attached.
Writing utensil (preferably black pen with indelible ink)

3.0 RESPONSIBILITIES

A field geologist or engineer is responsible for supervising all activities and assuring that each soil sample is properly and completely logged.

4.0 PROCEDURES FOR SAMPLE LOGGING

To maintain a consistent classification of soil, it is imperative that the field geologist understands and accurately uses the field classification system described in this SOP. This identification is based on visual examination and manual tests.

4.1 USCS Classification

Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification is detailed in Figure 1 (attached to this SOP). This method of classification identifies soil types on the basis of grain size and cohesiveness.

Fine-grained soils, or fines, are smaller than the No. 200 sieve and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors. Organic material (O) is a common component of soil but has no distinguishable size range; it is recognized by its composition. The careful study of the USCS will aid in developing the competence and consistency necessary for the classification of soils.

Coarse-grained soils will be divided into categories: rock fragments, sand, or gravel. The terms "sand" (S) and "gravel" (G) not only refer to the size of the soil particles but also to their depositional history. To insure accuracy in description, the term "rock fragments" will be used to indicate angular granular materials resulting from the breakup of rock. The sharp edges that are typically observed indicate little or no transport from their source area; and therefore, the term provides additional information in reconstructing the depositional environment of the soils encountered. When the term "rock fragments" is used, it will be followed by a size designation such as "(1/4-inch or ½-inch diameter)" or "coarse-sand size" either immediately after the entry or in the remarks column. The USCS classification would not be affected by this variation in terms.

4.2 Color

Soil colors will be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray." Because color can be utilized in correlating units between sampling locations, it is important for color descriptions to be consistent from one boring to another.

Colors must be described while the sample is still moist. Soil samples will be broken or split vertically to describe colors. Samplers tend to smear the sample surface, creating color variations between the sample interior and exterior.

The term "mottled" will be used to indicate soils irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.

4.3 Relative Density and Consistency

To classify the relative density and/or consistency of a soil, the geologist is to first identify the soil type. Granular soils contain predominantly sands and gravels. They are non-cohesive (particles do not adhere well when compressed). Finer-grained soils (silts and clays) are cohesive (particles will adhere together when compressed).

Granular soils are given the USCS classifications GW, GP, GM, SW, SP, SM, GC, or SC (see Figure 1).

The consistency of cohesive soils is determined by performing field tests and identifying the consistency as shown in the following table.

CONSISTENCY FOR COHESIVE SOILS

Consistency	Standard Penetration Resistance (Blows per Foot)	Unconfined Compressive Strength (Tons/Sq. Foot by pocket penetration)	Field Identification
Very soft	0 to 2	Less than 0.25	Easily penetrated several inches by fist.
Soft	2 to 4	0.25 to 0.50	Easily penetrated several inches by thumb.
Medium stiff	4 to 8	0.50 to 1.0	Can be penetrated several inches by thumb with moderate effort.
Stiff	8 to 15	1.0 to 2.0	Readily indented by thumb but penetrated only with great effort.
Very stiff	15 to 30	2.0 to 4.0	Readily indented by thumbnail.
Hard	Over 30	More than 4.0	Indented with difficulty by thumbnail.

Cohesive soils are given the USCS classifications ML, MH, CL, CH, OL, or OH (see Figure 1).

The consistency of cohesive soils is determined by hand by determining the resistance to penetration by the thumb. The thumb determination methods are conducted on a selected sample of the soil, preferably the lowest 0.5-foot of the sample. The sample will be broken in half and the thumb pushed into the end of the sample to determine the consistency. Do not determine consistency by attempting to penetrate a rock fragment. If the sample is decomposed rock, it is classified as a soft decomposed rock rather than a hard soil. One of the other methods will be used in conjunction with it. The designations used to describe the consistency of cohesive soils are shown in the above-listed table.

4.4 <u>Weight Percentages</u>

In nature, soils are consist of particles of varying size and shape and are combinations of the various grain types. The following terms are useful in the description of soil:

Terms of Identifying Proportion of the Component	Defining Range of Percentages by Weight
Trace	0 - 10 percent
Some	11 - 30 percent

Adjective form of the soil type (e.g., sandy)	31 - 50 percent

Examples:

- Silty fine sand: 50 to 69 percent fine sand, 31 to 50 percent silt.
- Medium to coarse sand, some silt: 70 to 80 percent medium to coarse sand, 11 to 30 percent silt.
- Fine sandy silt, trace clay: 50 to 68 percent silt, 31 to 49 percent fine sand, 1 to 10 percent clay.
- Clayey silt, some coarse sand: 70 to 89 percent clayey silt, 11 to 30 percent coarse sand.

4.5 Moisture

Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be little or no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment. A suggested parameter for this would be calling a soil wet if rolling it in the gloved hand or on a porous surface liberates water (i.e., dirties or muddies the surface). Whatever method is adopted for describing moisture, it is important that the method used by an individual remains consistent throughout an entire field activity.

4.6 Classification of Soil Grain Size for Chemical Analysis

To determine the gross grain size classification (e.g., clay, silt, and sand) from the USCS classification described above, the following table will be used.

Gross Soil Grain Size Classification	USCS Abbreviation	Description
Clay	CL	inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	CH	inorganic clays of high plasticity, fat clays.
	OH	organic clays of medium to high plasticity, organic silts.
Silt	ML	inorganic silts and very fine sands, rock four, silty or clayey fine sands with slight plasticity.
	OL	organic silts and organic silty clays of low plasticity.
	MH	inorganic silts, micaceous or diatomaceous fine sand or silty soils.
Sand	SW	well graded sands, gravelly sands, little or no fines.
	SP	poorly graded sands, gravelly sands, little or no fines.
	SM	silty sands, sand-silt mixtures.
	SC	clayey sands, sand-clay mixtures.

4.7 Summary of Soil Classification

In summary, soils will be classified in a similar manner by each geologist/engineer at a project site. The hierarchy of classification is as follows:

- Density and/or consistency
- Color
- Plasticity (optional)
- Soil types
- Moisture content
- Other distinguishing features
- Grain size
- Depositional environment

5.0 ATTACHMENTS

1. Figure 1 - Unified Soil Classification System
2. Boring Log

ATTACHMENT 1

FIGURE 1 - UNIFIED SOIL CLASSIFICATION SYSTEM

Unified Soil Classification System

Coarse Grained Soils (more than half of soil > No. 200 sieve)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Sandy gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-silt mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
Fine Grained Soils (more than half of soil < No. 200 sieve)	Silts and Clays LL = < 50	ML	Inorganic silts and very fine sands, rock flour, silty fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils, elastic silts
		CH	Inorganic silts of high plasticity, fat clays
		OH	Organic clays of high plasticity, organic silty clays, organic silts
Highly Organic Soils		Pt	Peat and other highly organic soils

Grain Size Chart

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size In Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 7.76
coarse	3" to 3/4"	76.2 to 4.76
fine	3/4" to No.4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No.4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Relative Density (SPT)

SANDS AND GRAVELS	BLOWS/FOOT
VERY LOOSE	0 – 4
LOOSE	4 – 10
MEDIUM DENSE	10 – 30
DENSE	32 – 50
VERY DENSE	OVER 50

Consistency (SPT)

SILTS AND CLAYS	BLOWS/FOOT
VERY SOFT	0 – 2
SOFT	2 – 4
MEDIUM STIFF	4 – 8
STIFF	8 – 16
VERY STIFF	16 – 22
HARD	OVER 32

ATTACHMENT 2

BORING LOG

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: ____________ BORING No.: ____________
PROJECT NUMBER: ____________ DATE: ____________
DRILLING COMPANY: ____________ GEOLOGIST: ____________
DRILLING RIG: ____________ DRILLER: ____________

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION			U S C S *	Remarks	PID/FID Reading (ppm)			
					Soil Density/ Consistency or Rock Hardness	Color	Material Classification			Sample	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: ____________ Drilling Area Background (ppm): ____

Converted to Well: Yes ______ No ______ Well I.D. #: ____________

STANDARD OPERATING PROCEDURE

SOP-07

SURFACE AND SUBSURFACE SOIL SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used for surface and subsurface soil sampling using direct-push technology (DPT) or hand augers during field activities at the NSA Crane facility. This procedure also describes the collection of samples for analysis of volatile organic compounds (VOCs) using EnCore samplers and the use of field screening [i.e., photoionization detector (PID)] to select the most appropriate subsurface soil interval for VOC sampling.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Disposable medical-grade gloves (i.e. latex, nitrile)
Boring log
Soil sample logsheets
Stainless-steel mixing bowls
Stainless-steel trowel or soup spoon
EnCore handle and samplers
Disposable trowels
Photoionization Detector (PID) or similar
Required sample containers: All sample containers including shipping coolers for analysis by fixed-base laboratories will be supplied and certified clean by the laboratory.
Required decontamination materials
Chain-of-custody records
Required personnel protective equipment (PPE)
Wooden stakes or pin flags
Survey tape
Marking Paint
Sealable polyethylene bags
Heavy-duty cooler
Ice

Razor knife

DPT Probe Rig and sampling equipment

Sample labels

3.0 COLLECTION OF SOIL SAMPLES FOR VOLATILE ORGANIC COMPOUNDS (VOCs)

When soil cores are collected using DPT, such as Geoprobe®, 4- to 5-foot soil intervals will be collected in clear acetate tubes, which can be extracted from the Geoprobe® core barrel upon retrieval at the surface (see SOP-05). Note: A surface soil sample is collected from the 0- to 2-foot depth. Additional subsurface soil samples each consist of 2-foot core segments.

3.1 Slit the acetate liner lengthwise with a razor knife, remove a section of the liner, and expose the length of the soil interval (see SOP-05).

3.2 Scan the soil core interval with a PID, slowly moving the intake nozzle along the length of the core where the acetate liner has been slit open. Note on the boring log the range of PID readings that are detected and the specific location(s) along the sample interval where above-background readings are encountered. If elevated volatile organics are measured via the PID, collect the VOC samples from the specific interval where the highest PID reading is measured. If no above-background PID readings are measured, then the VOC sample will be collected from a specific interval where visual signs of contamination (staining, etc.) are observed. If no above-background PID reading is measured and no discoloration or odor in the soil core indicates potential contamination, then collect the VOC sample from near the center of a core.

3.3 A small quantity of undisturbed soil (approximately *6* oz.) is removed from the sampler (e.g., Macrocore®, split-spoon sampler, etc.) and immediately placed in a sealing (Ziploc®-type) plastic bag. Once sealed in the bag, the sample is gently massaged to break apart any large soil clumps. The bag is then warmed for 15 minutes in order to volatilize the potential contaminants from the soil sample into the head-space of the bag. After 15 minutes, the tip of the PID is carefully pushed directly through the plastic bag and a direct reading is obtained of the maximum detection. All head-space readings (maximum detection per sample) will be noted on the appropriate soil boring log and/or sample log form.

3.4 The 0- to 2-foot core interval will be collected as a surface soil sample. Determine where in this core interval the highest PID reading was encountered. Soil samples collected for volatile organics will be obtained directly from soil cores using four EnCore samplers for each VOC sample. These samples are to be collected by pushing the EnCore samplers directly into the soil core where the highest PID readings were measured, ensuring that the sampler is packed tight with soil and leaving no headspace between cap and container. All four EnCore sample containers will be collected as close to each other as possible. Make sure that all caps are securely fastened to the samplers and locked in place with both clips (see instructions that come with samplers). Write the sample identification on the strip labels that come with the samplers and place a label on each of the four samplers.

3.5 Place the four EnCore samplers in the ziplock pouches that come with the samplers and fill in appropriate information, including sample identification, date, time, and other information on the label. Place the four pouches in a plastic bag and place the tag on the bag, identifying the sample identification and other necessary information (see SOP-01).

3.6 Once the samples are properly labeled and bagged, place the sample into the cooler containing ice and a trip blank. The cooler should be kept at 4°C and shipped to the analytical laboratory for preservation or extraction within 48 hours.

3.7 Fill in the required information on the Soil Sample Log Sheet (attached at the end of this SOP) and fill in the required information on the Chain-of-Custody (COC) Form.

4.0 COLLECTION OF OTHER SOIL SAMPLE ALIQUOTS

4.1 After the VOC sample has been collected for the soil interval of interest (see 3.0 above), the remainder of the remainder of the soil interval will be composited and used to fill the sample containers. Any surface debris (e.g., herbaceous vegetation, twigs, rocks, litter, etc.) should first be removed from the top of the surface soil core. For other core intervals, the top 2 inches of each core should be discarded because it often contains material scraped from the side of the borehole and not fresh material from the bottom of the borehole.

4.2 Slide the remaining core material out of the acetate liner and into a clean, decontaminated stainless-steel mixing bowl. Mix the soil thoroughly with a stainless-steel spoon and remove gravel, large pebbles, and other coarse materials. Fill the required sample containers in the following order:

- Containers for other organic analyses (including energetics, TPH, and perchlorate)
- Container for metals

- Container for pH

4.3 Complete all required information on the sample labels and secure the label to the sample container (see SOP-01).

4.4 Place the sample container in a ziplock plastic bag and seal shut. Place the bag in a cooler containing ice and cool to 4°C ± 2°C.

4.5 Record the required information on the Soil Sample Log Sheet and the COC Record form.

5.0 COLLECTION OF SOIL SAMPLES USING A HAND AUGER

5.1 Utilizing a properly decontaminated stainless steel trowel or disposable trowel, remove the sample material from the bucket bit and remove gravel, large pebbles, and other coarse materials.

5.2 Collect sample aliquot for VOCs directly from the hand auger bucket prior to disturbing the material. (See Sections 3.4 and 3.5 above.)

5.3 Slide the remaining core material out of the hand auger bucket and into a clean, decontaminated stainless-steel mixing bowl. Mix the soil thoroughly with a stainless-steel spoon and remove gravel, large pebbles, and other coarse materials. Fill the required sample containers in the following order:

5.4 Fill the remaining required sample containers for analysis.

5.5 Complete all required information on the sample labels and secure the label to the sample container (see SOP-01).

5.4 Place the sample container in a ziplock plastic bag and seal shut. Place the bag in a cooler containing ice and cool to 4°C ± 2°C.

5.6 Record the required information on the Soil Sample Log Sheet and the COC Record form.

6.0 PACKAGING AND SHIPPING OF SAMPLES

Samples will be packaged and shipped according to SOP-04.

7.0 ATTACHMENTS

1. Soil and Sediment Sample Log Sheet

ATTACHMENT 1

SOIL AND SEDIMENT SAMPLE LOG SHEET

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: ______________________
Project No.: ______________________

[] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other: ______________________
[] QA Sample Type: ______________________

Sample ID No.: ______________
Sample Location: ______________
Sampled By: ______________
C.O.C. No.: ______________

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:			
Time:			
Method:			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth Interval	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

STANDARD OPERATING PROCEDURE

SOP-08

DECONTAMINATION OF FIELD SAMPLING EQUIPMENT

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes the procedures to be followed when decontaminating non-dedicated field sampling equipment during the field investigations.

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Writing utensil (preferably black pen with indelible ink)
Non-latex rubber or plastic gloves
Cotton gloves
Field logbook
Potable water
Deionized water
Isoproponal (optional)
Liqui-Nox® or Alconox® detergent
Brushes, spray bottles, paper towels, etc.
Container to collect and transport decontamination fluids

3.0 DECONTAMINATION PROCEDURES

3.1 Don non-latex and/or cotton gloves and decontaminate sampling equipment (in accordance with the following steps) prior to field sampling and between samples.

3.2 Rinse the equipment with potable water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the potable water rinsate into a container.

3.3 Wash the equipment with a solution of Liqui-Nox® or Aloconox® detergent. Prepare the detergent wash solution in accordance with the instructions on the detergent container. Collect the wash solution into a container. Use brushes or sprays as appropriate for the equipment. If oily residue has accumulated on the sampling equipment, remove the residue with an isopropanol wash and repeat the detergent wash.

3.4 Rinse the equipment with potable water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the potable water rinsate into a container.

3.5 Rinse the equipment with deionized water. Rinsing may be conducted by spraying with water from a spray bottle or by dipping. Collect the deionized water rinsate into a container.

3.6 Remove excess water by air drying and shaking or by wiping with paper towels as necessary.

3.7 Document decontamination by recording it in the field logbook.

3.8 Containerized decontamination solutions will be managed in accordance with the procedures described in SOP-10.

STANDARD OPERATING PROCEDURE

SOP-09

GLOBAL POSITIONING SYSTEM

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide the field personnel with basic instructions for operating a handheld Global Positioning System (GPS) unit allowing them to set GPS parameters in the receiver, record GPS positions on the field device, and update existing Geographic Information System (GIS) data. This SOP is specific to GIS quality data collection for Trimble®-specific hardware and software.

If possible, the Trimble® GeoXM™ or GeoXH™ operators manual should be downloaded onto the operator's personal computer for reference before or while in the field. The manual can be downloaded at http://trl.trimble.com/docushare/dsweb/Get/Document-311749/TerraSyncReferenceManual.pdf

Unless the operator is proficient in the setup and operation of the GPS unit, the Project Manager (or designee) should have the GPS unit shipped to the project-specific contact listed below in the Pittsburgh, Pennsylvania, office at least five working days prior to field mobilization so project-specific shape files, data points, background images, and correct coordinate systems can be uploaded into the unit.

Tetra Tech NUS, Inc.
Attn: Kevin Moore
661 Anderson Drive, Bldg #7
Pittsburgh, PA 15220

2.0 REQUIRED EQUIPMENT

The following hardware and software should be utilized for locating and establishing GPS points in the field:

2.1 <u>Required GPS Hardware</u>

- Hand-held GPS unit capable of sub-meter accuracy (i.e. Trimble® GeoXM™ or Trimble® GeoXH™). This includes the docking cradle, A/C adapter, stylus, and USB cable for data transfer.

Optional Accessories:

- External antenna
- Range pole
- Hardware clamp (for mounting GPS unit to range pole)
- GeoBeacon

- Writing utensil (preferably black pen with indelible ink)
- Non-metallic pin flags for temporary marking of positions

2.2 Required GPS Software

The following software is required to transfer data from the handheld GPS unit to a personal computer:

- Trimble® TerraSync version 2.6 or later (pre-loaded onto GPS unit from vendor)

- Microsoft® ActiveSync® version 4.5 or later. Download to personal computer from: http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/activesync-download.mspx

- Trimble® Data Transfer Utility (freeware version 2.1 or later). Download to personal computer from: http://www.trimble.com/datatransfer.shtml

3.0 START-UP PROCEDURES

Prior to utilizing the GPS in the field, ensure the unit is fully charged. The unit may come charged from the vendor, but an overnight charge is recommended prior to fieldwork.

The Geo-series GPS units require a docking cradle for both charging and data transfer. The Geo-series GPS unit is docked in the cradle by first inserting the domed end in the top of the cradle, then gently seating the contact end into the latch. The power charger is then connected to the cradle at the back end using the twist-lock connector. Attach a USB cable as needed between the cradle (B end) and the laptop/PC (A end).

It is recommended that the user also be familiar and check various Windows Mobile settings. One critical setting is the Power Options. The backlight should be set as needed to conserve power when not in use.

Start Up:

1) Power on the GPS unit by pushing the small green button located on the lower right front of the unit.

2) Utilizing the stylus that came with the GPS unit, launch **TerraSync** from the Windows Operating System by tapping on the start icon located in the upper left hand corner of the screen and then tap on **TerraSync** from the drop-down list.

3) If the unit does not default to the Setup screen, tap the Main Menu (uppermost left tab, just below the Windows icon) and select Setup.

4) If the unit was previously shipped to the Pittsburgh office for setup, you can skip directly to Section 4.0. However, to confirm or change settings, continue on to Section 3.1.

3.1 Confirm Setup Settings

Use the Setup section to confirm the TerraSync software settings. To open the Setup section, tap the Main Menu and select Setup.

1) Coordinate System
   a. Tap on the Coordinate System.
   b. Verify the project specs are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu. **Note:** It is always best to utilize the Cancel tab rather than the OK tab if no changes are made since configurations are easily changed by mistake.
   c. Tap on the Units.
   d. Verify the user preferences are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
   e. Tap Real-time Settings.
   f. Verify the Real-time Settings are correct for your specific project by scrolling through the various settings. Edit as needed and then tap OK; otherwise, tap Cancel to return to Setup Menu.
   g. The GPS unit is now configured correctly for your specific project.

4.0 ANTENNA CONNECTION

1) If a connection has been properly made with the internal antenna, a satellite icon along with the number of usable satellites will appear at the top of the screen next to the battery icon. If no connection is made (e.g.: no satellite icon), tap on the GPS tab to connect antenna.
2) At this point the GPS unit is ready to begin collecting data.

5.0 COLLECTING NEW DATA IN THE FIELD

1) From the Main Menu select Data.
2) From the Sub Menu (located below the Data tab) select New which will bring up the New Data File menu.
3) An auto-generated filename appears and should be edited for your specific project. If the integral keyboard does not appear, tap the small keyboard icon at the bottom of the screen.
4) After entering the file name, tap Create to create the new file.
5) Confirm antenna height if screen appears. Antenna height is the height that the GPS unit will be held from the ground surface (Typically 3 to 4 feet).
6) The Choose Feature screen appears.

5.1 Collecting Features

1) If not already open, the Collect Feature screen can be opened by tapping the Main Menu and selecting Data. The Sub Menu should default to Collect.
2) **Do not begin the data logging process until you are at the specific location for which you intend to log the data.**
3) A known reference or two should be shot at the beginning and at the end of each day in which the GPS unit is being used. This allows for greater accuracy during post-processing of the data.
4) Upon arriving at the specific location, tap on Point_generic as the Feature Name.
5) Tap Create to begin data logging.
6) In the Comment Box enter sample ID or location-specific information.
7) Data logging can be confirmed by viewing the writing pencil icon in the upper part of the screen. Also, the logging counter will begin. As a Rule of Thumb, accumulate a minimum of 20 readings on the counter, per point, as indicated by the logging counter before saving the GPS data.
8) Once the counter has reached a minimum number of counts (i.e. 20), tap on OK to save the data point to the GPS unit. Confirm the feature. All data points are automatically saved within the GPS unit.
9) Repeat steps 2 through 8, giving each data point a unique name or number.

Note: If the small satellite icon or the pencil icon is blinking, this is an indication the GPS unit is not collecting data. A possible problem may be too few satellites. While still in data collection mode, tap on Main Menu in upper left hand corner of the screen and select Status. Skyplot will display as the default showing the number of available satellites. To increase productivity (number of usable satellites) use the stylus to move the pointer on the productivity and precision line to the left. This will decrease precision, but increase productivity. The precision and productivity of the GPS unit can be adjusted as the number of usable satellites changes throughout the day. To determine if GPS is correctly recording data, see Section 5.2.

5.2 Viewing Data or Entering Additional Data Points to the Current File

1) To view the stored data points in the current file, tap on the Main Menu and select Map. Stored data points for that particular file will appear. Use the +/- and <-/-> icons in lower left hand corner of screen to zoom in/out and to manipulate current view.
2) To return to data collection, tap on the Main Menu and select Data. You are now ready to continue to collect additional data points.

5.3 Viewing Data or Entering Data Points from an Existing File

1) To view data points from a previous file, tap on Main Menu and select Data, then select File Manager from the Sub Menu.
4) Highlight the file you want to view and select Map from the Main Menu.
5) To add data points to this file, tap on Main Menu and select Data. Continue to collect additional data points.

6.0 NAVIGATION

This section provides instructions on navigating to saved data points in an existing file within the GPS unit.

1) From the Main Menu select Map.
2) Using the Select tool, pick the point on the map to where you want to navigate.
3) The location you select will have a box placed around the point.
4) From the Options menu, choose the Set Nav Target (aka set navigation target).
5) The location will now have double blue flags indicating this point is you navigation target.
6) From the Main Menu select Navigation.

7) The dial and data on this page will indicate what distance and direction you need to travel to reach the desired target.
8) Follow the navigation guide until you reach the point you select.
9) Repeat as needed for any map point by going back to Step 1.

7.0 PULLING IN A BACKGROUND FILE

This section provides instructions on pulling in a pre-loaded background file. These files are helpful in visualizing your current location.

1) From the Main Menu select Map, then tap on Layers, select the background file from drop down list.
2) Select the project-specific background file from the list of available files.
3) Once the selected background file appears, the operator can manipulate the screen utilizing the +/- and <-/-> functions at the bottom of the screen.
4) In operating mode, the operator's location will show up on the background file as a floating "x".

8.0 DATA TRANSFER

This section provides instructions on how to transfer stored data on the handheld GPS unit to a personal computer. Prior to transferring data from the GPS unit to a computer, Microsoft ActiveSync and Trimble Data Transfer Utility software must be downloaded to the computer from the links provided in Section 2.2 (Required GPS Software). If a leased computer is utilized in which the operator cannot download files, see the Note at the end of Section 8.0.

1) See Attachment A at the end of this SOP for instructions on how to transfer data from the GPS to a personal computer.

Note: If you are unable to properly transfer data from the GPS unit to a personal computer, the unit should be shipped to the project-specific contact listed in Section 1.0 where the data will be transferred and the GPS unit then shipped back to the vendor.

9.0 SHUTTING DOWN

This section provides instruction for properly shutting down the GPS unit.

1) When shutting down the GPS unit for the day, first click on the "X" in the upper right hand corner.

2) You will be prompted to ensure you want to exit TerraSync. Select Yes.
3) Power off the GPS unit by pushing the small green button located on the bottom face of the unit.
4) Place the GPS unit in its cradle to recharge the battery overnight. Ensure the green charge light is visible on the charging cradle.

ATTACHMENT A

How to Transfer Trimble GPS Data between Data Collector and PC
original 11/21/06 (5/1/08 update) – John Wright

Remember – Coordinate System, Datum, and Units are critical!!!

Trimble Data Collection Devices:
Standard rental systems include the Trimble® ProXR/XRS backpack and the newer handheld GeoXT™ or GeoXH™ units. Some of the older backpack system may come with either a RECON "PDA-style" or a TSCe or TSC1 alpha-numeric style data collector.

The software on all of the above units should be Trimble® TerraSync (v 2.53 or higher – current version is 3.20) and to the user should basically look and function similar. The newer units and software versions (which should always be requested when renting) include enhancements for data processing, real-time display functions, and other features.

Data Transfer:
Trimble provides a free transfer utility program to aid in the transfer of GIS and field data. The Data Transfer Utility is a standalone program that will run on a standard office PC or laptop.

To connect a field data collector such as a RECON, GeoXM, GeoXT, GeoXH, or ProXH, you must first have Microsoft® ActiveSync® installed to allow the PC and the data collector to talk to one another. A standard USB cable is also needed to connect the two devices.

A CD or USB drive is provided with the data collector for use in data transfer. If needed, these programs are also available without charge via the web at:

• **Trimble Data Transfer Utility** (v 1.38) program to download the RECON or GeoXH field data to your PC: http://www.trimble.com/datatransfer.shtml

• **ActiveSync** from Microsoft to connect the data collector to the PC. The latest version (v4.5) can be found at: http://www.microsoft.com/windowsmobile/en-us/downloads/microsoft/activesync-download.mspx
(see page 2 for data transfer instructions)

To Transfer Data Collected in the Field:

• Install the Data Transfer and ActiveSync software installed on your PC
• Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
• ActiveSync should auto-detect the connection and recognize the data collector
• Make sure the data file desired is CLOSED in TerraSync prior to transfer
• Connect via ActiveSync as a guest (not a partnership)
• Run the Trimble Data Transfer Utility program on your PC
• Select "***GIS Datalogger on Windows CE***" or similar selection
• Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
• Select the "***Receive***" data tab (under device)
• Select "***Data***" from file types on the right
• Find the file(s) needed for data transfer. You can sort the data files by clicking on the date/time header
• Select or browse to a C-drive folder you can put this file for emailing
• When the file appears on the list, hit the "***Transfer All***"
• Go to your Outlook or other email, send a message to: John.Wright@tetratech.com (or GIS department)
• Attach the file(s) you downloaded from your C-drive. For each TerraSync data file created you should have a packet of multiple data files. All need to be sent as a group – make sure you attach all files (the number of files may vary – examples include: ssf, obx, obs, gix, giw, gis, gip, gic, dd, and car)

To Transfer GIS Data from PC to the Field Device (must be converted in Pathfinder Office):

• Obtain GIS file(s) desired from GIS Department and have converted to Trimble extension
• Contact John Wright (John.Wright@tetratech.com) if needed for file conversion and upload support
• The GIS file(s) can be quickly converted if requested and sent back to the field user in the needed "Trimble xxx.imp" extension via email – then quickly downloaded from Outlook to your PC for transfer
• Install the Data Transfer and ActiveSync software installed on your PC
• Connect the RECON or GeoXH to your PC via an A/B USB cable (blade end and square end type "HP printer" style)
• ActiveSync should auto-detect the connection and recognize the data collector
• Connect via ActiveSync as a guest (not a partnership)
• Run the Trimble Data Transfer Utility program on your PC
• Select "***GIS Datalogger on Windows CE***" or similar selection
• Hit the green connect icon to the right - the far right area should say "***Connected to ....***" if successful
• Select the "**Send**" data tab (under device)
• Select "**Data**" from file types on the right (you can also send background files)
• Browse to the location of the data on your PC (obtain the file from Pathfinder Office or from the person who converted the data for field use)
• Select the options as appropriate for the name and location of the data file to go on the data collector (usually you can choose main memory or a data storage card)
• When the file(s) appears on the list, hit the "***Transfer All***"
• Run TerraSync on the field device and open the existing data files. Your transferred file should appear (make sure you have selected Main Memory, Default, or Storage Card as appropriate)

STANDARD OPERATING PROCEDURE
SOP-10

MANAGEMENT OF INVESTIGATION-DERIVED WASTE

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes how investigation-derived waste (IDW) will be collected, segregated, classified, and managed during the field investigations at Naval Support Activity (NSA) Crane. The following types of IDW may be generated during this investigation:

- Soil sampling residues
- Decontamination solutions
- Personal protective equipment (PPE) and clothing
- Miscellaneous trash and incidental items

2.0 REQUIRED FIELD FORMS AND EQUIPMENT

Health and safety equipment (with PPE)
Bucket (with collected development/purge water)
Decontamination equipment
Field logbook
Writing utensil (preferably black pen with indelible ink)
Plastic sheeting and/or tarps
55-gallon drums with sealable lids
IDW labels for drums
Plastic garbage bags

3.0 PROCEDURES

Management of IDW includes the collection, segregation, temporary storage, classification, final disposal, and documentation of the waste-handling activities if necessary.

3.1 Liquid Wastes

Liquid wastes that may be generated during the site activities include decontamination solutions from sampling equipment. These wastes will be collected and containerized in a central location at NSA Crane for proper disposal.

3.2 Solid Wastes

Solid wastes that may be generated during site activities include soil and sediment sampling residues. Excess soil core/sampling materials will be returned to the hole and tamped. If insufficient soil is available to fill the hole to the ground surface, then bentonite pellets mixed with the soil will be used to backfill the hole and hydrated with potable water. Excess sediment sampling materials will be returned to the point of collection. The disposition of this materials will be carried out in a manner such as not to contribute further environmental degradation or pose a threat to public health or safety.

3.3 PPE and Incidental Trash

All PPE wastes and incidental trash materials (e.g., wrapping or packing materials from supply cartons, waste paper, etc.) will be decontaminated (if contaminated), double bagged, securely tied shut, and placed in a designated waste receptacle at NSA Crane.

APPENDIX C – LABORATORY ACCREDITATION DOCUMENTATION AND CURRENT CONTROL LIMITS

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited DoD ELAP Laboratory

A2LA has accredited

GEL LABORATORIES, LLC

Charleston, SC

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 22nd day of August 2011.

President & CEO
For the Accreditation Council
Certificate Number 2567.01
Valid to June 30, 2013

AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION
CORPORATE SEAL 1978
DISTRICT OF COLUMBIA
A2LA

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

APPENDIX C.1

LABORATORY PRECISION AND ACCURACY DATA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
1,1'-Biphenyl	0 - 30.0 ME 0 - 35.0	34 - 115 ME 20 - 129	0 - 30.0 ME 0 - 35.0	28 - 101 ME 16 -	0 - 30.0 ME 0 - 36.0	NA
1,2,4,5-Tetrachlorobenzene	NA	36 - 104 ME 25 - 116	0 - 30.0 ME 0 - 35.0	25 - 101 ME 12 -	0 - 30.0 ME 0 - 34.0	NA
1,2,4-Trichlorobenzene	0 - 30.0 ME 0 - 35.0	45 - 110 ME 30 - 120	0 - 30.0	45 - 110 ME 30 -	0 - 30.0	NA
1,2-Dichlorobenzene	0 - 30.0 ME 0 - 35.0	45 - 95 ME 35 - 105	0 - 30.0	45 - 95 ME 35 -	0 - 30.0	NA
1,2-Diphenylhydrazine	0 - 30.0 ME 0 - 35.0	31 - 125 ME 15 - 141	0 - 30.0 ME 0 - 35.0	23 - 115 ME 8 - 131	0 - 30.0 ME 0 - 37.0	NA
1,3,5-Trinitrobenzene	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
1,3-Dichlorobenzene	0 - 30.0 ME 0 - 35.0	40 - 100 ME 30 - 110	0 - 30.0	40 - 100 ME 30 -	0 - 30.0	NA
1,4-Dichlorobenzene	0 - 30.0 ME 0 - 35.0	35 - 105 ME 25 - 115	0 - 30.0	35 - 105 ME 25 -	0 - 30.0	NA
1,4-Dinitrobenzene	NA	45 - 95 ME 36 - 104	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
1,4-Dioxane	0 - 30.0 ME 0 - 35.0	40 - 70 ME 35 - 75	0 - 30.0 ME 0 - 35.0	17 - 63 ME 9 - 71	0 - 35.0 ME 0 - 44.0	NA
1,4-Naphthoquinone	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
1-Hexanol	NA	40 - 165 ME 19 - 186	0 - 30.0 ME 0 - 35.0	30 - 163 ME 15 -	0 - 30.0 ME 0 - 35.0	NA
1-Methylnaphthalene	0 - 30.0 ME 0 - 35.0	37 - 113 ME 24 - 126	0 - 30.0 ME 0 - 35.0	19 - 119 ME 2 - 136	0 - 30.0 ME 0 - 35.0	NA
1-Naphthylamine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
1-Nitropyrene	NA	43 - 149 ME 26 - 166	0 - 30.0 ME 0 - 35.0	26 - 155 ME 5 - 177	0 - 30.0 ME 0 - 35.0	NA
2,2'-Dichlorobenzil	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
2,3,4,6-Tetrachlorophenol	NA	41 - 110 ME 30 - 122	0 - 30.0 ME 0 - 35.0	23 - 106 ME 9 - 120	0 - 34.0 ME 0 - 42.0	NA
2,3-Dichloroaniline	0 - 30.0 ME 0 - 35.0	40 - 88 ME 32 - 97	0 - 30.0 ME 0 - 35.0	28 - 89 ME 18 - 99	0 - 31.0 ME 0 - 39.0	NA
2,4,5-Trichlorophenol	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 120	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
2,4,6-Tribromophenol	NA	NA	NA	NA	NA	35 - 125
2,4,6-Trichlorophenol	0 - 30.0 ME 0 - 35.0	45 - 110 ME 30 - 120	0 - 30.0	45 - 110 ME 30 -	0 - 30.0	NA
2,4-Dichlorophenol	0 - 30.0 ME 0 - 35.0	45 - 110 ME 35 - 120	0 - 30.0	45 - 110 ME 35 -	0 - 30.0	NA
2,4-Dimethylphenol	0 - 30.0 ME 0 - 35.0	30 - 105 ME 20 - 115	0 - 30.0	30 - 105 ME 20 -	0 - 30.0	NA
2,4-Dinitrophenol	0 - 30.0 ME 0 - 35.0	15 - 130 ME 10 - 150	0 - 30.0	15 - 130 ME 10 -	0 - 30.0	NA
2,4-Dinitrotoluene	0 - 30.0 ME 0 - 35.0	50 - 115 ME 35 - 130	0 - 30.0	50 - 115 ME 35 -	0 - 30.0	NA
2,4-Toluene diisocyanate	NA	50 - 150 ME 45 - 155	NA	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
2,6-Dichlorophenol	NA	39 - 107 ME 28 - 118	0 - 30.0 ME 0 - 35.0	20 - 109 ME 5 - 123	0 - 30.0 ME 0 - 36.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
2,6-Dinitrotoluene	0 - 30.0 ME 0 - 35.0	50 - 110 ME 35 - 125	0 - 30.0	50 - 110 ME 35 -	0 - 30.0	NA
2-Acetylaminofluorene	NA	40 - 123 ME 26 - 137	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
2-Chloronaphthalene	0 - 30.0 ME 0 - 35.0	45 - 105 ME 35 - 115	0 - 30.0	45 - 105 ME 35 -	0 - 30.0	NA
2-Chlorophenol	0 - 30.0 ME 0 - 35.0	45 - 105 ME 35 - 115	0 - 30.0	45 - 105 ME 35 -	0 - 30.0	NA
2-Fluorobiphenyl	NA	NA	NA	NA	NA	45 - 105
2-Fluorophenol	NA	NA	NA	NA	NA	35 - 105
2-Methyl-4,6-dinitrophenol	0 - 30.0 ME 0 - 35.0	30 - 135 ME 10 - 155	0 - 30.0	30 - 135 ME 10 -	0 - 30.0	NA
2-Methylnaphthalene	0 - 30.0 ME 0 - 35.0	45 - 105 ME 35 - 115	0 - 30.0	45 - 105 ME 35 -	0 - 30.0	NA
2-Naphthylamine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
2-Nitrophenol	0 - 30.0 ME 0 - 35.0	40 - 110 ME 30 - 120	0 - 30.0	40 - 110 ME 30 -	0 - 30.0	NA
2-Picoline	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
3,3'-Dichlorobenzidine	0 - 30.0 ME 0 - 35.0	10 - 130 ME 0 - 145	0 - 30.0	10 - 130 ME 0 - 145	0 - 30.0	NA
3,3'-Dimethylbenzidine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
3-Methylcholanthrene	NA	49 - 122 ME 36 - 134	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
4-Aminobiphenyl	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
4-Bromophenylphenylether	0 - 30.0 ME 0 - 35.0	45 - 115 ME 35 - 130	0 - 30.0	45 - 115 ME 35 -	0 - 30.0	NA
4-Chloro-3-methylphenol	0 - 30.0 ME 0 - 35.0	45 - 115 ME 35 - 125	0 - 30.0	45 - 115 ME 35 -	0 - 30.0	NA
4-Chloroaniline	0 - 30.0 ME 0 - 35.0	Oct-95 ME 0 - 110	0 - 30.0	Oct-95 ME 0 - 110	0 - 30.0	NA
4-Chlorophenylphenylether	0 - 30.0 ME 0 - 35.0	45 - 110 ME 35 - 120	0 - 30.0	45 - 110 ME 35 -	0 - 30.0	NA
4-Chlorothioanisole	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
4-Chlorothiophenol	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
4-Nitrophenol	0 - 30.0 ME 0 - 35.0	15 - 140 ME 10 - 160	0 - 30.0	15 - 140 ME 10 -	0 - 30.0	NA
4-Nitroquinoline-1-oxide	NA	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
5-Methylchrysene	NA	49 - 117 ME 37 - 128	0 - 30.0 ME 0 - 35.0	35 - 119 ME 20 -	0 - 30.0 ME 0 - 35.0	NA
5-Nitro-o-toluidine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
7,12Dimethylbenz(a)anthracene	NA	42 - 107 ME 31 - 118	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Acenaphthene	0 - 30.0 ME 0 - 35.0	45 - 110 ME 35 - 120	0 - 30.0	45 - 110 ME 35 -	0 - 30.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
Acenaphthylene	0 - 30.0 ME 0 - 35.0	45 - 105 ME 35 - 115	0 - 30.0	45 - 105 ME 35 -	0 - 30.0	NA
Acetophenone	0 - 30.0 ME 0 - 35.0	32 - 127 ME 16 - 143	0 - 30.0 ME 0 - 35.0	30 - 143 ME 15 -	0 - 33.0 ME 0 - 40.0	NA
Aniline	0 - 30.0 ME 0 - 35.0	13 - 126 ME 5 - 145	0 - 30.0 ME 0 - 35.0	10 - 104 ME 5 - 120	0 - 33.0 ME 0 - 41.0	NA
Anthracene	0 - 30.0 ME 0 - 35.0	55 - 105 ME 45 - 115	0 - 30.0	55 - 105 ME 45 -	0 - 30.0	NA
Aramite	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Atrazine	0 - 30.0 ME 0 - 35.0	32 - 122 ME 17 - 137	0 - 30.0 ME 0 - 35.0	23 - 118 ME 7 - 134	0 - 32.0 ME 0 - 39.0	NA
Benzaldehyde	0 - 30.0 ME 0 - 35.0	35 - 84 ME 27 - 92	0 - 30.0 ME 0 - 35.0	30 - 106 ME 15 -	0 - 34.0 ME 0 - 42.0	NA
Benzidine	0 - 30.0 ME 0 - 35.0	11 - 123 ME 5 - 141	0 - 30.0 ME 0 - 35.0	30 - 93 ME 15 -	0 - 34.0 ME 0 - 41.0	NA
Benzo(a)anthracene	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 120	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
Benzo(a)pyrene	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 120	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
Benzo(b)fluoranthene	0 - 30.0 ME 0 - 35.0	45 - 115 ME 35 - 125	0 - 30.0	45 - 115 ME 35 -	0 - 30.0	NA
Benzo(ghi)perylene	0 - 30.0 ME 0 - 35.0	40 - 125 ME 25 - 140	0 - 30.0	40 - 125 ME 25 -	0 - 30.0	NA
Benzo(j)fluoranthene	NA	53 - 187 ME 31 - 209	NA	58 - 196 ME 35 -	0 - 30.0 ME 0 - 35.0	NA
Benzo(k)fluoranthene	0 - 30.0 ME 0 - 35.0	45 - 125 ME 30 - 135	0 - 30.0	45 - 125 ME 30 -	0 - 30.0	NA
Benzoic acid	0 - 30.0 ME 0 - 35.0	0 - 110.0 ME 0 - 130.0	0 - 30.0	0 - 110.0 ME 0 -	0 - 30.0	NA
Benzyl alcohol	0 - 30.0 ME 0 - 35.0	20 - 125 ME 10 - 140	0 - 30.0	20 - 125 ME 10 -	0 - 30.0	NA
Butylbenzylphthalate	0 - 30.0 ME 0 - 35.0	50 - 125 ME 35 - 135	0 - 30.0	50 - 125 ME 35 -	0 - 30.0	NA
Caprolactam	0 - 30.0 ME 0 - 35.0	36 - 119 ME 22 - 132	0 - 30.0 ME 0 - 35.0	30 - 132 ME 15 -	0 - 36.0 ME 0 - 44.0	NA
Carbazole	0 - 30.0 ME 0 - 35.0	45 - 115 ME 30 - 130	0 - 30.0	45 - 115 ME 30 -	0 - 30.0	NA
Chlorobenzilate	0 - 30.0 ME 0 - 35.0	30 - 128 ME 14 - 144	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Chrysene	0 - 30.0 ME 0 - 35.0	55 - 110 ME 45 - 120	0 - 30.0	55 - 110 ME 45 -	0 - 30.0	NA
Di-n-butylphthalate	0 - 30.0 ME 0 - 35.0	55 - 110 ME 45 - 120	0 - 30.0	55 - 110 ME 45 -	0 - 30.0	NA
Di-n-octylphthalate	0 - 30.0 ME 0 - 35.0	40 - 130 ME 25 - 145	0 - 30.0	40 - 130 ME 25 -	0 - 30.0	NA
Diallate	NA	40 - 93 ME 31 - 102	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Dibenzo(a,h)anthracene	0 - 30.0 ME 0 - 35.0	40 - 125 ME 25 - 140	0 - 30.0	40 - 125 ME 25 -	0 - 30.0	NA
Dibenzo(a,h)pyrene	NA	23 - 162 ME 0 - 186	0 - 30.0 ME 0 - 35.0	30 - 173 ME 15 -	0 - 30.0 ME 0 - 35.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
Dibenzofuran	0 - 30.0 ME 0 - 35.0	50 - 105 ME 40 - 110	0 - 30.0	50 - 105 ME 40 -	0 - 30.0	NA
Diethylphthalate	0 - 30.0 ME 0 - 35.0	50 - 115 ME 40 - 125	0 - 30.0	50 - 115 ME 40 -	0 - 30.0	NA
Dimethoate	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Dimethylphthalate	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 120	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
Dinoseb	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Diphenyl disulfide	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
Diphenyl sulfide	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
Diphenylamine	0 - 30.0 ME 0 - 35.0	50 - 115 ME 40 - 125	0 - 30.0	50 - 115 ME 40 -	0 - 30.0	NA
Disulfoton	NA	46 - 92 ME 38 - 100	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Ethyl Methanesulfonate	NA	41 - 90 ME 33 - 98	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Ethyl methacrylate	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Famphur	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Fluoranthene	0 - 30.0 ME 0 - 35.0	55 - 115 ME 45 - 125	0 - 30.0	55 - 115 ME 45 -	0 - 30.0	NA
Fluorene	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 115	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
Hexachlorobenzene	0 - 30.0 ME 0 - 35.0	45 - 120 ME 35 - 130	0 - 30.0	45 - 120 ME 35 -	0 - 30.0	NA
Hexachlorobutadiene	0 - 30.0 ME 0 - 35.0	40 - 115 ME 25 - 130	0 - 30.0	40 - 115 ME 25 -	0 - 30.0	NA
Hexachlorocyclopentadiene	0 - 30.0 ME 0 - 35.0	22 - 130 ME 4 - 149	0 - 30.0 ME 0 - 35.0	Oct-95 ME 5 - 110	0 - 37.0 ME 0 - 45.0	NA
Hexachloroethane	0 - 30.0 ME 0 - 35.0	35 - 110 ME 20 - 120	0 - 30.0	35 - 110 ME 20 -	0 - 30.0	NA
Hexachlorophene	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Hexachloropropene	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Indeno(1,2,3-cd)pyrene	0 - 30.0 ME 0 - 35.0	40 - 120 ME 25 - 135	0 - 30.0	40 - 120 ME 25 -	0 - 30.0	NA
Isodrin	NA	20 - 148 ME 5 - 169	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Isophorone	0 - 30.0 ME 0 - 35.0	45 - 110 ME 30 - 125	0 - 30.0	45 - 110 ME 30 -	0 - 30.0	NA
Isosafrole	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Kepone	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Methapyrilene	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
Methyl methacrylate	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Methyl methanesulfonate	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Methyl parathion	NA	10 - 150 ME 5 - 155	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Methyl-N-nitrosomethylamine	0 - 30.0 ME 0 - 35.0	20 - 115 ME 10 - 130	0 - 30.0	20 - 115 ME 10 -	0 - 30.0	NA
N-Nitrosodi-n-butylamine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Nitrosodiethylamine	NA	40 - 93 ME 32 - 101	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Nitrosodipropylamine	0 - 30.0 ME 0 - 35.0	40 - 115 ME 30 - 125	0 - 30.0	40 - 115 ME 30 -	0 - 30.0	NA
N-Nitrosomethylethylamine	NA	39 - 94 ME 29 - 103	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Nitrosomorpholine	NA	40 - 107 ME 29 - 119	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Nitrosopiperidine	NA	44 - 82 ME 38 - 88	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
N-Nitrosopyrrolidine	NA	36 - 125 ME 22 - 140	0 - 30.0 ME 0 - 35.0	17 - 125 ME 5 - 143	0 - 33.0 ME 0 - 41.0	NA
Naphthalene	0 - 30.0 ME 0 - 35.0	40 - 105 ME 30 - 120	0 - 30.0	40 - 105 ME 30 -	0 - 30.0	NA
Nitrobenzene	0 - 30.0 ME 0 - 35.0	40 - 115 ME 30 - 125	0 - 30.0	40 - 115 ME 30 -	0 - 30.0	NA
Nitrobenzene-d5	NA	NA	NA	NA	NA	35 - 100
Octachlorostyrene	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
Parathion	NA	46 - 103 ME 36 - 112	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Pentachlorobenzene	NA	54 - 88 ME 48 - 93	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Pentachloroethane	NA	40 - 85 ME 33 - 93	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Pentachloronitrobenzene	NA	53 - 100 ME 45 - 108	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Pentachlorophenol	0 - 30.0 ME 0 - 35.0	25 - 120 ME 10 - 135	0 - 30.0	25 - 120 ME 10 -	0 - 30.0	NA
Phenacetin	NA	40 - 114 ME 28 - 126	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Phenanthrene	0 - 30.0 ME 0 - 35.0	50 - 110 ME 40 - 120	0 - 30.0	50 - 110 ME 40 -	0 - 30.0	NA
Phenol	0 - 30.0 ME 0 - 35.0	40 - 100 ME 30 - 110	0 - 30.0	40 - 100 ME 30 -	0 - 30.0	NA
Phenol-d5	NA	NA	NA	NA	NA	40 - 100
Phenyl sulfone	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
Phorate	NA	39 - 107 ME 27 - 119	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Pronamide	NA	34 - 102 ME 23 - 114	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
Pyrene	0 - 30.0 ME 0 - 35.0	45 - 125 ME 35 - 135	0 - 30.0	45 - 125 ME 35 -	0 - 30.0	NA
Pyridine	0 - 30.0 ME 0 - 35.0	16 - 126 ME 5 - 144	0 - 30.0 ME 0 - 35.0	15 - 85 ME 4 - 97	0 - 31.0 ME 0 - 38.0	NA
Quinoline	NA	47 - 103 ME 38 - 113	0 - 30.0 ME 0 - 35.0	36 - 99 ME 26 -	0 - 30.0 ME 0 - 35.0	NA
Safrole	NA	44 - 74 ME 38 - 79	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Sulfotepp	NA	39 - 108 ME 27 - 120	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Thionazin	NA	50 - 113 ME 40 - 123	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
Thiophenol	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
Tributylphosphate	0 - 30.0 ME 0 - 35.0	45 - 123 ME 32 - 136	0 - 30.0 ME 0 - 35.0	20 - 130 ME 2 - 149	0 - 37.0 ME 0 - 46.0	NA
Triethylphosphorothioate	NA	42 - 86 ME 34 - 93	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
a,a-Dimethylphenethylamine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
alpha-Terpineol	0 - 30.0 ME 0 - 35.0	36 - 102 ME 25 - 113	0 - 30.0 ME 0 - 35.0	19 - 103 ME 5 - 117	0 - 28.0 ME 0 - 34.0	NA
bis(2-Chloroethoxy)methane	0 - 30.0 ME 0 - 35.0	45 - 110 ME 30 - 120	0 - 30.0	45 - 110 ME 30 -	0 - 30.0	NA
bis(2-Chloroethyl) ether	0 - 30.0 ME 0 - 35.0	40 - 105 ME 25 - 115	0 - 30.0	40 - 105 ME 25 -	0 - 30.0	NA
bis(2-Chloroisopropyl)ether	30-Aug ME 0 - 35	20 - 115 ME 10 - 130	0 - 30.0	20 - 115 ME 10 -	0 - 30.0	NA
bis(2-Ethylhexyl)phthalate	0 - 30.0 ME 0 - 35.0	45 - 125 ME 35 - 140	0 - 30.0	45 - 125 ME 35 -	0 - 30.0	NA
bis(Chloromethyl)ether	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
bis(p-Chlorophenyl)disulfide	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
bis(p-Chlorophenyl)sulfone	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 - 155	0 - 30.0 ME 0 - 35.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA
m,p-Cresols	0 - 30.0 ME 0 - 35.0	40 - 105 ME 30 - 120	0 - 30.0	40 - 105 ME 30 -	0 - 30.0	NA
m-Dinitrobenzene	NA	48 - 92 ME 41 - 99	0 - 30.0 ME 0 - 35.0	50 - 150 ME 40 -	0 - 30.0 ME 0 - 35.0	NA
m-Nitroaniline	0 - 30.0 ME 0 - 35.0	25 - 110 ME 15 - 125	0 - 30.0	25 - 110 ME 15 -	0 - 30.0	NA
m-Toluidine	NA	50 - 150 ME 15 - 155	0 - 30.0	50 - 150 ME 45 -	50 - 150	NA
n-Decane	0 - 30.0 ME 0 - 35.0	29 - 104 ME 16 - 117	0 - 30.0 ME 0 - 35.0	30 - 110 ME 15 -	0 - 31.0 ME 0 - 38.0	NA
n-Octadecane	0 - 30.0 ME 0 - 35.0	31 - 118 ME 17 - 133	0 - 30.0 ME 0 - 35.0	30 - 131 ME 15 -	0 - 32.0 ME 0 - 39.0	NA
o-Cresol	0 - 30.0 ME 0 - 35.0	40 - 105 ME 30 - 115	0 - 30.0	40 - 105 ME 30 -	0 - 30.0	NA
o-Nitroaniline	0 - 30.0 ME 0 - 35.0	45 - 120 ME 30 - 130	0 - 30.0	45 - 120 ME 30 -	0 - 30.0	NA

Precision and Accuracy Data

BNA 3550/8270 Solids 26-MAR-2012

Client Type: DOD QSM

Parameter	Duplicate	LCS	LCSD	MS	MSD	SURR
o-Toluidine	NA	20 - 180 ME 5 - 206	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
p-(Dimethylamino)azobenzene	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
p-Benzoquinone	NA	60 - 140 ME 50 - 150	NA	60 - 140 ME 50 -	NA	NA
p-Nitroaniline	0 - 30.0 ME 0 - 35.0	35 - 115 ME 20 - 125	0 - 30.0	35 - 115 ME 20 -	0 - 30.0	NA
p-Phenylenediamine	NA	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	10 - 150 ME 5 - 155	0 - 30.0 ME 0 - 35.0	NA
p-Terphenyl-d14	NA	NA	NA	NA	NA	30 - 125
p-Toluidine	NA	50 - 150 ME 45 - 155	0 - 30.0	50 - 150 ME 45 -	0 - 30.0 ME 0 - 35.0	NA

APPENDIX C.2

HUMAN HEALTH AND ECOLOGICAL SCREENING CRITERIA

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil [1] (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil [2] (mg/kg)	EPA Regional Screening Level, Migration to Groundwater [1] (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater [2] (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) [3]			Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil [1] (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) [3]		
						Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level				Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level
Volatile Organic Compounds (Target Compound List [TCL] and/or Appendix IX List [IX])														
1,1,1,2-Tetrachloroethane (IX only)	630-20-6	1.9 C	1.9 C	0.00019	0.0038	39	0.053	0.053	0.0038	RBSSL	9.3 C	67	0.85	0.85
1,1,1-Trichloroethane	71-55-6	8700 N	870 N	0.070	1.4	5000	1.9	1.9	1.4	RBSSL	38000 N	6700	280	280
1,1,2,2-Tetrachloroethane	79-34-5	0.56 C	0.56 C	0.000026	0.00052	5	0.007	0.007	0.00052	RBSSL	2.8 C	8.7	0.11	0.11
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) (TCL only)	76-13-1	43000 N	4300 N	130	2600	NA	NA	NA	2600	RBSSL	180000 N	NA	NA	NA
1,1,2-Trichloroethane	79-00-5	1.6 N[4]	0.16 N[4]	0.0001	0.0015	9.4	0.03	0.03	0.0015	RBSSL	5.3 C	15	0.3	0.3
1,1-Dichloroethane	75-34-3	3.3 C	3.3 C	0.00068	0.014	1300	5.6	5.6	0.014	RBSSL	17 C	1700	58	58
1,1-Dichloroethene	75-35-4	240 N	24 N	0.0025	0.050	310	0.058	0.058	0.050	RBSSL	1100 N	410	42	42
1,2,3-Trichlorobenzene (TCL only)	87-61-6	49 N	4.9 N	0.015	0.30	NA	NA	NA	0.30	RBSSL	490 N	NA	NA	NA
1,2,3-Trichloropropane (IX only)	96-18-4	0.005 C	0.005 C	0.00000028	0.0000056	NA	NA	NA	0.0000056	RBSSL	0.095 C	NA	NA	NA
1,2,4-Trichlorobenzene	120-82-1	62 N[4]	6.2 N[4]	0.20	4.0	1800	5.3	5.3	4.0	RBSSL	270 N[4]	4900	77	77
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.0054 C	0.0054 C	0.000000	0.0000028	NA	NA	NA	0.0000028	RBSSL	0.069 C	NA	NA	NA
1,2-Dibromoethane (EDB)	106-93-4	0.034 C	0.034 C	0.000002	0.000036	0.3	0.00034	0.00034	0.000036	RBSSL	0.17 C	0.49	0.0096	0.0096
1,2-Dichlorobenzene	95-50-1	1900 N	190 N	0.27	5.4	2800	17	17	5.4	RBSSL	9800 N	3900	270	220
1,2-Dichloroethane	107-06-2	0.43 C	0.43 C	0.000042	0.00084	3.7	0.024	0.024	0.00084	RBSSL	2.2 C	5.8	0.15	0.15
1,2-Dichloropropane	78-87-5	0.94 C	0.94 C	0.00013	0.0026	4.5	0.03	0.03	0.0026	RBSSL	4.7 C	7.2	0.25	0.25
1,3-Dichlorobenzene	541-73-1	NA	NA	NA	NA	420	2.3	2.3	2.3	IDEM-RDCL	NA	890	8.9	8.9
1,4-Dichlorobenzene	106-46-7	2.4 C	2.4 C	0.00040	0.0080	42	2.2	2.2	0.0080	RBSSL	12 C	73	3.4	3.4
1,4-Dioxane	123-91-1	4.9 C	4.9 C	0.00014	0.0028	NA	NA	NA	0.0028	RBSSL	17 C	NA	NA	NA
2-Butanone (MEK)	78-93-3	28000 N	2800 N	1.0	20	44000	35	35	20	RBSSL	200000 N	70000	250	250
2-Hexanone	591-78-6	210 N	21 N	0.0079	0.16	NA	NA	NA	0.16	RBSSL	1400 N	NA	NA	NA
3-Chloropropene (Allyl chloride) (IX only)	107-05-1	1.8 N[4]	0.18 N[4]	0.00020	0.0040	NA	NA	NA	0.0040	RBSSL	3.4 C	NA	NA	NA
4-Methyl-2-pentanone (MIBK)	108-10-1	5300 N	530 N	0.23	4.6	12000	20	20	4.6	RBSSL	53000 N	29000	75	75
Acetone	67-64-1	61000 N	6100 N	2.4	48	35000	28	28	28	IDEM-RDCL	630000 N	51000	370	370
Acetonitrile (IX only)	75-05-8	870 N	87 N	0.026	0.52	NA	NA	NA	0.52	RBSSL	3700 N	NA	NA	NA
Acrolein (IX only)	107-02-8	0.15 N	0.015 N	0.0000084	0.00017	0.5	0.00027	0.00027	0.00017	RBSSL	0.65 N	0.64	0.25	0.25
Acrylonitrile (IX only)	107-13-1	0.24 C	0.24 C	0.0000098	0.00020	NA	NA	NA	0.00020	RBSSL	1.2 C	NA	NA	NA
Benzene	71-43-2	1.1 C	1.1 C	0.00020	0.0040	8.4	0.034	0.034	0.0040	RBSSL	5.4 C	14	0.35	0.35
Bromochloromethane (TCL only)	74-97-5	160 N	16 N	0.021	0.42	NA	NA	NA	0.42	RBSSL	680 N	NA	NA	NA
Bromodichloromethane	75-27-4	0.27 C	0.27 C	0.000032	0.00064	10	0.51	0.51	0.00064	RBSSL	1.4 C	17	0.51	0.51
Bromoform	75-25-2	62 C	62 C	0.0021	0.042	280	0.6	0.6	0.042	RBSSL	220 C	580	2.7	2.7
Bromomethane	74-83-9	7.3 N	0.73 N	0.0018	0.036	9.9	0.052	0.052	0.036	RBSSL	32 N	13	0.7	0.7
Carbon disulfide	75-15-0	820 N	82 N	0.21	4.2	900	10	10	4.2	RBSSL	3700 N	1200	82	82
Carbon tetrachloride	56-23-5	0.61 C	0.61 C	0.00015	0.0030	3.3	0.066	0.066	0.0030	RBSSL	3.0 C	5.2	0.29	0.29
Chlorobenzene	108-90-7	290 N	29 N	0.049	0.98	380	1.3	1.3	0.98	RBSSL	1400 N	510	27	27
Chlorodibromomethane (Dibromochloromethane)	124-48-1	0.68 C	0.68 C	0.000039	0.00078	NA	NA	NA	0.00078	RBSSL	3.3 C	NA	NA	NA
Chloroethane (Ethyl chloride)	75-00-3	15000 N	1500 N	5.9	118	80	0.65	0.65	0.65	IDEM-RDCL	61000 N	120	10	10
Chloroform	67-66-3	0.29 C	0.29 C	0.000053	0.0011	3	0.47	0.47	0.0011	RBSSL	1.5 C	4.7	6	4.7
Chloromethane	74-87-3	120 N	12 N	0.049	0.98	NA	NA	NA	0.98	RBSSL	500 N	NA	NA	NA
Chloroprene (2-Chloro-1,3-butadiene) (IX only)	126-99-8	0.0094 C	0.0094 C	0.0000085	0.00017	NA	NA	NA	0.00017	RBSSL	0.047 C	NA	NA	NA
cis-1,2-Dichloroethene (TCL only)	156-59-2	160 N	16 N	0.0082	0.16	110	0.4	0.4	0.16	RBSSL	2000 N	140	5.8	5.8
cis-1,3-Dichloropropene	10061-01-5	1.7 C[5]	1.7 C[5]	0.00015 [5]	0.0030 [5]	NA	NA	NA	0.0030	RBSSL	8.1 C[5]	NA	NA	NA
Cyclohexane (TCL only)	110-82-7	7000 N	700 N	13	260	7200	330	69	69	IDEM-RDCL	29000 N	9300	1400	69
Dibromomethane (methylene bromide) (IX only)	74-95-3	25 N	2.5 N	0.0019	0.038	NA	NA	NA	0.038	RBSSL	110 N	NA	NA	NA
Dichlorodifluoromethane	75-71-8	94 N	9.4 N	0.30	6.0	NA	NA	NA	6.0	RBSSL	400 N	NA	NA	NA
Ethyl methacrylate (IX only)	97-63-2	1500 N	150 N	0.099	2.0	NA	NA	NA	2.0	RBSSL	7500 N	NA	NA	NA
Ethylbenzene	100-41-4	5.4 C	5.4 C	0.0015	0.030	4600	13	13	0.030	RBSSL	27 C	6800	200	160
Isobutanol (Isobutyl alcohol) (IX only)	78-83-1	18000 N	1800 N	0.95	19	NA	NA	NA	19	RBSSL	180000 N	NA	NA	NA
Isopropylbenzene (Cumene) (TCL only)	98-82-8	2100 N	210 N	0.64	13	1400	11	11	11	IDEM-RDCL	11000 N	1900	140	42
Methacrylonitrile (IX only)	126-98-7	3.2 N	0.32 N	0.00017	0.0034	NA	NA	NA	0.0034	RBSSL	18 N	NA	NA	NA
Methyl acetate (TCL only)	79-20-9	78000 N	7800 N	3.2	64	NA	NA	NA	64	RBSSL	1000000 N	NA	NA	NA
Methyl cyclohexane (TCL only)	108-87-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Methyl iodide (iodomethane) (IX only)	74-88-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Methyl methacrylate (IX only)	80-62-6	4800 N	480 N	0.30	6.0	NA	NA	NA	6.0	RBSSL	21000 N	NA	NA	NA
Methyl tert-butyl ether (MTBE) (TCL only)	1634-04-4	43 C	43 C	0.0028	0.056	350	0.18	0.18	0.056	RBSSL	220 C	650	3.2	3.2
Methylene chloride	75-09-2	56 C	56 C	0.0025	0.050	120	0.023	0.023	0.023	IDEM-RDCL	960 C	200	1.8	1.8
m-Xylene	108-38-3	590 N	59 N	0.18	3.6	NA	NA	NA	3.6	RBSSL	2500 N	NA	NA	NA
o-Xylene	95-47-6	690 N	69 N	0.19	3.8	NA	NA	NA	3.8	RBSSL	3000 N	NA	NA	NA
p-Xylene	106-42-3	600 N	60 N	0.18	3.6	NA	NA	NA	3.6	RBSSL	2600 N	NA	NA	NA
Pentachloroethane (IX only)	76-01-7	5.4 C	5.4 C	0.00027	0.0054	NA	NA	NA	0.0054	RBSSL	19 C	NA	NA	NA
Propionitrile (IX only)	107-12-0	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Styrene	100-42-5	6300 N	630 N	0.11	2.2	11000	3.5	3.5	2.2	RBSSL	36000 N	16000	720	550
Tetrachloroethene	127-18-4	22 C	22 C	0.0044	0.088	9.9	0.058	0.058	0.058	IDEM-RDCL	110 C	16	0.64	0.64
Toluene	108-88-3	5000 N	500 N	0.59	12	8800	12	12	12	RBSSL	45000 N	16000	96	96
trans-1,2-Dichloroethene	156-60-5	150 N	15 N	0.025	0.50	180	0.68	0.68	0.50	RBSSL	690 N	230	14	14

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil (1) (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil (2) (mg/kg)	EPA Regional Screening Level, Migration to Groundwater (1) (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater (2) (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) (3)			Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil (1) (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) (3)		
						Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level				Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level
trans-1,3-Dichloropropene	10061-02-6	1.7 C (5)	1.7 C (5)	0.00015 (5)	0.0030 (5)	NA	NA	NA	0.0030	RBSSL	8.1 C (5)	NA	NA	NA
trans-1,4-Dichloro-2-butene (IX only)	110-57-6	0.0069 C	0.0069 C	0.00000054	0.000011	NA	NA	NA	0.000011	RBSSL	0.035 C	NA	NA	NA
Trichloroethene	79-01-6	2.5 N (4)	0.25 N (4)	0.00016	0.0032	4.9	0.057	0.057	0.0032	RBSSL	6.4 C	24	0.35	0.35
Trichlorofluoromethane	75-69-4	790 N	79 N	0.69	14	980	29	29	14	RBSSL	3400 N	1300	540	540
Vinyl acetate (IX only)	108-05-4	970 N	97 N	0.087	1.7	1100	2.3	2.3	1.7	RBSSL	4100 N	1400	430	430
Vinyl chloride	75-01-4	0.060 C	0.060 C	0.0000053	0.00011	1.5	0.013	0.013	0.00011	RBSSL	1.7 C	6.4	0.027	0.027
Xylenes (total) (Total Xylenes)	1330-20-7	630 N (6)	63 N (6)	0.19 (6)	3.8 (6)	690	210	170	3.8	RBSSL	2700 (6)	890	430	170
Semivolatile Organic Compounds (TCL and/or IX) (not including Polycyclic Aromatic Hydrocarbons)														
1,1'-Biphenyl (TCL only)	92-52-4	51 N	5.1 N	0.0087	0.17	NA	NA	NA	0.17	RBSSL	210 N	NA	NA	NA
1,2,4,5-Tetrachlorobenzene (IX only)	95-94-3	18 N	1.8 N	0.0058	0.12	NA	NA	NA	0.12	RBSSL	180 N	NA	NA	NA
1,3,5-Trinitrobenzene (IX only)	99-35-4	2200 N	220 N	1.7	34	NA	NA	NA	34	RBSSL	27000 N	NA	NA	NA
1,3-Dinitrobenzene	99-65-0	6.1 N	0.61 N	0.0014	0.028	NA	NA	NA	0.028	RBSSL	62 N	NA	NA	NA
1,4-Naphthoquinone (IX only)	130-15-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
1,4-Phenylenediamine (IX only)	106-50-3	12000 N	1200 N	0.79	16	NA	NA	NA	16	RBSSL	12000 N	NA	NA	NA
1-Naphthylamine (IX only)	134-32-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
2,2-Oxybis(1-chloropropane) (Bis(2-chloro-1-methylethyl)eth	108-60-1	4.6 C	4.6 C	0.00011	0.0022	30	0.027	0.027	0.0022	RBSSL	22 C	61	0.26	0.26
2,3,4,6-Tetrachlorophenol (IX only)	58-90-2	1800 N	180 N	1.1	22	NA	NA	NA	22	RBSSL	18000 N	NA	NA	NA
2,4,5-Trichlorophenol	95-95-4	6100 N	610 N	3.3	66	18000	250	250	66	RBSSL	62000 N	49000	690	690
2,4,6-Trichlorophenol	88-06-2	61 N (4)	6.1 N (4)	0.013	0.26	18	0.07	0.07	0.07	IDEM-RDCL	620 N (4)	49	0.2	0.2
2,4-Dichlorophenol	120-83-2	180 N	18 N	0.041	0.82	550	1.1	1.1	0.82	RBSSL	1800 N	1500	3	3
2,4-Dimethylphenol	105-67-9	1200 N	120 N	0.32	6.4	3700	9	9	6.4	RBSSL	12000 N	9800	25	25
2,4-Dinitrophenol	51-28-5	120 N	12 N	0.034	0.68	370	0.29	0.29	0.29	IDEM-RDCL	1200 N	980	0.82	0.82
2,4-Dinitrotoluene	121-14-2	1.6 C	1.6 C	0.00028	0.0056	NA	NA	NA	0.0056	RBSSL	5.5 C	NA	NA	NA
2,6-Dichlorophenol (IX only)	87-65-0	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
2,6-Dinitrotoluene	606-20-2	61 N	6.1 N	0.020	0.40	NA	NA	NA	0.40	RBSSL	620 N	NA	NA	NA
2-Acetylaminofluorene (IX only)	53-96-3	0.13 C	0.13 C	0.000065	0.0013	NA	NA	NA	0.0013	RBSSL	0.45 C	NA	NA	NA
2-Chloronaphthalene	91-58-7	6300 N	630 N	2.9	58	15000	42	42	42	IDEM-RDCL	82000 N	39000	560	560
2-Chlorophenol	95-57-8	390 N	39 N	0.057	1.1	360	0.75	0.75	0.75	IDEM-RDCL	5100 N	580	10	10
2-Methylphenol (o-Cresol)	95-48-7	3100 N	310 N	0.58	12	7500	14	14	12	RBSSL	31000 N	17000	39	39
2-Naphthylamine (IX only)	91-59-8	0.27 C	0.27 C	0.00017	0.0034	NA	NA	NA	0.0034	RBSSL	0.96 C	NA	NA	NA
2-Nitroaniline	88-74-4	610 N	61 N	0.062	1.2	550	0.67	0.67	0.67	IDEM-RDCL	6000 N	1500	1.9	1.9
2-Nitrophenol	88-75-5	120 N (7)	12 N (7)	0.08 (7)	1.6 (7)	NA	NA	NA	1.6	RBSSL	1200 N (7)	NA	NA	NA
2-Picoline (IX only)	109-06-8	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
3-Methylphenol (m-Cresol)	108-39-4	3100 N	310 N	0.57	11	9100	9.8	9.8	9.8	IDEM-RDCL	31000 N	25000	28	28
3,3'-Dichlorobenzidine	91-94-1	1.1 C	1.1 C	0.00071	0.014	9.5	0.062	0.062	0.014	RBSSL	3.8 C	31	0.21	0.21
3,3'-Dimethylbenzidine (IX only)	119-93-7	0.044 C	0.044 C	0.000037	0.00074	NA	NA	NA	0.00074	RBSSL	0.16 C	NA	NA	NA
3-Methylcholanthrene (IX only)	56-49-5	0.0052 C	0.0052 C	0.0019	0.038	NA	NA	NA	0.0052	R-RSL	0.078 C	NA	NA	NA
3-Nitroaniline	99-09-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol (2-Methyl-4,6-dinitrophenol)	534-52-1	4.9 N	0.49 N	0.0020	0.040	NA	NA	NA	0.040	RBSSL	49 N	NA	NA	NA
4-Aminobiphenyl (IX only)	92-67-1	0.023 C	0.023 C	0.000013	0.00026	NA	NA	NA	0.00026	RBSSL	0.082 C	NA	NA	NA
4-Bromophenyl phenyl ether	101-55-3	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
4-Chloro-3-methylphenol	59-50-7	6100 N	610 N	1.3	26	NA	NA	NA	26	RBSSL	62000 N	NA	NA	NA
4-Chloroaniline	106-47-8	2.4 C	2.4 C	0.00013	0.0026	730	0.97	0.97	0.0026	RBSSL	8.6 C	2000	2.7	2.7
4-Chlorophenyl phenyl ether	7005-72-3	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
4-Methylphenol (p-Cresol)	106-44-5	6100 N	610 N	1.1	22	910	1.1	1.1	1.1	IDEM-RDCL	62000 N	2500	3	3
4-Nitroaniline	100-01-6	24 C	24 C	0.0014	0.028	NA	NA	NA	0.028	RBSSL	86 C	NA	NA	NA
4-Nitrophenol	100-02-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
4-Nitroquinoline-1-oxide (IX only)	56-57-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
5-Nitro-o-toluidine (IX only)	99-55-8	54 N	5.4 N	0.0039	0.078	NA	NA	NA	0.078	RBSSL	190 N	NA	NA	NA
7,12-Dimethylbenz(a)anthracene (IX only)	57-97-6	0.0018 C	0.0018 C	0.000085	0.0017	NA	NA	NA	0.0017	RBSSL	0.0062 C	NA	NA	NA
a,a-Dimethylphenethylamine (IX only)	122-09-8	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Acetophenone	98-86-2	7800 N	780 N	0.45	9.0	NA	NA	NA	9.0	RBSSL	100000 N	NA	NA	NA
Aniline (IX only)	62-53-3	85 N	8.5 N	0.0039	0.078	NA	NA	NA	0.078	RBSSL	300 N	NA	NA	NA
Aramite (IX only)	140-57-8	19 C	19 C	0.030	0.60	NA	NA	NA	0.60	RBSSL	69 C	NA	NA	NA
Atrazine (TCL only)	1912-24-9	2.1 C	2.1 C	0.00017	0.0034	19	0.048	0.048	0.0034	RBSSL	7.5 C	63	0.21	0.21
Benzaldehyde (TCL only)	100-52-7	7800 N	780 N	0.33	6.6	NA	NA	NA	6.6	RBSSL	100000 N	NA	NA	NA
Benzo(a)anthracene	56-55-3	0.15 C	0.15 C	0.010	0.20	5	19	5	0.15	R-RSL	2.1 C	15	62	15
Benzyl alcohol (IX only)	100-51-6	6100 N	610 N	0.37	7.4	5500	48	48	7.4	RBSSL	62000 N	150000	140	140
Bis(2-chloroethoxy)methane	111-91-1	180 N	18 N	0.011	0.22	NA	NA	NA	0.22	RBSSL	1800 N	NA	NA	NA
Bis(2-chloroethyl)ether	111-44-4	0.21 C	0.21 C	0.0000031	0.000062	1.6	0.0007	0.0007	0.000062	RBSSL	1.0 C	3	0.012	0.012
Bis(2-ethylhexyl)phthalate	117-81-7	35 C	35 C	0.017	0.34	300	3600	300	0.34	RBSSL	120 C	980	120000	980
Butyl benzyl phthalate	85-68-7	260 C	260 C	0.20	4.0	37000	6200	310	4.0	RBSSL	910 C	98000	6200	310
Caprolactam (TCL only)	105-60-2	31000 N	3100 N	1.9	38	NA	NA	NA	38	RBSSL	310000 N	NA	NA	NA
Carbazole (TCL only)	86-74-8	NA	NA	NA	NA	210	5.9	5.9	5.9	IDEM-RDCL	NA	690	20	20
Chlorobenzilate (IX only)	510-15-6	4.4 C	4.4 C	0.00088	0.018	NA	NA	NA	0.018	RBSSL	16 C	NA	NA	NA

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil (1) (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil (2) (mg/kg)	EPA Regional Screening Level, Migration to Groundwater (1) (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater (2) (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) (3)			Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil (1) (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) (3)		
						Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level				Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level
Diallate (IX only)	2303-16-4	8.0 C	8.0 C	0.00068	0.014	NA	NA	NA	0.014	RBSSL	28 C	NA	NA	NA
Dibenzofuran	132-64-9	78 N	7.8 N	0.11	2.2	370	4.9	4.9	2.2	RBSSL	1000 N	980	65	65
Diethyl phthalate	84-66-2	49000 N	4900 N	4.7	94	150000	450	450	94	RBSSL	490000 N	390000	1300	840
Dimethoate (IX only)	60-51-5	12 N	1.2 N	0.00070	0.014	NA	NA	NA	0.014	RBSSL	120 N	NA	NA	NA
Dimethyl phthalate	131-11-3	49000 N(8)	4900 N(8)	12 (8)	240 (8)	1000000	2000	1100	240	RBSSL	490000 N(8)	1000000	5600	1100
Di-n-butyl phthalate	84-74-2	6100 N	610 N	1.7	34	18000	5000	760	34	RBSSL	62000 N	49000	14000	760
Di-n-octyl phthalate	117-84-0	NA	NA	NA	NA	7300	67000	2000	2000	IDEM-RDCL	NA	20000	67000	2000
Diphenylamine (IX only)	122-39-4	1500 N	150 N	0.44	8.8	NA	NA	NA	8.8	RBSSL	15000 N	NA	NA	NA
Disulfoton (IX only)	298-04-4	2.4 N	0.24 N	0.00071	0.014	NA	NA	NA	0.014	RBSSL	25 N	NA	NA	NA
Ethyl methane sulfonate (IX only)	62-50-0	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Ethyl parathion (Parathion) (IX only)	56-38-2	370 N	37 N	0.33	6.6	NA	NA	NA	6.6	RBSSL	3700 N	NA	NA	NA
Famphur (IX only)	52-85-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Hexachlorobenzene	118-74-1	0.30 C	0.30 C	0.00053	0.011	2.7	2.2	2.2	0.011	RBSSL	1.1 C	8.6	3.9	3.9
Hexachlorobutadiene	87-68-3	61 N(4)	6.1 N(4)	0.0050	0.10	55	24	24	0.10	RBSSL	22 C	150	66	66
Hexachlorocyclopentadiene	77-47-4	370 N	37 N	0.070	1.4	1100	400	400	1.4	RBSSL	3700 N	2900	4900	720
Hexachloroethane	67-72-1	43 N(4)	4.3 N(4)	0.00048	0.0096	120	2.8	2.8	0.0096	RBSSL	43 N(4)	240	7.7	7.7
Hexachlorophene (IX only)	70-30-4	18 N	1.8 N	6.3	126	NA	NA	NA	1.8	R-RSL	180 N	NA	NA	NA
Hexachloropropene (IX only)	1888-71-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Isodrin (IX only)	465-73-6	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Isophorone	78-59-1	510 C	510 C	0.022	0.44	4500	5.3	5.3	0.44	RBSSL	1800 C	14000	18	18
Isosafrole (IX only)	120-58-1	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Kepone (Chlordecone) (IX only)	143-50-0	0.049 C	0.049 C	0.00011	0.0022	NA	NA	NA	0.0022	RBSSL	0.17 C	NA	NA	NA
Methapyrilene (IX only)	91-80-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Methyl methane sulfonate (IX only)	66-27-3	4.9 C	4.9 C	0.00014	0.0028	NA	NA	NA	0.0028	RBSSL	17 C	NA	NA	NA
Methyl Parathion (IX only)	298-00-0	15 N	1.5 N	0.0057	0.11	NA	NA	NA	0.11	RBSSL	150 N	NA	NA	NA
Nitrobenzene	98-95-3	4.8 C	4.8 C	0.000079	0.0016	91	0.028	0.028	0.0016	RBSSL	24 C	250	0.34	0.34
N-Nitrosodiethylamine (IX only)	55-18-5	0.00077 C	0.00077 C	0.000000052	0.0000010	NA	NA	NA	0.0000010	RBSSL	0.011 C	NA	NA	NA
N-Nitrosodimethylamine (IX only)	62-75-9	0.0023 C	0.0023 C	0.00000010	0.0000020	NA	NA	NA	0.0000020	RBSSL	0.034 C	NA	NA	NA
N-Nitroso-di-n-butylamine (IX only)	924-16-3	0.087 C	0.087 C	0.0000048	0.000096	NA	NA	NA	0.000096	RBSSL	0.40 C	NA	NA	NA
N-Nitroso-di-n-propylamine	621-64-7	0.069 C	0.069 C	0.0000070	0.00014	0.61	0.0006	0.0006	0.00014	RBSSL	0.25 C	2	0.002	0.002
N-Nitrosodiphenylamine	86-30-6	99 C	99 C	0.057	1.1	870	9.7	9.7	1.1	RBSSL	350 C	2800	32	32
N-Nitrosomethylethylamine (IX only)	10595-95-6	0.022 C	0.022 C	0.00000087	0.000017	NA	NA	NA	0.000017	RBSSL	0.078 C	NA	NA	NA
N-Nitrosomorpholine (IX only)	59-89-2	0.073 C	0.073 C	0.0000025	0.000050	NA	NA	NA	0.000050	RBSSL	0.26 C	NA	NA	NA
N-Nitrosopiperidine (IX only)	100-75-4	0.052 C	0.052 C	0.0000038	0.000076	NA	NA	NA	0.000076	RBSSL	0.18 C	NA	NA	NA
N-Nitrosopyrrolidine (IX only)	930-55-2	0.23 C	0.23 C	0.000012	0.00024	NA	NA	NA	0.00024	RBSSL	0.82 C	NA	NA	NA
o,o,o-Triethylphosphorothioate (IX only)	126-68-1	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
o-Toluidine (IX only)	95-53-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Pentachlorobenzene (IX only)	608-93-5	49 N	4.9 N	0.017	0.34	NA	NA	NA	0.34	RBSSL	490 N	NA	NA	NA
Pentachloronitrobenzene (IX only)	82-68-8	1.9 C	1.9 C	0.0013	0.026	NA	NA	NA	0.026	RBSSL	6.6 C	NA	NA	NA
Pentachlorophenol (TCL only)	87-86-5	0.89 C	0.89 C	0.010	0.20	20	0.028	0.028	0.028	IDEM-RDCL	2.7 C	54	0.66	0.66
Phenacetin (IX only)	62-44-2	220 C	220 C	0.0083	0.17	NA	NA	NA	0.17	RBSSL	780 C	NA	NA	NA
Phenol	108-95-2	18000 N	1800 N	2.6	52	44000	56	56	52	RBSSL	180000 N	96000	160	160
Phorate (IX only)	298-02-2	12 N	1.2 N	0.00026	0.0052	NA	NA	NA	0.0052	RBSSL	120 N	NA	NA	NA
Pronamide (IX only)	23950-58-5	4600 N	460 N	0.91	18	NA	NA	NA	18	RBSSL	46000 N	NA	NA	NA
Pyridine (IX only)	110-86-1	78 N	7.8 N	0.0053	0.11	NA	NA	NA	0.11	RBSSL	1000 N	NA	NA	NA
Safrole (IX only)	94-59-7	0.52 C	0.52 C	0.000038	0.00076	NA	NA	NA	0.00076	RBSSL	7.8 C	NA	NA	NA
Solvent Yellow (p-Dimethylaminoazobenzene) (IX only)	60-11-7	0.11 C	0.11 C	0.00018	0.0036	NA	NA	NA	0.0036	RBSSL	0.37 C	NA	NA	NA
Sulfotepp (IX only)	3689-24-5	31	3.1 N	0.0039	0.078	NA	NA	NA	0.078	RBSSL	310 N	NA	NA	NA
Thionazin (IX only)	297-97-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Polycyclic Aromatic Hydrocarbons														
1-Methylnaphthalene	90-12-0	16 C	16 C	0.0051	0.10	NA	NA	NA	0.10	RBSSL	53 C	NA	NA	NA
2-Methylnaphthalene	91-57-6	230 N	23 N	0.14	2.8	630	3.1	3.1	2.8	RBSSL	2200 N	1600	42	42
Acenaphthene	83-32-9	3400 N	340 N	4.1	82	9500	130	130	82	RBSSL	33000 N	24000	1800	1800
Acenaphthylene	208-96-8	3400 N(9)	340 N(9)	4.1 (9)	82 (9)	1100	18	18	18	IDEM-RDCL	33000 N(9)	2800	180	180
Anthracene	120-12-7	17000 N	1700 N	42	840	47000	2700	2000	840	RBSSL	170000 N	120000	36000	2000
Benzo(a)anthracene	56-55-3	0.15 C	0.15 C	0.010	0.20	5	19	5	0.15	R-RSL	2.1 C	15	62	15
Benzo(a)pyrene	50-32-8	0.015 C	0.015 C	0.0035	0.070	0.5	8.2	0.5	0.015	R-RSL	0.21 C	1.5	16	1.5
Benzo(b)fluoranthene	205-99-2	0.15 C	0.15 C	0.035	0.70	5	57	5	0.15	R-RSL	2.1 C	15	190	15
Benzo(g,h,i)perylene	191-24-2	1700 N(10)	170 N(10)	9.5 (10)	190 (10)	NA	NA	NA	170	RBSSL	17000 N(10)	NA	NA	NA
Benzo(k)fluoranthene	207-08-9	1.5 C	1.5 C	0.35	7.0	50	570	50	1.5	R-RSL	21 C	150	1900	150
Chrysene	218-01-9	15 C	15 C	1.1	22	500	1900	500	15	R-RSL	210 C	1500	6200	1500
Dibenzo(a,h)anthracene	53-70-3	0.015 C	0.015 C	0.011	0.22	0.5	18	0.5	0.015	R-RSL	0.21 C	1.5	60	1.5
Fluoranthene	206-44-0	2300 N	230 N	70	1400	6300	6300	2000	230	R-RSL	22000 N	16000	18000	2000
Fluorene	86-73-7	2300 N	230 N	4.0	80	6300	170	170	80	RBSSL	22000 N	16000	2300	2000
Indeno(1,2,3-c,d)pyrene	193-39-5	0.15 C	0.15 C	0.12	2.4	5	160	5	0.15	R-RSL	2.1 C	15	540	15

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil [1] (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil [2] (mg/kg)	EPA Regional Screening Level, Migration to Groundwater [1] (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater [2] (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) [3]			Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil [1] (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) [3]		
						Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level				Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level
Naphthalene	91-20-3	3.6 C	3.6 C	0.00047	0.0094	3200	0.7	0.7	0.0094	RBSSL	18 C	8000	170	170
Phenanthrene	85-01-8	1700 N[10]	170 N[10]	9.5 [10]	190 [10]	470	13	13	13	IDEM-RDCL	17000 N[10]	1200	170	170
Pyrene	129-00-0	1700 N	170 N	9.5	190	4700	4600	2000	170	R-RSL	17000 N	12000	13000	2000
Polychlorinated Biphenyls (TCL and/or IX)														
Aroclor-1016	12674-11-2	3.9 N	0.39 N	0.092	1.8	NA	NA	NA	0.39	R-RSL	21 C	NA	NA	NA
Aroclor-1221	11104-28-2	0.14 C	0.14 C	0.000074	0.0015	NA	NA	NA	0.0015	RBSSL	0.54 C	NA	NA	NA
Aroclor-1232	11141-16-5	0.14 C	0.14 C	0.000074	0.0015	NA	NA	NA	0.0015	RBSSL	0.54 C	NA	NA	NA
Aroclor-1242	53469-21-9	0.22 C	0.22 C	0.0053	0.11	NA	NA	NA	0.11	RBSSL	0.74 C	NA	NA	NA
Aroclor-1248	12672-29-6	0.22 C	0.22 C	0.0052	0.10	NA	NA	NA	0.10	RBSSL	0.74 C	NA	NA	NA
Aroclor-1254	11097-69-1	1.1 N[4]	0.11 N[4]	0.0088	0.18	NA	NA	NA	0.11	R-RSL	0.74 C	NA	NA	NA
Aroclor-1260	11096-82-5	0.22 C	0.22 C	0.024	0.48	NA	NA	NA	0.22	R-RSL	0.74 C	NA	NA	NA
Aroclor-1262 (IX only)	37324-23-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Aroclor-1268 (IX only)	11100-14-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total PCBs	1336-36-3	0.22 C	0.22 C	NA	NA	1.8	6.2	1.8	0.22	R-RSL	0.74 C	5.3	18	5.3
Pesticides (TCL and IX)														
4,4'-DDD	72-54-8	2.0 C	2.0 C	0.066	1.3	28	140	28	1.3	RBSSL	7.2 C	120	480	120
4,4'-DDE	72-55-9	1.4 C	1.4 C	0.046	0.92	20	450	20	0.92	RBSSL	5.1 C	86	1500	86
4,4'-DDT	50-29-3	1.7 C	1.7 C	0.067	1.3	20	260	20	1.3	RBSSL	7.0 C	86	890	86
Aldrin	309-00-2	0.029 C	0.029 C	0.000034	0.00068	0.25	4.9	0.25	0.00068	RBSSL	0.10 C	0.8	16	0.8
alpha-BHC	319-84-6	0.077 C	0.077 C	0.000036	0.00072	0.99	0.0072	0.0072	0.00072	RBSSL	0.27 C	4	0.024	0.024
alpha-Chlordane	5103-71-9	1.6 C[11]	1.6 C[11]	0.0018 [11]	0.036 [11]	17	9.6	9.6	0.036	RBSSL	6.5 C[11]	68	39	39
beta-BHC	319-85-7	0.27 C	0.27 C	0.00013	0.0026	3.3	0.026	0.026	0.0026	RBSSL	0.96 C	12	0.086	0.086
delta-BHC	319-86-8	0.077 C[12]	0.077 C[12]	0.000036 [12]	0.00072 [12]	0.99	0.0072	0.0072	0.00072	RBSSL	0.27 C[12]	4	0.024	0.024
Dieldrin	60-57-1	0.030 C	0.030 C	0.000061	0.0012	0.27	0.046	0.046	0.0012	RBSSL	0.11 C	0.86	0.15	0.15
Endosulfan I	959-98-8	370 N[13]	37 N[13]	1.1 [13]	22 [13]	1100	20	20	20	IDEM-RDCL	3700 N[13]	2900	46	46
Endosulfan II	33213-65-9	370 N[13]	37 N[13]	1.1 [13]	22 [13]	1100	20	20	20	IDEM-RDCL	3700 N[13]	2900	46	46
Endosulfan sulfate	1031-07-8	370 N[13]	37 N[13]	1.1 [13]	22 [13]	1100	20	20	20	IDEM-RDCL	3700 N[13]	2900	46	46
Endrin	72-20-8	18 N	1.8 N	0.068	1.4	55	0.99	0.99	0.99	IDEM-RDCL	180 N	150	15	15
Endrin aldehyde	7421-93-4	18 N[14]	1.8 N[14]	0.068 [14]	1.4 [14]	55	0.99	0.99	0.99	IDEM-RDCL	180 N[14]	150	15	15
Endrin ketone	53494-70-5	18 N[14]	1.8 N[14]	0.068 [14]	1.4 [14]	55	0.99	0.99	0.99	IDEM-RDCL	180 N[14]	150	15	15
gamma-BHC (Lindane)	58-89-9	0.52 C	0.52 C	0.00021	0.0042	4.8	0.0094	0.0094	0.0042	RBSSL	2.1 C	19	0.1	0.1
gamma-chlordane	5103-74-2	1.6 C[11]	1.6 C[11]	0.013 [11]	0.26 [11]	17	9.6	9.6	0.26	RBSSL	6.5 C[11]	68	39	39
Heptachlor	76-44-8	0.11 C	0.11 C	0.00014	0.0028	0.93	23	0.93	0.0028	RBSSL	0.38 C	2.9	36	2.9
Heptachlor epoxide	1024-57-3	0.053 C	0.053 C	0.000068	0.0014	0.47	0.67	0.47	0.0014	RBSSL	0.19 C	1.5	1	1
Methoxychlor	72-43-5	310 N	31 N	1.5	30	910	160	160	30	RBSSL	3100 N	2500	180	180
Toxaphene	8001-35-2	0.44 C	0.44 C	0.0021	0.042	3.9	31	3.9	0.042	RBSSL	1.6 C	12	31	12
Herbicides (Appendix IX)														
2,4,5-T	93-76-5	610 N	61 N	0.052	1.0	NA	NA	NA	1.0	RBSSL	6200 N	NA	NA	NA
2,4,5-TP (Silvex)	93-72-1	490 N	49 N	0.046	0.92	NA	NA	NA	0.92	RBSSL	4900 N	NA	NA	NA
2,4-D	94-75-7	690 N	69 N	0.035	0.70	NA	NA	NA	0.70	RBSSL	7700 N	NA	NA	NA
Dinoseb	88-85-7	61 N	6.1 N	0.098	2.0	NA	NA	NA	2.0	RBSSL	620 N	NA	NA	NA
Pentachlorophenol	87-86-5	0.89 C	0.89 C	0.0017	0.034	20	0.028	0.028	0.028	IDEM-RDCL	2.7 C	54	0.66	0.66
Organophosphorus Pesticides (Appendix IX)														
Azinphos methyl	86-50-0	180 N	18 N	0.013	0.26	NA	NA	NA	0.26	RBSSL	1800 N	NA	NA	NA
Bolstar	35400-43-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Chlorpyrifos	2921-88-2	61 N	6.1 N	0.092	1.8	NA	NA	NA	1.8	RBSSL	620 N	NA	NA	NA
Cuomaphos	56-72-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Demeton	8065-48-3	2.4 N	0.24 N	NA	NA	NA	NA	NA	0.24	R-RSL	25 N	NA	NA	NA
Demeton-O	298-03-3	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Demeton-S	126-75-0	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Diazinon	333-41-5	43 N	4.3 N	0.049	0.98	NA	NA	NA	0.98	RBSSL	430 N	NA	NA	NA
Dichlorovos	62-73-7	1.7 C	1.7 C	0.000070	0.0014	NA	NA	NA	0.0014	RBSSL	5.9 C	NA	NA	NA
Dimethoate	60-51-5	12 N	1.2 N	0.00070	0.014	NA	NA	NA	0.014	RBSSL	120 N	NA	NA	NA
Disulfoton	298-04-4	2.4 N	0.24 N	0.00071	0.014	NA	NA	NA	0.014	RBSSL	25 N	NA	NA	NA
EPN (Ethyl-p-nitrophenyl phosphate)	2104-64-5	0.61 N	0.061 N	0.0021	0.042	NA	NA	NA	0.042	RBSSL	6.2 N	NA	NA	NA
Ethoprop	13194-48-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Ethyl parathion (Parathion)	56-38-2	370 N	37 N	0.33	6.6	NA	NA	NA	6.6	RBSSL	3700 N	NA	NA	NA
Famphur	52-85-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Fensulfothion	115-90-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Fenthion	55-38-9	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Malathion	121-75-5	1200 N	120 N	0.079	1.6	NA	NA	NA	1.6	RBSSL	12000 N	NA	NA	NA
Methyl parathion	298-00-0	15 N	1.5 N	0.0057	0.11	NA	NA	NA	0.11	RBSSL	150 N	NA	NA	NA
Mevinphos	7786-34-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil (1) (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil (2) (mg/kg)	EPA Regional Screening Level, Migration to Groundwater (1) (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater (2) (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) (3): Residential Direct Contact	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) (3): Migration to Groundwater	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) (3): Residential Default Closure Level	Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil (1) (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) (3): Industrial Direct Contact	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) (3): Migration to Groundwater	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) (3): Industrial Default Closure Level
O,O,O-Triethylphosphorothioate	126-68-1	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Phorate	298-02-2	12 N	1.2 N	0.00026	0.0052	NA	NA	NA	0.0052	RBSSL	120 N	NA	NA	NA
Ronnel	299-84-3	3100 N	310 N	2.7	54	NA	NA	NA	54	RBSSL	31000 N	NA	NA	NA
Sulfotepp	3689-24-5	31 N	3.1 N	0.0039	0.078	NA	NA	NA	0.078	RBSSL	310 N	NA	NA	NA
Tetrachlorovinphos	22248-79-9	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Thionazin	297-97-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Tokuthion	34643-46-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Trichloronate	327-98-0	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Explosives and Propellants														
1,3,5-Trinitrobenzene	99-35-4	2200 N	220 N	1.7	34	NA	NA	NA	34	RBSSL	27000 N	NA	NA	NA
1,3-Dinitrobenzene	99-65-0	6.1 N	0.61 N	0.0033	0.066	NA	NA	NA	0.066	RBSSL	62 N	NA	NA	NA
2,4,6-Trinitrotoluene (TNT)	118-96-7	36 N(4)	3.6 N(4)	0.013	0.26	NA	NA	NA	0.26	RBSSL	79 C	NA	NA	NA
2,4-Dinitrotoluene	121-14-2	1.6 C	1.6 C	0.00028	0.0056	NA	NA	NA	0.0056	RBSSL	6 C	NA	NA	NA
2,6-Dinitrotoluene	606-20-2	61 N	6.1 N	0.020	0.40	NA	NA	NA	0.40	RBSSL	620 N	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	35572-78-2	150 N	15 N	0.023	0.46	NA	NA	NA	0.46	RBSSL	2000 N	NA	NA	NA
2-Nitrotoluene	88-72-2	2.9 C	2.9 C	0.00025	0.0050	NA	NA	NA	0.0050	RBSSL	13 C	NA	NA	NA
3-Nitrotoluene	99-08-1	6.1 N	0.61 N	0.0012	0.024	NA	NA	NA	0.024	RBSSL	62 N	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	19406-51-0	150 N	15 N	0.023	0.46	NA	NA	NA	0.46	RBSSL	1900 N	NA	NA	NA
4-Nitrotoluene	99-99-0	240 N(4)	24 N(4)	0.0034	0.068	NA	NA	NA	0.068	RBSSL	110 C	NA	NA	NA
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra)	2691-41-0	380 N	38 N	0.99	20	NA	NA	NA	20	RBSSL	49000 N	NA	NA	NA
Nitrobenzene	98-95-3	4.8 C	4.8 C	0.000079	0.0016	91	0.028	0.028	0.0016	RBSSL	24 C	NA	NA	NA
Nitroglycerin	55-63-0	6.1 N	0.61 N	0.00066	0.013	NA	NA	NA	0.013	RBSSL	62 N	NA	NA	NA
Nitroguanadine	556-88-7	6100 N	610 N	0.38	7.6	NA	NA	NA	7.6	RBSSL	62000 N	NA	NA	NA
Perchlorate	14797-73-0	55 N	5.5 N	NA	NA	NA	NA	NA	5.5	R-RSL	720 N	NA	NA	NA
PETN (Pentaerythritol tetranitrate)	78-11-5	120 N(4)	12 N(4)	0.024	0.48	NA	NA	NA	0.48	RBSSL	430 C	NA	NA	NA
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	5.6 C	5.6 C	0.00023	0.0046	NA	NA	NA	0.0046	RBSSL	24 C	NA	NA	NA
Tetryl (Trinitrophenylmethylnitramine)	479-45-8	240 N	24 N	0.59	12	NA	NA	NA	12	RBSSL	2500 N	NA	NA	NA
TPH (GRO, DRO, ERO)														
GRO (C5-C12) Gasoline Range	NA	NA	NA	NA	NA	3100	120	120	120	IDEM-RDCL	NA	4300	1500	1500
DRO (C8-C28) Diesel Range	NA	NA	NA	NA	NA	3100	230	230	230	IDEM-RDCL	NA	5800	2300	2300
ERO (C8-C34) High End Hydrocarbons	NA	NA	NA	NA	NA	3100	230	230	230	IDEM-RDCL	NA	5800	2300	2300
TPH Fractionation														
Aliphatic EC > 5-6	NA	NA	NA	NA	NA	NA	NA	1.7	1.7	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 6-8	NA	NA	NA	NA	NA	NA	NA	1.7	1.7	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 8-10	NA	NA	NA	NA	NA	NA	NA	0.03	0.03	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 10-12	NA	NA	NA	NA	NA	NA	NA	0.03	0.03	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 12-16	NA	NA	NA	NA	NA	NA	NA	0.03	0.03	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 16-21	NA	NA	NA	NA	NA	NA	NA	2.0	2.0	IDEM-RDCL	NA	NA	NA	NA
Aliphatic EC > 21-34	NA	NA	NA	NA	NA	NA	NA	2.0	2.0	IDEM-RDCL	NA	NA	NA	NA
Aromatic EC > 8-10	NA	NA	NA	NA	NA	NA	NA	0.1	0.1	IDEM-RDCL	NA	NA	NA	NA
Aromatic EC > 10-12	NA	NA	NA	NA	NA	NA	NA	0.05	0.05	IDEM-RDCL	NA	NA	NA	NA
Aromatic EC > 12-16	NA	NA	NA	NA	NA	NA	NA	0.05	0.05	IDEM-RDCL	NA	NA	NA	NA
Aromatic EC > 16-21	NA	NA	NA	NA	NA	NA	NA	0.03	0.03	IDEM-RDCL	NA	NA	NA	NA
Aromatic EC > 21-34	NA	NA	NA	NA	NA	NA	NA	0.03	0.03	IDEM-RDCL	NA	NA	NA	NA
Metals (Target Analyte List [TAL] and/or IX)														
Aluminum	7429-90-5	77000 N	7700 N	23000	460000	NA	NA	NA	7700	R-RSL	990000 N	NA	NA	NA
Antimony	7440-36-0	31 N	3.1 N	0.27	5.4	140	5.4	5.4	3.1	R-RSL	410 N	620	37	37
Arsenic	7440-38-2	0.39 C	0.39 C	0.0013	0.026	3.9	5.8	3.9	0.026	RBSSL	1.6 C	20	5.8	5.8
Barium	7440-39-3	15000 N	1500 N	82	1640	63000	1600	1600	1500	R-RSL	190000 N	230000	17000	10000
Beryllium	7440-41-7	160 N	16 N	3.2	64	680	63	63	16	R-RSL	2000 N	2900	3200	2300
Cadmium	7440-43-9	70 N	7.0 N	0.38	7.6	12	7.5	7.5	7.0	R-RSL	800 N	990	77	77
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Chromium	7440-47-3	0.29 C(15)	0.29 C(15)	0.00059 (15)	0.012 (15)	430(15)	38(15)	38(15)	0.012	RBSSL	5.6 C(15)	650	120	120
Cobalt	7440-48-4	23 N	2.3 N	0.21	4.2	NA	NA	NA	2.3	R-RSL	300 N	NA	NA	NA
Copper	7440-50-8	3100 N	310 N	22	440	14000	920	920	310	R-RSL	41000 N	62000	2900	2900
Iron	7439-89-6	55000 N	5500 N	270	5400	NA	NA	NA	5400	RBSSL	720000 N	NA	NA	NA
Lead	7439-92-1	400 L(16)	400 L(16)	14 (19)	280 (19)	400	81	81	81	IDEM-RDCL	800 L(21)	1300	230	230
Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Manganese	7439-96-5	1800 N	180 N	21	420	NA	NA	NA	180	R-RSL	23000 N	NA	NA	NA
Mercury	7439-97-6	7.8 N(17)	0.78 N(17)	0.033	0.66	NA	NA	NA	0.66	RBSSL	43 N	NA	NA	NA
Nickel	7440-02-0	1500 N	150 N	20	400	6900	950	950	150	R-RSL	20000 N	31000	2700	2700
Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Selenium	7782-49-2	390 N	39 N	0.26	5.2	1700	5.2	5.2	5.2	IDEM-RDCL	5100 N	7800	53	53

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil [1] (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil [2] (mg/kg)	EPA Regional Screening Level, Migration to Groundwater [1] (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater [2] (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) [3]: Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level	Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil [1] (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) [3]: Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level
Silver	7440-22-4	390 N	39 N	0.60	12	1700	31	31	12	RBSSL	5100 N	7800	87	87
Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Thallium	7440-28-0	0.78 N	0.078 N	0.011	0.22	24	2.8	2.8	0.078	R-RSL	10 N	110	10	10
Tin (IX only)	7440-31-5	47000 N	4700 N	2300	46000	NA	NA	NA	4700	R-RSL	610000 N	NA	NA	NA
Vanadium	7440-62-2	390 N[18]	39 N[18]	78 [18]	1560 [18]	NA	NA	NA	39	R-RSL	5200 N[18]	NA	NA	NA
Zinc	7440-66-6	23000 N	2300 N	290	5800	100000	14000	10000	2300	R-RSL	310000 N	470000	38000	10000
Hexavalent Chromium														
Hexavalent Chromium	18540-29-9	0.29 C[15]	0.29 C[15]	0.00059 [15]	0.012 [15]	430[15]	38[15]	38[15]	0.012	RBSSL	5.6 C[15]	650	120	120
Cyanide														
Cyanide	57-12-5	47 N	4.7 N	0.094	1.9	6900	0.94	0.94	0.94	IDEM-RDCL	610 N	31000	9.6	9.6
Dioxins/Furans														
1,2,3,4,6,7,8,9-OCDD	3268-87-9	0.015 C[20]	0.015 C[20]	0.00087 [20]	0.017 [20]	NA	NA	NA	0.015	R-RSL	0.06 C[20]	NA	NA	NA
1,2,3,4,6,7,8,9-OCDF	39001-02-0	0.015 C[20]	0.015 C[20]	0.00087 [20]	0.017 [20]	NA	NA	NA	0.015	R-RSL	0.06 C[20]	NA	NA	NA
1,2,3,4,6,7,8-HPCDD	35822-46-9	0.00045 C[20]	0.00045 C[20]	0.000026 [20]	0.00052 [20]	NA	NA	NA	0.00045	R-RSL	0.0018 C[20]	NA	NA	NA
1,2,3,4,6,7,8-HPCDF	67562-39-4	0.00045 C[20]	0.00045 C[20]	0.000026 [20]	0.00052 [20]	NA	NA	NA	0.00045	R-RSL	0.0018 C[20]	NA	NA	NA
1,2,3,4,7,8,9-HPCDF	55673-89-7	0.00045 C[20]	0.00045 C[20]	0.000026 [20]	0.00052 [20]	NA	NA	NA	0.00045	R-RSL	0.0018 C[20]	NA	NA	NA
1,2,3,4,7,8-HXCDD	39227-28-6	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,4,7,8-HXCDF	70648-26-9	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,6,7,8-HXCDD	57653-85-7	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,6,7,8-HXCDF	57117-44-9	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,7,8,9-HXCDD	19408-74-3	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,7,8,9-HXCDF	72918-21-9	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
1,2,3,7,8-PECDD	40321-76-4	0.0000045 C[20]	0.0000045 C[20]	0.00000026 [20]	0.0000052 [20]	NA	NA	NA	0.0000045	R-RSL	0.000018 C[20]	NA	NA	NA
1,2,3,7,8-PECDF	57117-41-6	0.00015 C[20]	0.00015 C[20]	0.0000087 [20]	0.00017 [20]	NA	NA	NA	0.00015	R-RSL	0.00060 C[20]	NA	NA	NA
2,3,4,6,7,8-HXCDF	60851-34-5	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
2,3,4,7,8-PECDF	57117-31-4	0.000015 C[20]	0.000015 C[20]	0.00000087 [20]	0.000017 [20]	NA	NA	NA	0.000015	R-RSL	0.000060 C[20]	NA	NA	NA
2,3,7,8-TCDD	1746-01-6	0.0000045 C	0.0000045 C	0.00000026	0.0000052	NA	NA	NA	0.0000045	R-RSL	0.000018 C	NA	NA	NA
2,3,7,8-TCDF	51207-31-9	0.000045 C[20]	0.000045 C[20]	0.0000026 [20]	0.000052 [20]	NA	NA	NA	0.000045	R-RSL	0.00018 C[20]	NA	NA	NA
Total HpCDD	37871-00-4	0.000094 C	0.000094 C	0.0000090	0.00018	NA	NA	NA	0.000094	R-RSL	0.00039 C	NA	NA	NA
Total HpCDF	38998-75-3	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total HxCDD	34465-46-8	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total HxCDF	55684-94-1	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total PeCDD	36088-22-9	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total PeCDF	30402-15-4	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total TCDD	41903-57-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA
Total TCDF	55722-27-5	NA	NA	NA	NA	NA	NA	NA	NA	None	NA	NA	NA	NA

Notes:

1 - The residential direct contact regional screening level (R-RSL) and risk-based migration to groundwater soil screening level (RBSSL) values are from the USEPA Regional Screening Levels for Chemical Contaminants at Superfund Sites (USEPA, May 2012) available online at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.html. The risk-based screening levels are based on a target hazard quotient of 1 for noncarcinogens (denoted with a "N" flag) or an incremental lifetime cancer risk (ILCR) of 1E-6 for carcinogens (denoted with a "C" flag). The RBSSL is the lower of the risk-based and MCL-based values, if available. (Industrial criteria are also presented for information purposes.)

2 - The R-RSL value for noncarcinogens is adjusted by dividing by 10, equivalent to a target hazard quotient of 0.1. The R-RSL value for carcinogens (not adjusted) is equivalent to an incremental lifetime cancer risk (ILCR) of 1E-6. The RBSSL is adjusted for a dilution attenuation factor (DAF) of 20.

3 - Indiana Department of Environmental Management (IDEM) residential soil direct contact screening levels, migration to groundwater screening levels, and Residential Default Closure Levels are from the IDEM RISC Technical Guide, January 31, 2006, Appendix 1, revised May 1, 2009 (IDEM, May 2009). (Industrial criteria are also presented for information purposes.)

4 - One tenth the noncarcinogenic value is less than the carinogenic value; therefore, the noncarcinogenic value is presented.

5 - Value is for 1,3-dichloropropene.

6 - Value is for xylenes.

7 - Value is for 2,4-dinitrophenol.

8 - Value is for diethyl phthalate.

9 - Value is for acenapththene.

10 - Value is for pyrene.

11 - Value is for chlordane.

12 - Value is for alpha-BHC.

13 - Value is for endosulfan.

14 - Value is for endrin.

15 - Value is for hexavalent chromium.

16 - Office of Solid Waste and Emergency Response soil screening level (EPA, 1994b). Incorporated into May 2012 RSL Tables under code "L".

17 - Value is for methyl mercury.

18 - Value is for vanadium and compounds.

19 - Calculated from the EPA website (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

New values from June 2011 criteria tables.
New values from November 2011 criteria tables.
Potentially redundant analyte.
New values from May 2012 criteria tables.

NSA Crane SWMU 34 Human Health Screening Criteria - Surface and Subsurface Soil Samples

Analyte	CAS Number	EPA Regional Screening Level, Residential Soil [1] (mg/kg)	Adjusted EPA Regional Screening Level, Residential Soil [2] (mg/kg)	EPA Regional Screening Level, Migration to Groundwater [1] (mg/kg)	Adjusted EPA Regional Screening Level, Migration to Groundwater [2] (mg/kg)	2009 IDEM RISC Residential Closure Levels for Soil (mg/kg) [3]			Lowest Human Health Criterion	Lowest Human Health Criterion Reference	EPA Regional Screening Level, Industrial Soil [1] (mg/kg)	2009 IDEM RISC Industrial Closure Levels for Soil (mg/kg) [3]		
						Residential Direct Contact	Migration to Groundwater	Residential Default Closure Level				Industrial Direct Contact	Migration to Groundwater	Industrial Default Closure Level

20 - Value is derived by multiplying criteria for 2,3,7,8-TCDD by World Health Organization Toxicity Equivalent Factor.

21 - USEPA Technical Review Workgroup for Lead. Guidance Document. “Frequently Asked Question (FAQs) on the Adult Lead Model.” October 2010. http://www.epa.gov/superfund/lead/almfaq.htm. Incorporated into May 2012 RSL Tables under code "L".

Abbreviations:

EPA - United States Environmental Protection Agency
mg/kg - milligrams per kilogram
IDEM - Indiana Department of Environmental Management
RISC - Risk Integrated System of Closure

N - Noncarcinogen
C - Carcinogen
NA - Not applicable or not available

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [(1)] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Volatile Organic Compounds (Target Compound List [TCL] and/or Appendix IX List [IX])						
1,1,1,2-Tetrachloroethane (IX only)	630-20-6	225	R5 ECOS	NA	225	
1,1,1-Trichloroethane	71-55-6	29.8	R5 ECOS	NA	29.8	29.8
1,1,2,2-Tetrachloroethane	79-34-5	0.127	R5 ECOS	NA	0.127	0.127
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) (TCL only)	76-13-1	--	--	NA	NA	NA
1,1,2-Trichloroethane	79-00-5	28.6	R5 ECOS	NA	28.6	28.6
1,1-Dichloroethane	75-34-3	20.1	R5 ECOS	NA	20.1	20.1
1,1-Dichloroethene	75-35-4	8.28	R5 ECOS	NA	8.28	8.28
1,2,3-Trichlorobenzene (TCL only)	87-61-6	11.1	R5 ECOS	NA	11.1	11.1
1,2,3-Trichloropropane (IX only)	96-18-4	3.36	R5 ECOS	NA	3.36	
1,2,4-Trichlorobenzene	120-82-1	11.1	R5 ECOS	NA	11.1	11.1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	0.0352	R5 ECOS	NA	0.0352	0.0352
1,2-Dibromoethane (EDB)	106-93-4	1.23	R5 ECOS	NA	1.23	1.23
1,2-Dichlorobenzene	95-50-1	2.96	R5 ECOS	NA	2.96	2.96
1,2-Dichloroethane	107-06-2	21.2	R5 ECOS	NA	21.2	21.2
1,2-Dichloropropane	78-87-5	32.7	R5 ECOS	NA	32.7	32.7
1,3-Dichlorobenzene	541-73-1	37.7	R5 ECOS	NA	37.7	37.7
1,4-Dichlorobenzene	106-46-7	0.546	R5 ECOS	NA	0.546	0.546
1,4-Dioxane	123-91-1	2.05	R5 ECOS	NA	2.05	2.05
2-Butanone (MEK)	78-93-3	89.6	R5 ECOS	NA	89.6	89.6
2-Hexanone	591-78-6	12.6	R5 ECOS	NA	12.6	12.6
3-Chloropropene (Allyl chloride) (IX only)	107-05-1	0.0134	R5 ECOS	NA	0.0134	
4-Methyl-2-pentanone (MIBK)	108-10-1	443	R5 ECOS	NA	443	443
Acetone	67-64-1	2.5	R5 ECOS	NA	2.5	2.5
Acetonitrile (IX only)	75-05-8	1.37	R5 ECOS	NA	1.37	
Acrolein (IX only)	107-02-8	5.27	R5 ECOS	NA	5.27	
Acrylonitrile (IX only)	107-13-1	0.0239	R5 ECOS	NA	0.0239	
Benzene	71-43-2	0.255	R5 ECOS	NA	0.255	0.255
Bromochloromethane (TCL only)	74-97-5	--	--	NA	NA	NA
Bromodichloromethane	75-27-4	0.54	R5 ECOS	NA	0.54	0.54
Bromoform	75-25-2	15.9	R5 ECOS	NA	15.9	15.9
Bromomethane	74-83-9	0.235	R5 ECOS	NA	0.235	0.235
Carbon disulfide	75-15-0	0.0941	R5 ECOS	NA	0.0941	0.0941
Carbon tetrachloride	56-23-5	2.98	R5 ECOS	NA	2.98	2.98
Chlorobenzene	108-90-7	13.1	R5 ECOS	NA	13.1	13.1
Chlorodibromomethane (Dibromochloromethane)	124-48-1	2.05	R5 ECOS	NA	2.05	NA
Chloroethane (Ethyl chloride)	75-00-3	--	--	NA	NA	NA
Chloroform	67-66-3	1.19	R5 ECOS	NA	1.19	1.19
Chloromethane	74-87-3	10.4	R5 ECOS	NA	10.4	10.4

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Chloroprene (2-Chloro-1,3-butadiene) (IX only)	126-99-8	0.0029	R5 ECOS	NA	0.0029	
cis-1,2-Dichloroethene (TCL only)	156-59-2	0.78373	R5 ECOS	NA	0.784	0.784
cis-1,3-Dichloropropene	10061-01-5	0.398	R5 ECOS	NA	0.398	0.398
Cyclohexane (TCL only)	110-82-7	--	--	NA	NA	NA
Dibromomethane (methylene bromide) (IX only)	74-95-3	65	R5 ECOS	NA	65	
Dichlorodifluoromethane	75-71-8	39.5	R5 ECOS	NA	39.5	39.5
Ethyl methacrylate (IX only)	97-63-2	30	R5 ECOS	NA	30	
Ethylbenzene	100-41-4	5.16	R5 ECOS	NA	5.16	5.16
Isobutanol (Isobutyl alcohol) (IX only)	78-83-1	20.8	R5 ECOS	NA	20.8	
Isopropylbenzene (Cumene) (TCL only)	98-82-8	--	--	NA	NA	NA
Methacrylonitrile (IX only)	126-98-7	0.057	R5 ECOS	NA	0.057	
Methyl acetate (TCL only)	79-20-9	--	--	NA	NA	NA
Methyl cyclohexane (TCL only)	108-87-2	--	--	NA	NA	NA
Methyl iodide (iodomethane) (IX only)	74-88-4	1.23	R5 ECOS	NA	1.23	
Methyl methacrylate (IX only)	80-62-6	984	R5 ECOS	NA	984	
Methyl tert-butyl ether (MTBE) (TCL only)	1634-04-4	--	--	NA	NA	NA
Methylene chloride	75-09-2	4.05	R5 ECOS	NA	4.05	4.05
m-Xylene	108-38-3	10	R5 ECOS	NA	10	
o-Xylene	95-47-6	10	R5 ECOS	NA	10	10
p-Xylene	106-42-3	10	R5 ECOS	NA	10	
Pentachloroethane (IX only)	76-01-7	10.7	R5 ECOS	NA	10.7	
Propionitrile (IX only)	107-12-0	0.0498	R5 ECOS	NA	0.0498	
Styrene	100-42-5	4.69	R5 ECOS	NA	4.69	4.69
Tetrachloroethene	127-18-4	9.92	R5 ECOS	NA	9.92	9.92
Toluene	108-88-3	5.45	R5 ECOS	NA	5.45	5.45
trans-1,2-Dichloroethene	156-60-5	0.784	R5 ECOS	NA	0.784	0.784
trans-1,3-Dichloropropene	10061-02-6	0.398	R5 ECOS	NA	0.398	0.398
trans-1,4-Dichloro-2-butene (IX only)	110-57-6	--	--	NA	NA	
Trichloroethene	79-01-6	12.4	R5 ECOS	NA	12.4	12.4
Trichlorofluoromethane	75-69-4	16.4	R5 ECOS	NA	16.4	16.4
Vinyl acetate (IX only)	108-05-4	12.7	R5 ECOS	NA	12.7	
Vinyl chloride	75-01-4	0.646	R5 ECOS	NA	0.646	0.646
Xylenes (total) (Total Xylenes)	1330-20-7	10	R5 ECOS	NA	10	10
Semivolatile Organic Compounds (TCL and/or IX) (not including Polycyclic Aromatic Hydrocarbons)						
1,1'-Biphenyl (TCL only)	92-52-4	60	R5 ECOS	NA	60	60
1,2,4,5-Tetrachlorobenzene (IX only)	95-94-3	2.02	R5 ECOS	NA	2.02	2.02
1,3,5-Trinitrobenzene (IX only)	99-35-4	0.376	R5 ECOS	NA	0.376	
1,3-Dinitrobenzene	99-65-0	0.655	R5 ECOS	NA	0.655	
1,4-Naphthoquinone (IX only)	130-15-4	1.67	R5 ECOS	NA	1.67	

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
1,4-Phenylenediamine (IX only)	106-50-3	6.16	R5 ECOS	NA	6.16	
1-Naphthylamine (IX only)	134-32-7	--	--	NA	NA	
2,2-Oxybis(1-chloropropane) (Bis(2-chloro-1-methylethyl)ether)	108-60-1	19.9	R5 ECOS	NA	19.9	19.9
2,3,4,6-Tetrachlorophenol (IX only)	58-90-2	0.199	R5 ECOS	NA	0.199	0.199
2,4,5-Trichlorophenol	95-95-4	14.1	R5 ECOS	NA	14.1	14.1
2,4,6-Trichlorophenol	88-06-2	9.94	R5 ECOS	NA	9.94	9.94
2,4-Dichlorophenol	120-83-2	87.5	R5 ECOS	NA	87.5	87.5
2,4-Dimethylphenol	105-67-9	0.01	R5 ECOS	NA	0.01	0.01
2,4-Dinitrophenol	51-28-5	0.0609	R5 ECOS	NA	0.0609	0.0609
2,4-Dinitrotoluene	121-14-2	1.28	R5 ECOS	NA	1.28	1.28
2,6-Dichlorophenol (IX only)	87-65-0	1.17	R5 ECOS	NA	1.17	
2,6-Dinitrotoluene	606-20-2	0.0328	R5 ECOS	NA	0.0328	0.0328
2-Acetylaminofluorene (IX only)	53-96-3	0.596	R5 ECOS	NA	0.596	
2-Chloronaphthalene	91-58-7	0.0122	R5 ECOS	NA	0.0122	0.0122
2-Chlorophenol	95-57-8	0.243	R5 ECOS	NA	0.243	0.243
2-Methylphenol (o-Cresol)	95-48-7	40.4	R5 ECOS	NA	40.4	40.4
2-Naphthylamine (IX only)	91-59-8	3.03	R5 ECOS	NA	3.03	
2-Nitroaniline	88-74-4	74.1	R5 ECOS	NA	74.1	74.1
2-Nitrophenol	88-75-5	1.6	R5 ECOS	NA	1.6	1.6
2-Picoline (IX only)	109-06-8	9.9	R5 ECOS	NA	9.9	
3-Methylphenol (m-Cresol)	108-39-4	3.49	R5 ECOS	NA	3.49	
3,3'-Dichlorobenzidine	91-94-1	0.646	R5 ECOS	NA	0.646	0.646
3,3'-Dimethylbenzidine (IX only)	119-93-7	0.104	R5 ECOS	NA	0.104	
3-Methylcholanthrene (IX only)	56-49-5	0.00779	R5 ECOS	NA	0.00779	
3-Nitroaniline	99-09-2	3.16	R5 ECOS	NA	3.16	3.16
4,6-Dinitro-2-methylphenol (2-Methyl-4,6-dinitrophenol)	534-52-1	0.144	R5 ECOS	NA	0.144	0.144
4-Aminobiphenyl (IX only)	92-67-1	0.00305	R5 ECOS	NA	0.00305	
4-Bromophenyl phenyl ether	101-55-3	--	--	NA	NA	NA
4-Chloro-3-methylphenol	59-50-7	7.95	R5 ECOS	NA	7.95	7.95
4-Chloroaniline	106-47-8	1.1	R5 ECOS	NA	1.1	1.1
4-Chlorophenyl phenyl ether	7005-72-3	--	--	NA	NA	NA
4-Methylphenol (p-Cresol)	106-44-5	163	R5 ECOS	NA	163	163
4-Nitroaniline	100-01-6	21.9	R5 ECOS	NA	21.9	21.9
4-Nitrophenol	100-02-7	5.12	R5 ECOS	NA	5.12	5.12
4-Nitroquinoline-1-oxide (IX only)	56-57-5	0.122	R5 ECOS	NA	0.122	
5-Nitro-o-toluidine (IX only)	99-55-8	8.73	R5 ECOS	NA	8.73	
7,12-Dimethylbenz(a)anthracene (IX only)	57-97-6	16.3	R5 ECOS	NA	16.3	
a,a-Dimethylphenethylamine (IX only)	122-09-8	0.3	R5 ECOS	NA	0.3	
Acetophenone	98-86-2	300	R5 ECOS	NA	300	300

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Aniline (IX only)	62-53-3	0.0568	R5 ECOS	NA	0.0568	
Aramite (IX only)	140-57-8	166	R5 ECOS	NA	166	
Atrazine (TCL only)	1912-24-9	--	--	NA	NA	NA
Benzaldehyde (TCL only)	100-52-7	--	--	NA	NA	NA
Benzyl alcohol (IX only)	100-51-6	65.8	R5 ECOS	NA	65.8	
Bis(2-chloroethoxy)methane	111-91-1	0.302	R5 ECOS	NA	0.302	0.302
Bis(2-chloroethyl)ether	111-44-4	23.7	R5 ECOS	NA	23.7	23.7
Bis(2-ethylhexyl)phthalate	117-81-7	0.925	R5 ECOS	NA	0.925	0.925
Butyl benzyl phthalate	85-68-7	0.239	R5 ECOS	NA	0.239	0.239
Caprolactam (TCL only)	105-60-2	--	--	NA	NA	NA
Carbazole (TCL only)	86-74-8	--	--	NA	NA	NA
Chlorobenzilate (IX only)	510-15-6	5.05	R5 ECOS	NA	5.05	
Diallate (IX only)	2303-16-4	0.452	R5 ECOS	NA	0.452	
Dibenzofuran	132-64-9	--	--	NA	NA	NA
Diethyl phthalate	84-66-2	24.8	R5 ECOS	NA	24.8	24.8
Dimethoate (IX only)	60-51-5	0.218	R5 ECOS	NA	0.218	
Dimethyl phthalate	131-11-3	734	R5 ECOS	NA	734	734
Di-n-butyl phthalate	84-74-2	0.15	R5 ECOS	NA	0.15	0.15
Di-n-octyl phthalate	117-84-0	709	R5 ECOS	NA	709	709
Diphenylamine (IX only)	122-39-4	1.01	R5 ECOS	NA	1.01	
Disulfoton (IX only)	298-04-4	0.0199	R5 ECOS	NA	0.0199	
Ethyl methane sulfonate (IX only)	62-50-0	--	--	NA	NA	
Ethyl parathion (Parathion) (IX only)	56-38-2	0.00034	R5 ECOS	NA	0.00034	
Famphur (IX only)	52-85-7	0.0497	R5 ECOS	NA	0.0497	
Hexachlorobenzene	118-74-1	0.199	R5 ECOS	NA	0.199	0.199
Hexachlorobutadiene	87-68-3	0.0398	R5 ECOS	NA	0.0398	0.0398
Hexachlorocyclopentadiene	77-47-4	0.755	R5 ECOS	NA	0.755	0.755
Hexachloroethane	67-72-1	0.596	R5 ECOS	NA	0.596	0.596
Hexachlorophene (IX only)	70-30-4	0.199	R5 ECOS	NA	0.199	
Hexachloropropene (IX only)	1888-71-7	--	--	NA	NA	
Isodrin (IX only)	465-73-6	0.00332	R5 ECOS	NA	0.00332	
Isophorone	78-59-1	139	R5 ECOS	NA	139	139
Isosafrole (IX only)	120-58-1	9.94	R5 ECOS	NA	9.94	
Kepone (Chlordecone) (IX only)	143-50-0	0.03272	R5 ECOS	NA	0.03272	
Methapyrilene (IX only)	91-80-5	2.78	R5 ECOS	NA	2.78	
Methyl methane sulfonate (IX only)	66-27-3	--	--	NA	NA	
Methyl Parathion (IX only)	298-00-0	0.000292	R5 ECOS	NA	0.000292	
Nitrobenzene	98-95-3	1.31	R5 ECOS	NA	1.31	1.31
N-Nitrosodiethylamine (IX only)	55-18-5	0.0693	R5 ECOS	NA	0.0693	

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
N-Nitrosodimethylamine (IX only)	62-75-9	0.0000321	R5 ECOS	NA	0.0000321	
N-Nitroso-di-n-butylamine (IX only)	924-16-3	0.267	R5 ECOS	NA	0.267	
N-Nitroso-di-n-propylamine	621-64-7	0.544	R5 ECOS	NA	0.544	0.544
N-Nitrosodiphenylamine	86-30-6	0.545	R5 ECOS	NA	0.545	0.545
N-Nitrosomethylethylamine (IX only)	10595-95-6	0.00166	R5 ECOS	NA	0.00166	
N-Nitrosomorpholine (IX only)	59-89-2	0.0706	R5 ECOS	NA	0.0706	
N-Nitrosopiperidine (IX only)	100-75-4	0.00665	R5 ECOS	NA	0.00665	
N-Nitrosopyrrolidine (IX only)	930-55-2	0.0126	R5 ECOS	NA	0.0126	
o,o,o-Triethylphosphorothioate (IX only)	126-68-1	0.818	R5 ECOS	NA	0.818	
o-Toluidine (IX only)	95-53-4	2.97	R5 ECOS	NA	2.97	
Pentachlorobenzene (IX only)	608-93-5	0.497	R5 ECOS	NA	0.497	
Pentachloronitrobenzene (IX only)	82-68-8	7.09	R5 ECOS	NA	7.09	
Pentachlorophenol (TCL only)	87-86-5	2.1	Eco SSL	2.1	0.119	0.119
Phenacetin (IX only)	62-44-2	11.7	R5 ECOS	NA	11.7	
Phenol	108-95-2	120	R5 ECOS	NA	120	120
Phorate (IX only)	298-02-2	0.000496	R5 ECOS	NA	0.000496	
Pronamide (IX only)	23950-58-5	0.0136	R5 ECOS	NA	0.0136	
Pyridine (IX only)	110-86-1	1.03	R5 ECOS	NA	1.03	
Safrole (IX only)	94-59-7	0.404	R5 ECOS	NA	0.404	
Solvent Yellow (p-Dimethylaminoazobenzene) (IX only)	60-11-7	0.04	R5 ECOS	NA	0.04	
Sulfotepp (IX only)	3689-24-5	0.596	R5 ECOS	NA	0.596	
Thionazin (IX only)	297-97-2	0.799	R5 ECOS	NA	0.799	
Polycyclic Aromatic Hydrocarbons						
1-Methylnaphthalene		--	--	NA	NA	
2-Methylnaphthalene	91-57-6	29	Eco SSL	29	3.24	3.24
Acenaphthene	83-32-9	29	Eco SSL	29	682	682
Acenaphthylene	208-96-8	29	Eco SSL	29	682	682
Anthracene	120-12-7	29	Eco SSL	29	1480	1480
Benzo(a)anthracene	56-55-3	1.1	Eco SSL	1.1	5.21	5.21
Benzo(a)pyrene	50-32-8	1.1	Eco SSL	1.1	1.52	1.52
Benzo(b)fluoranthene	205-99-2	1.1	Eco SSL	1.1	59.8	59.8
Benzo(g,h,i)perylene	191-24-2	1.1	Eco SSL	1.1	119	119
Benzo(k)fluoranthene	207-08-9	1.1	Eco SSL	1.1	148	148
Chrysene	218-01-9	1.1	Eco SSL	1.1	4.73	4.73
Dibenzo(a,h)anthracene	53-70-3	1.1	Eco SSL	1.1	18.4	18.4
Fluoranthene	206-44-0	29	Eco SSL	29	122	122
Fluorene	86-73-7	29	Eco SSL	29	122	122
Indeno(1,2,3-c,d)pyrene	193-39-5	1.1	Eco SSL	1.1	109	109
Naphthalene	91-20-3	29	Eco SSL	29	0.0994	0.0994

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Phenanthrene	85-01-8	29	Eco SSL	**29**	45.7	45.7
Pyrene	129-00-0	1.1	Eco SSL	**1.1**	78.5	78.5
Polychlorinated Biphenyls						
Aroclor-1016	12674-11-2	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1221	11104-28-2	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1232	11141-16-5	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1242	53469-21-9	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1248	12672-29-6	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1254	11097-69-1	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1260	11096-82-5	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1262 (IX only)	37324-23-5	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Aroclor-1268 (IX only)	11100-14-4	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Total PCBs	1336-36-3	0.000332	R5 ECOS	NA	**0.000332**	**0.000332**
Pesticides						
4,4'-DDD	72-54-8	0.021	R5 ECOS	**0.021**	0.758	
4,4'-DDE	72-55-9	0.021	R5 ECOS	**0.021**	0.596	
4,4'-DDT	50-29-3	0.021	Eco SSL	**0.021**	0.0035	
Aldrin	309-00-2	0.00332	R5 ECOS	NA	**0.00332**	
alpha-BHC	319-84-6	0.0994	R5 ECOS	NA	**0.0994**	
alpha-Chlordane	5103-71-9	0.224	R5 ECOS	NA	**0.224**	
beta-BHC	319-85-7	0.00398	R5 ECOS	NA	**0.00398**	
delta-BHC	319-86-8	9.94	R5 ECOS	NA	**9.94**	
Dieldrin	60-57-1	0.0049	Eco SSL	**0.0049**	0.00238	
Endosulfan I	959-98-8	0.119	R5 ECOS	NA	**0.119**	
Endosulfan II	33213-65-9	0.119	R5 ECOS	NA	**0.119**	
Endosulfan sulfate	1031-07-8	0.0358	R5 ECOS	NA	**0.0358**	
Endrin	72-20-8	0.0101	R5 ECOS	NA	**0.0101**	
Endrin aldehyde	7421-93-4	0.0105	R5 ECOS	NA	**0.0105**	
Endrin ketone	53494-70-5	--	--	NA	NA	
gamma-BHC (Lindane)	58-89-9	0.005	R5 ECOS	NA	**0.005**	
gamma-chlordane	5103-74-2	0.224	R5 ECOS	NA	**0.224**	
Heptachlor	76-44-8	0.00598	R5 ECOS	NA	**0.00598**	
Heptachlor epoxide	1024-57-3	0.152	R5 ECOS	NA	**0.152**	
Methoxychlor	72-43-5	0.0199	R5 ECOS	NA	**0.0199**	
Toxaphene	8001-35-2	0.119	R5 ECOS	NA	**0.119**	
Herbicides						
2,4,5-T	93-76-5	0.596	R5 ECOS	NA	**0.596**	
2,4,5-TP (Silvex)	93-72-1	0.109	R5 ECOS	NA	**0.109**	
2,4-D	94-75-7	0.0272	R5 ECOS	NA	**0.0272**	

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Dinoseb	88-85-7	0.0218	R5 ECOS	NA	**0.0218**	
Pentachlorophenol	87-86-5	2.1	Eco SSL	**2.1**	0.119	0.119
Organophosphorus Pesticides						
Azinphos methyl	86-50-0	--	--	NA	NA	
Bolstar	35400-43-2	--	--	NA	NA	
Chlorpyrifos	2921-88-2	--	--	NA	NA	
Cuomaphos	56-72-4	--	--	NA	NA	
Demeton	8065-48-3	--	--	NA	NA	
Demeton-O	298-03-3	--	--	NA	NA	
Demeton-S	126-75-0	--	--	NA	NA	
Diazinon	333-41-5	--	--	NA	NA	
Dichlorovos	62-73-7	--	--	NA	NA	
Dimethoate	60-51-5	--	--	NA	NA	
Disulfoton	298-04-4	--	--	NA	NA	
EPN (Ethyl-p-nitrophenyl phosphate)	2104-64-5	--	--	NA	NA	
Ethoprop	13194-48-4	--	--	NA	NA	
Ethyl parathion (Parathion)	56-38-2	--	--	NA	NA	
Famphur	52-85-7	--	--	NA	NA	
Fensulfothion	115-90-2	--	--	NA	NA	
Fenthion	55-38-9	--	--	NA	NA	
Malathion	121-75-5	--	--	NA	NA	
Methyl parathion	298-00-0	--	--	NA	NA	
Mevinphos	7786-34-7	--	--	NA	NA	
O,O,O-Triethylphosphorothioate	126-68-1	--	--	NA	NA	
Phorate	298-02-2	--	--	NA	NA	
Ronnel	299-84-3	--	--	NA	NA	
Sulfotepp	3689-24-5	--	--	NA	NA	
Tetrachlorovinphos	22248-79-9	--	--	NA	NA	
Thionazin	297-97-2	--	--	NA	NA	
Tokuthion	34643-46-4	--	--	NA	NA	
Trichloronate	327-98-0	--	--	NA	NA	
Explosives and Propellants						
1,3,5-Trinitrobenzene	99-35-4	--	--	NA	NA	
1,3-Dinitrobenzene	99-65-0	--	--	NA	NA	
2,4,6-Trinitrotoluene (TNT)	118-96-7	--	--	NA	NA	
2,4-Dinitrotoluene	121-14-2	--	--	NA	NA	
2,6-Dinitrotoluene	606-20-2	--	--	NA	NA	
2-Amino-4,6-Dinitrotoluene	35572-78-2	--	--	NA	NA	
2-Nitrotoluene	88-72-2	--	--	NA	NA	

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
3-Nitrotoluene	99-08-1	--	--	NA	NA	
4-Amino-2,6-Dinitrotoluene	19406-51-0	--	--	NA	NA	
4-Nitrotoluene	99-99-0	--	--	NA	NA	
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra)	2691-41-0	--	--	NA	NA	
Nitrobenzene	98-95-3	--	--	NA	NA	
Nitroglycerin	55-63-0	--	--	NA	NA	
Nitroguanadine	556-88-7	--	--	NA	NA	
Perchlorate	14797-73-0	--	--	NA	NA	
PETN (Pentaerythritol tetranitrate)	78-11-5	--	--	NA	NA	
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	121-82-4	--	--	NA	NA	
Tetryl (Trinitrophenylmethylnitramine)	479-45-8	--	--	NA	NA	
Other		--	--	NA	NA	
Metals						
Aluminum	7429-90-5	pH>5.5	Eco SSL	**pH>5.5**	NA	NA
Antimony	7440-36-0	0.27	Eco SSL	**0.27**	0.142	0.142
Arsenic	7440-38-2	18	Eco SSL	**18**	5.7	5.7
Barium	7440-39-3	330	Eco SSL	**330**	1.04	1.04
Beryllium	7440-41-7	21	Eco SSL	**21**	1.06	1.06
Cadmium	7440-43-9	0.36	Eco SSL	**0.36**	0.00222	0.00222
Calcium	7440-70-2	--	--	NA	NA	NA
Chromium	7440-47-3	26	Eco SSL	**26**	0.4	0.4
Cobalt	7440-48-4	13	Eco SSL	**13**	0.14	0.14
Copper	7440-50-8	28	Eco SSL	**28**	5.4	5.4
Iron	7439-89-6	5<pH<8	Eco SSL	**5<pH<8**	NA	NA
Lead	7439-92-1	11	Eco SSL	**11**	0.0537	0.0537
Magnesium	7439-95-4	--	--	NA	NA	NA
Manganese	7439-96-5	220	Eco SSL	**220**	**220**	**220**
Mercury	7439-97-6	0.1	R5 ECOS	NA	**0.1**	**0.1**
Nickel	7440-02-0	38	Eco SSL	**38**	13.6	13.6
Potassium	7440-09-7	--	--	NA	NA	NA
Selenium	7782-49-2	0.52	Eco SSL	**0.52**	0.0276	**0.52**
Silver	7440-22-4	4.2	Eco SSL	**4.2**	2	2
Sodium	7440-23-5	--	--	NA	NA	NA
Thallium	7440-28-0	0.0569	R5 ECOS	NA	**0.0569**	**0.0569**
Tin (IX only)		7.62	R5 ECOS	NA	**7.62**	
Vanadium	7440-62-2	7.8	Eco SSL	**7.8**	1.59	1.59
Zinc	7440-66-6	46	Eco SSL	**46**	6.62	6.62
Hexavalent Chromium						
Hexavalent Chromium	18540-29-9	130	Eco SSL	**130**	0.4	

NSA Crane SWMU 34 Ecological Screening Criteria - Surface Soil Samples

Analyte	CAS Number	Ecological Soil Screening Level [1] (mg/kg)	Source of Ecological Soil Screening Level	EPA Eco SSL (mg/kg)	EPA R5 Eco Soil (mg/kg)	NOAA SQUIRT (mg/kg)
Cyanide						
Cyanide	57-12-5	1.33	R5 ECOS	NA	1.33	
Dioxins/Furans						
1,2,3,4,6,7,8,9-OCDD	3268-87-9	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,4,6,7,8,9-OCDF	39001-02-0	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,4,6,7,8-HPCDD	35822-46-9	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,4,6,7,8-HPCDF	67562-39-4	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,4,7,8,9-HPCDF	55673-89-7	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,4,7,8-HXCDD	39227-28-6	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,4,7,8-HXCDF	70648-26-9	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,6,7,8-HXCDD	57653-85-7	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,6,7,8-HXCDF	57117-44-9	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,7,8,9-HXCDD	19408-74-3	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,7,8,9-HXCDF	72918-21-9	0.0000386	R5 ECOS	NA	0.0000386	
1,2,3,7,8-PECDD	40321-76-4	0.000000199	R5 ECOS	NA	0.000000199	
1,2,3,7,8-PECDF	57117-41-6	0.0000386	R5 ECOS	NA	0.0000386	
2,3,4,6,7,8-HXCDF	60851-34-5	0.0000386	R5 ECOS	NA	0.0000386	
2,3,4,7,8-PECDF	57117-31-4	0.0000386	R5 ECOS	NA	0.0000386	
2,3,7,8-TCDD	1746-01-6	0.000000199	R5 ECOS	NA	0.000000199	
2,3,7,8-TCDF	51207-31-9	0.0000386	R5 ECOS	NA	0.0000386	
Total HpCDD	37871-00-4	--	NA	NA	NA	
Total HpCDF	38998-75-3	--	NA	NA	NA	
Total HxCDD	34465-46-8	--	NA	NA	NA	
Total HxCDF	55684-94-1	--	NA	NA	NA	
Total PeCDD	36088-22-9	--	NA	NA	NA	
Total PeCDF	30402-15-4	--	NA	NA	NA	
Total TCDD	41903-57-5	--	NA	NA	NA	
Total TCDF	55722-27-5	--	NA	NA	NA	

1- The following hierarchy was used for selecting the Ecological Screening level in order of preference:
USEPA Ecological Soil Screening Levels (Eco SSL) (EPA, 2003, 2005, 2006, 2007). The lower of the plant, invertebrate, or wildlife Eco SSL is selected as the screening level.
USEPA Region 5 Ecological Soil Screening Levels (R5 ECOS) (USEPA, 2005).
Lowest of National Oceanographic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRT) surface soil benchmarks (Buchman, 2008).

Shaded cells are values that were selected as the overall ecological soil screening level.