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FINAL TIER II SAMPLING AND ANALYSIS PLAN FOR REMEDIAL INVESTIGATION OF SOILS AT MUNITIONS RESPONSE PROGRAM SITE SKEET RANGE NAS BRUNSWICK ME

12/1/2011

TETRA TECH NUS

FINAL
Tier II Sampling and Analysis Plan for Remedial Investigation of Soils at Munitions Response Program Site Skeet Range

Former Naval Air Station Brunswick
Brunswick, Maine

Base Realignment and Closure Program Management Office Northeast

Contract Number N62472-03-D-0057
Contract Task Order 69

December 2011

Title and Approval Page

(UFP-QAPP Manual Section 2.1 – Worksheet #1)

FINAL

TIER II SAMPLING AND ANALYSIS PLAN

DECEMBER 2011

REMEDIAL INVESTIGATION OF SOILS AT MUNITIONS RESPONSE PROGRAM SITE SKEET RANGE

FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE

Prepared for:
Base Realignment and Closure Program Management Office Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112-1303

Prepared by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
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Prepared under:
CONTRACT NUMBER N62472-03-D-0057
CONTRACT TASK ORDER 69

Review Signature: _____ 12-9-11
Tom Johnston/Quality Assurance Manager Date

Approval Signature: _____
Navy Quality Assurance Officer Date

Other Approval Signature: _____ FOR LK 12/9/11
Linda Klink/Project Manager Date

Title and Approval Page

(UFP-QAPP Manual Section 2.1 – Worksheet #1)

DRAFT

TIER II SAMPLING AND ANALYSIS PLAN

OCTOBER 2011

REMEDIAL INVESTIGATION OF SURFACE SOILS AT MUNITIONS RESPONSE PROGRAM SITE SKEET RANGE

FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE

Prepared for:
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CONTRACT TASK ORDER 69

Review Signature: Kelly A Carper for 10/20/11
Tom Johnston/Quality Assurance Manager — Date

Approval Signature: 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: 2011.10.20 16:17:30 -04'00'
Navy Quality Assurance Officer — Date

Other Approval Signature: Jeff Quint FOR LK 10/20/11
Linda Klink/Project Manager — Date

EXECUTIVE SUMMARY

In 2005, Naval Air Station Brunswick (NASB) was designated for closure under the authority of the Defense Base Realignment and Closure (BRAC) Act of 1990, Public Law 101-510, as amended. BRAC legislation requires that base closure be in full compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The operational closure date for NASB was September 15, 2011, and relocation of mission operations to Naval Air Station (NAS) Jacksonville, Florida, began in 2008. The former NASB Main Base is located in Cumberland County, Maine, and comprises approximately 2,834 acres situated between the Androscoggin River and Casco Bay southeast of the town center of Brunswick, approximately 25 miles northeast of Portland, Maine. NASB includes undeveloped property with forest and grass cover (for recreational use), redeveloped buildings (for commercial use), and residential areas. The Base Reuse Plan indicates that the central, southern, and western portions of the Skeet Range (SKT) will be used for business and technology industries, and the eastern portion will be used for outdoor recreation.

This Sampling and Analysis Plan (SAP) encompasses Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) requirements for a Remedial Investigation (RI) of shallow soils at SKT at NASB. This document constitutes the planning document, addressing specific protocols for sample collection, sample handling and storage, chain of custody, laboratory and field analyses, data validation, and data reporting. This SAP is being prepared and will be implemented by Tetra Tech NUS, Inc. (Tetra Tech).

SKT is located on 78 acres in the southeastern portion of former NASB in an open field approximately 75 meters north and 100 meters east of Building 55. The former range was located adjacent to Range Road just northeast of the taxiway intersection and was used for the training of military personnel during the 1950s. Navy Programming Guidance from the 1950s defined the surface danger zone (SDZ) of a standard skeet range as a 900-foot radius from the shooting field, therefore, the potential for munitions constituents (MC) exists in this entire area. The likely shotfall zone, the area between 375 to 680 feet from the firing point, is the area where the highest concentrations of MC are expected. On range maps from 1952, the range is shown with the direction of fire to the north; however, in a 1957 aerial photograph, the range is shown with the direction of fire to the east. It appears that the layout of the range and direction of fire were changed to maintain a safe distance from the shooting field, as outlined in the Programming Guide, because the area east of the range was undeveloped. During the Site Inspection (SI) (Tetra Tech, 2011), shallow surface soil [0 to 3 inches below ground surface (bgs)], deep surface soil (3 to 12 inches bgs), sediment, and surface water samples were collected. Soil samples were analyzed for lead using X-Ray Fluoresence (XRF) and/or fixed-base laboratory Target Analyte List (TAL) metals. All soil samples analyzed by fixed-base laboratory were analyzed for polynuclear aromatic hydrocarbons

(PAHs), and soil samples near the firing point were also analyzed for nitroglycerin and dinitrotoluenes (DNTs). A few samples were also analyzed for total organic carbon (TOC), pH, and cation exchange capacity (CEC). The SI soil sampling focused on the likely shotfall zone, which is defined by the Navy Programming Guidance from the 1950s as up to 680 feet from the firing point. During the SI, chemical concentrations indicated that contamination was present up to the rear edge (680 feet) of the likely shotfall zone. Therefore, additional investigation of the area beyond the likely shotfall zone of 680 feet is needed to confirm the extent of surface and subsurface soil contamination, to approximately 900 feet from the firing point, encompassing the entire SDZ. Additional sample locations around the firing point to the edge of the likely shotfall zone are also proposed to delineate the extent of contamination over the entire SDZ, and support a likely future surface soil removal action.

Portions of SKT have been a part of environmental investigations in the recent past, including Site 9 (northeastern portion of SKT), where a former incinerator was located, and ash buried from incinerator operations. A removal action occurred at Site 9 from 2006 to 2008 during which the majority of an ash landfill was excavated from the site. However, due to scope restrictions the excavation ended and clean backfill was put in place prior to all ash being removed. Subsequent investigations at Site 9 have delineated the visible extent of ash remaining. This report is pending.

Site 6 is also located within the SKT footprint, and was the location of the Sandy Road Rubble and Asbestos Disposal Site, where construction debris and asbestos-containing materials were disposed of in a shallow pit. A removal action was conducted following the 1993 Record of Decision, and the debris was removed and the site was regarded. The site requires No Further Action (NFA).

A portion of Site 11 is also located within the SKT footprint. Site 11 is the location of a former Fire Training Area that was used regularly over a 30-year period ending in the fall of 1990. Waste liquids (fuels, oils, and degreasing solvents) were used as fuels for fire training exercises, resulting in contamination of soil and groundwater at the site. In February 1998, a ROD was finalized for Site 11 documenting the selected remedy for soil at Site 11 as NFA. The NFA decision was supported by the results of the 1990 FS, which concluded that the only risk at this site was for the potential of continuing impacts to groundwater from soil at Sites 11 and 13. Site 11 groundwater contamination is addressed by continued operation of the groundwater remedy for the Eastern Plume. Site 11 is not considered a potential source of contamination to the SKT.

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ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
%D	Percent Drift
bgs	below ground surface
BRAC	Base Realignment and Closure
CAS	Chemical Abstract Services
CCME	Canadian Council of Ministers of the Environment
CEC	Cation Exchange Capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
CTO	Contract Task Order
DoD	Department of Defense
DOT	Department of Transportation
DNTs	Dinitrotoluenes
DQO	Data Quality Objective
DVM	Data Validation Manager
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
EPA-NE	Environmental Protection Agency Northeast
ERA	Ecological Risk Assessment
FOL	Field Operation Leader
FSP	Field Sampling Plan
FTMR	Field Task Modification Request
g	gram
GC	Gas Chromatograph
GC/MS	Gas Chromatograph/Mass Spectrometer
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HI	Hazard Index
HSM	Health and Safety Manager
ICP	Inductively Coupled Plasma

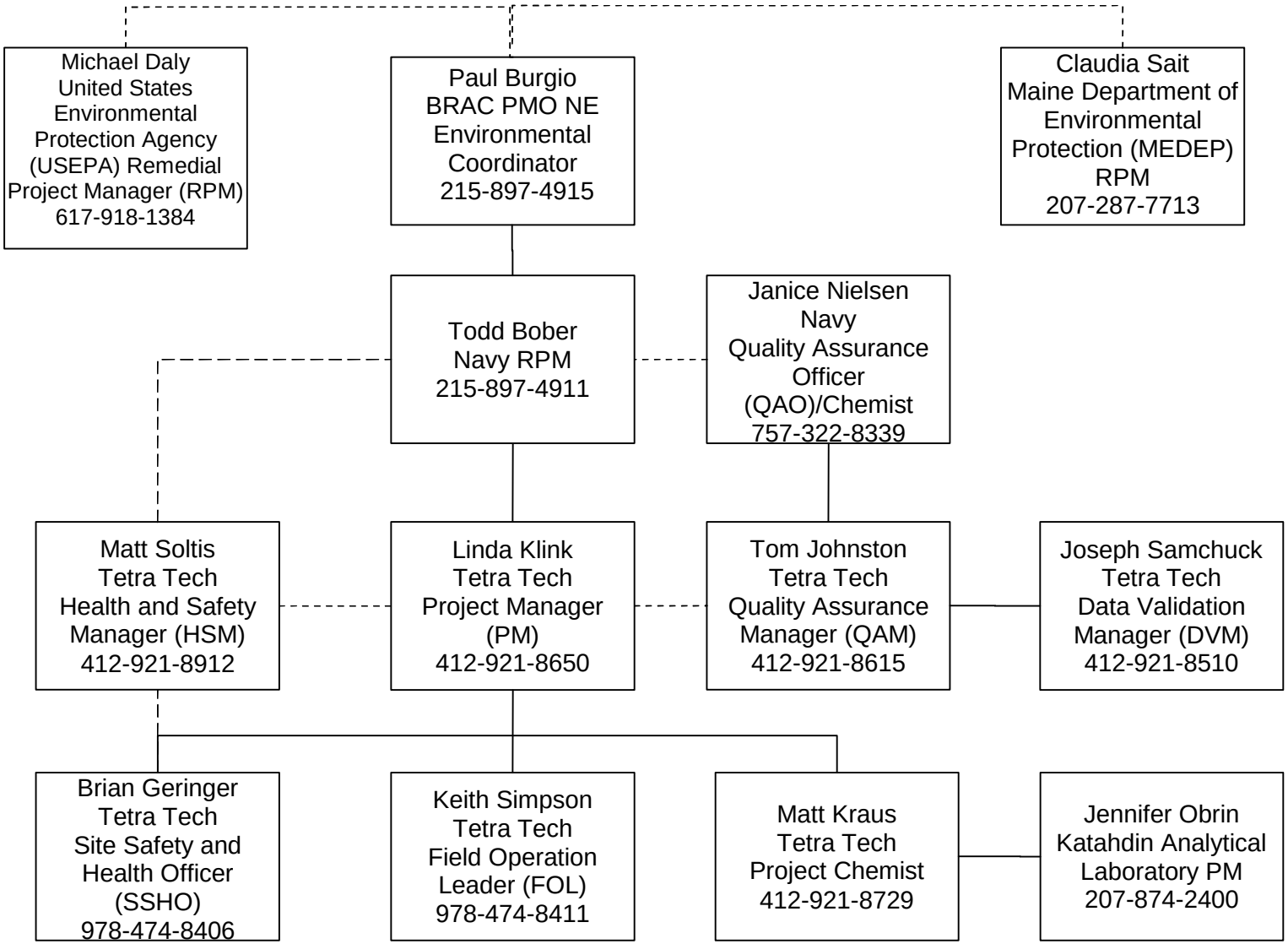
ICP-MS	Inductively Coupled Plasma Mass Spectrometer
IDW	Investigation-Derived Waste
IEUBK	Integrated Exposure Uptake Biokinetic
ILCR	Incremental Lifetime Cancer Risk
Katahdin	Katahdin Analytical Services, Inc.
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection
LOQ	Limit of Quantification
MC	Munitions Constituents
MEDEP	Maine Department of Environmental Protection
mL	milliliter
MPC	Measurement Performance Criteria
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAS	Naval Air Station
NASB	Naval Air Station Brunswick
NAVFAC	Naval Facilities Engineering Command
Navy	United States Department of the Navy
NIRIS	Naval Installation Restoration Information Solution
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear aromatic hydrocarbon
PALs	Project Action Levels
PA	Preliminary Assessment
PID	Photoionization Detector
PM	Project Manager
PQOs	Project Quality Objectives
PRG	Preliminary Remediation Goals
PSL	Project Screening Levels
QA	Quality Assurance
QAM	Quality Assurance Manager
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RAGs	Remedial Action Guidelines
RI	Remedial Investigation

RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
RSLs	Regional Screening Levels
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SDZ	surface danger zone
SI	Site Inspection
SIM	Selective Ion Method
SKT	Skeet Range
SOP	Standard Operating Procedure
SSHO	Site Safety and Health Officer
TAL	Target Analyte List
Tetra Tech	Tetra Tech NUS, Inc.
TOC	total organic carbon
ug/dL	microgram per decaliter
USDA-SCS	United States Department of Agriculture, Soil Conservation Service
USEPA	United States Environmental Protection Agency
XRF	X-Ray Fluorescence

1.0 Project Organizational Chart

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

Lines of Authority ———————— Lines of Communication - - - - - - - - - - - - - -



2.0 Communication Pathways

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

The communication pathways for the SAP are shown below.

Communication Drivers	Responsible Person Affiliation	Name	Phone Number and/or E-Mail	Procedure
SAP amendments	Tetra Tech PM Navy RPM MEDEP RPM EPA RPM	Linda Klink Todd Bober Claudia Sait Michael Daly	412-921-8650 215-897-4911 207-287-7713 617-918-1384	After realizing an amendment is needed, 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 for review and approval. The Navy RPM will sign the letter within 5 days of receipt, if approved. The Navy RPM will then inform the regulator RPMs of the issue within one day. The Tetra Tech PM will send scope changes to the Project Team via e-mail within 1 business day.
Schedule changes	Tetra Tech PM Navy RPM	Linda Klink Todd Bober	412-921-8650 215-897-4911	The Tetra Tech PM will verbally inform the Navy RPM and the NASB IRP-Manager on the day that schedule change is known and document via a schedule concurrence letter within 7 days or prior to the first affected deliverable date.

Communication Drivers	Responsible Person Affiliation	Name	Phone Number and/or E-Mail	Procedure
Field issues that require changes in scope or implementation of field work	Tetra Tech FOL Tetra Tech PM Navy RPM MEDEP RPM EPA RPM	Keith Simpson Linda Klink Todd Bober Claudia Sait Michael Daly	412-9218131 412-921-8650 215-897-4911 207-287-7713 617-918-1384	The Tetra Tech FOL will inform Tetra Tech PM verbally the day the issue is realized. Tetra Tech PM will inform the Navy RPM of the issue (verbally or via e-mail) within 1 day of the Tetra Tech FOL's notification. The Navy RPM will then inform the regulator RPMs of the issue within one day. Tetra Tech PM will also send a concurrence letter to the Navy RPM within 7 days, if project scope is affected. The Navy RPM will sign the letter within 5 days of receipt, if scope change is warranted. The scope change is to be implemented before further work is executed. The Tetra Tech PM will document the change via a FTMR form within 2 days of identifying the need for change and will obtain required approvals within 5 days of initiating the form. The form will be placed in the project file, with signatures as determined by the Tetra Tech PM.
Stop work recommendations, for example, to protect workers from unsafe conditions/situations or to prevent a degradation in quality of work	Tetra Tech FOL/SSHO Tetra Tech PM Tetra Tech QAM Navy RPM On-site Point of Contact MEDEP RPM EPA RPM	Keith Simpson/Brian Geringer Linda Klink Tom Johnston Todd Bober Bob LeClere Claudia Sait Michael Daly	412-921-8131/978-474-8406 412-921-8650 412-921-8615 215-897-4911 207-406-2290 207-287-7713 617-918-1384	The Tetra Tech FOL or SSHO will inform onsite personnel, subcontractor(s), and the identified Project Team members within one hour (verbally or by e-mail).

Communication Drivers	Responsible Person Affiliation	Name	Phone Number and/or E-Mail	Procedure
Field data quality issues	Tetra Tech FOL Tetra Tech PM	Keith Simpson Linda Klink	412-921-8131 412-921-8650	The Tetra Tech FOL will inform the Tetra Tech PM verbally or by e-mail on the same day that a field data quality issue is discovered. If the Tetra Tech PM determines that the problem significantly impacts the project, the Tetra Tech PM will inform the Navy RPM of the issue (verbally or via e-email) within 1 day of the Tetra Tech FOL's notification.
Laboratory analytical data quality issues	Laboratory PM Tetra Tech Project Chemist Tetra Tech DVM Tetra Tech PM Navy RPM	Kelly Perkins Matthew Kraus Joe Samchuck Linda Klink Todd Bober Dave Barclift Jan Nielsen	207-874-2400 412-921-8729 412-921-8510 412-921-8650 215-897-4911 215-897-4913 757-322-8339	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 hrs 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 verification. Corrective actions may include a consult with the Navy Chemist.

3.0 Project Planning Session Participants Sheet

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

Project Name:	RI for Munitions Response Program Site SKT	Site Name:	SKT
Projected Date(s) of Sampling:	Fall 2011	Site Location:	NASB, Brunswick, Maine
Project Manager:	Linda Klink		
Date of Session:	Sessions held in July/August 2011		
Scoping Session Purpose:	To establish project scope for SKT RI		

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Todd Bober	RPM	Naval Facilities Engineering Command (NAVFAC) Atlantic	215-897-4911	todd.bober@navy.mil	RPM
Linda Klink	PM	Tetra Tech	412-921-8650	linda.klink@tetratech.com	PM
Jeff Orient	Activity Coordinator	Tetra Tech	412-921-8778	jeff.orient@tetratech.com	Activity Coordinator and technical review
Stephanie Warino	Geologist	Tetra Tech	412-921-8868	stephanie.warino@tetratech.com	Geologist
Matt Kraus	Risk Assessor	Tetra Tech	412-921-8729	matthew.kraus@tetratech.com	Project Chemist and Risk Assessor
Lee Ann Sinagoga	Risk Assessment Manager	Tetra Tech	412-921-8887	leeann.sinagoga@tetratech.com	Risk Assessment Technical Review

Note: MEDEP, EPA, and/or the public were not participants in the project planning sessions.

Comments/Consensus Decisions:

- Shallow surface (0 to 3 inches bgs) and deep surface soil (3 to 12 inches bgs) will be investigated during the RI.
- Soil will be analyzed for select metals and PAHs, since there were exceedances of project action levels (PALs) during the SI.

- Project Screening Levels (PSLs) for use in Contaminant of Potential Concern (COPC) selection during the RI will include USEPA Residential Soil Regional Screening Levels (RSLs).

- The shallow soil sampling will be extended beyond the likely shotfall zone of 680 feet from the firing points and will fill in data gaps from the firing points to 900 feet from the firing points (the entire SDZ), in the following areas (defined in the SI): Skeet Range (pre-1950s) and Skeet Range (post-1950). Since areas north of the Impoundment Ponds are developed (parking lots, buildings, reworked soil, etc), sampling in these areas is designed to identify native soil so that impacts to shallow soil from the SKT can be fully delineated (Figure 1).

- A risk assessment will be conducted to determine potential risks to human health and the environment and to aid in the development of Preliminary Remediation Goals (PRGs) and establishing the remediation footprint for shallow soil.

- During the SI, samples were analyzed using XRF to confirm the approximate site footprint. No XRF data will be used in the RI risk assessment, because sufficient and more reliable fixed-base laboratory data is/will be available for risk assessment purposes.

4.0 Conceptual Site Model

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

4.1 HISTORICAL INFORMATION

SKT is located on 78 acres in the southeastern portion of former NASB in an open field approximately 75 meters north and 100 meters east of Building 55 (Figure 1). The former SKT was located adjacent to Range Road just northeast of the taxiway intersection, and was used for training military personnel during the 1950s. Navy Programming Guidance from the 1950s defined the SDZ of a skeet range as a 900-foot radius from the shooting field. On range maps from 1952, the range is shown with the direction of fire to the north; however, in a 1957 aerial photograph, the range is shown with the direction of fire to the east. It appears that the layout of the range and direction of fire were changed to maintain a safe distance from the shooting field outlined in the Programming Guidance because the area east of the range was undeveloped. An SI was conducted at SKT to build on the information presented in the Preliminary Assessment (PA), by gathering initial field data to determine whether munitions constituents (MC) that may have originated from previous site operations were present and potentially contributing to environmental impacts in site media. The SI conducted at SKT (Tetra Tech, 2011) included shallow surface (0 to 3 inches bgs) and deep surface (3 to 12 inches bgs) soil, sediment, and surface water sampling extending slightly beyond the likely shotfall zone (680 feet from the firing point).

Buildings which were located within the SKT boundary, but have been demolished include:

- Building 52, for which no information is currently available. Building 52's construction and demolition dates, and uses will be researched during the RI.

- Building 293, for which no information is currently available. Building 293's construction and demolition dates, and uses will be researched during the RI.

Buildings which are currently located within the SKT boundary include:

- Building 226, which was built in 2001 and is the Sea Cadets Building,

- Building 221, which was built in 1999 and is the Thrift Shop,

- Building 537, which was built in 1958 and is the Sewage Pump House,

- Building 201, which was built in 1953 and is the Galley/Neptune Hall,

- Building 420, for which no information is currently available. Building 420's construction uses will be researched during the RI.

- Building 29, which was built in 1988 and is the Auto Hobby Shop,

- Building 79, which was built in 1980 and is the Auto Hobby Shop Storage,

- Building 81, located in the western portion of the site, was used as an inert weapons storage facility between 1980 and 1995. From 1995 until 2010, the building was used for management and storage of hazardous materials (CHRIMP facility). Building 81 was built in 1980.

- The housing located in the northern portion of the SKT was built in 2002, and is currently in use as the Bachelors Enlisted Quarters complex known as Orion's Landing barracks; the buildings are two-story, wood-framed on concrete slab foundations with two-story apartments used as living quarters for two people, plus a mechanical room with two natural-gas-fired boilers; within safety zone of former skeet range, but outside shot fall zone.

Site 9 is the site of a former incinerator and ash landfill/dump area. During operation of the incinerator, from April 1943 until fall 1946 and possibly as late as 1953, solid wastes were burned and the ash was placed in the dump at and around the location of former barracks Buildings 218 and 219 (located north of Neptune Drive). Wastes reportedly disposed of at this location included solvents that were burned on the ground, paint sludge, and possibly wastes from a metal shop. The dump was eventually covered by vegetation and asphalt when Barracks Buildings 218 and 219 were constructed over the dump area. Approximately 49,000 tons of ash-contaminated soils have been removed from the site. Visual observations of ash at and beyond the northern and southern excavation boundaries prompted additional investigations. The SKT also encompasses a portion of Site 9 (the Neptune Drive Disposal Site) (Figure 1).

Site 6 is located within the SKT boundary. Site 6 (eastern portion of site) was originally a small depression that was later filled with construction debris until the late 1970's. Aircraft parts reportedly were disposed of at this site, and asbestos-covered pipes were seen protruding from the surface soil during a site inspection in 1980. It was estimated that approximately 250 cubic yards (yd^3) of the fill material at Site 6 contained asbestos. Based on the RI and baseline risk assessment results, no asbestos was detected in surface soil samples; therefore, there was no current risk to human health and the environment from exposure to asbestos. The remedy was designed to remove the buried wasted and place it beneath a permanent low-permeability cap at Sites 1 and 3, providing necessary subgrade

material beneath the cap. After receipt of the confirmatory sampling data, Site 6 was re-graded to minimize erosion and seeded to re-establish vegetation. NFA is required for Site 6 (Tetra Tech, 2010).

Site 11 is the location of a former Fire Training Area that was used regularly over a 30-year period ending in the fall of 1990. Waste liquids (fuels, oils, and degreasing solvents) were used as fuels for fire training exercises, resulting in contamination of soil and groundwater at the site. Originally, the training exercises introduced the various combustible materials directly onto the ground surface at the site. In 1987, a circular concrete liner, berm, and 6,000-gallon underground storage tank (UST) (located north of the pit) were installed at the site. The concrete pad and UST were removed from the site in 1995. Site 11 is one of three former sources of groundwater contamination in the Eastern Plume. In February 1998, a ROD was finalized for Site 11 documenting the selected remedy for soil at Site 11 as NFA. This alternative was selected because the soil did not pose an unacceptable risk from direct contact or incidental ingestion. The NFA decision was supported by the results of the 1990 FS, which concluded that the only risk at this site was for the potential of continuing impacts to groundwater from soil at Sites 11 and 13. Site 11 groundwater contamination is addressed by continued operation of the groundwater remedy for the Eastern Plume.

4.2 GEOLOGY

The subsurface material located at the SKT consists of unconsolidated sediment (gravel, sand, and silty clays) overlying the Ordovician metamorphic Cape Elizabeth Formation, which is described as a rusty-weathering, thinly bedded, micaceous schist or gneiss with interbeds of mica-quartz schist. The United States Department of Agriculture, Soil Conservation Service (USDA-SCS) Soil Survey for Cumberland County, Maine (1974) shows soils in the vicinity of former NASB as belonging to the Windsor-Hinckley-Deerfield Association. These soils are described as deep, excessively drained to moderately well drained, nearly level to steep, and coarse textured. They occur on bottomlands, glacial terraces, outwash plains, and a few hills and ridges. The major soils are rapidly permeable with a seasonal high water table. Soil borings were advanced during the SI to maximum depths of 1 foot at the SKT. Based on the soil boring log information, the shallow subsurface at the site is fine- to medium-grained sand with trace to some silt.

The site is relatively level in the area of the former shooting stations. The land surface in the area of the shooting field slopes to the north and east toward Upper and Lower Impoundment Ponds, respectively. Surface water drainage generally follows topography, and surface water drains into the Upper and Lower Impoundment Ponds. The Upper Impoundment Pond and the Lower Impoundment Pond were separated by dikes in 1997 and drain directly to the unnamed stream south of the Night Flight Outfall, and into the

Picnic Pond from the northwest. These ponds also likely receive water from the area of the base north of Neptune Road.

Note that hydrogeology was not investigated based on previous groundwater investigations north (Site 9) and south (Site 1) of the SKT, groundwater is expected to flow to the southeast north toward Merriconeag Stream. Historic aerial photographs of the base from 1945 indicate that the impoundment Ponds were present prior to NAS Brunswick being built, and therefore it is probably that the ponds receive groundwater discharge, and well as receiving surface water flow from NAS Brunswick.

Where construction activities have taken place within the SKT boundary, especially north of the Impoundment Ponds, soil which was present during the time when the SKT was in operation may have been moved around, reworked, or covered as construction activities required. Within the Ash Excavation Area at Site 9 and within the Site 6 and Site 11 boundaries, the original native material is no longer in place.

4.3 CURRENT LAND USE AND ANTICIPATED FUTURE LAND USE

Prior to 1950, the SKT was in a partially developed part of the base and included several buildings. After 1950, the SKT was undeveloped except for the northernmost portion, which contains residential housing (Figure 1), and the central portion, which reportedly contains a baseball field (Site 6 on Figure 1). The SKT was actively used until at least 1957. Recently, the SKT uses were community mixed use, which includes recreational, residential, and business and technologies industry uses. In the future, most of the SKT will be slated for community mixed use.

4.4 NATURE AND EXTENT OF CONTAMINATION

Constituents at Three Munitions Response Sites (Tetra Tech, 2009). Selected surface soil samples located in and around the firing points were also analyzed for nitroglycerin and DNT. Selected surface soil samples (Table 1) were analyzed for TOC, pH, and CEC. Shallow surface soil samples were collected from the 0 to 3 inches bgs interval. Deep surface soil samples were collected from the 3 to 12 inches bgs interval.

Shallow surface soil is contaminated with metals and PAHs (primarily antimony, arsenic, lead, and benzo(a)pyrene) at unacceptable concentrations. The contamination appears to be located within the combined middle area of the pre-1950 and post-1950 range fans overlap. Contamination is present from the firing points extending outward to encompass the shotfall zones in this central area.

For shallow surface soil (0 to 3 inches bgs) and deep surface (3 to 12 inches bgs) soil, five metals (antimony, arsenic, cobalt, lead, and manganese) exceeded PALs during the SI in both shallow and deep surface soil samples at concentrations exceeding Maine Remedial Action Guidelines (RAGs) for Multiple Contaminants, all Scenarios and all Pathways (MEDEP, 2010) and USEPA Residential Soil RSLs (USEPA, 2011) (with the exception of manganese, which only exceeded in shallow surface soil). Of the metals, lead was the metal which most frequently exceeded RAGs and RSLs, at approximately half the locations which were sampled during the SI. Figure 2 shows detections of metals from the SI in shallow and deep surface soil, and Appendix A contains the table of positive detections from the SI, in which concentrations exceeding the RAGs and RSLs are highlighted. Cadmium was detected at concentrations exceeding only the Maine RAG and aluminum, chromium, and iron were detected at concentrations that exceeded only USEPA RSLs. Antimony and arsenic were detected at concentrations that exceeded Maine RAGS by two orders of magnitude and USEPA RSLs by three orders of magnitude. All concentrations of aluminum, cadmium, cobalt, and manganese were an order of magnitude or less greater than screening levels. All metals concentrations that exceeded the screening levels by more than one order of magnitude were detected in the shallow surface samples (0 to 3 inches bgs). Deep surface soil samples (3 to 12 inches bgs) did have metals concentrations exceeding screening levels, but exceedances were lower in magnitude than in shallow surface soils (0 to 3 inches bgs).

Figure 3 shows detections of PAHs, nitroglycerin, and DNTs in shallow surface (0 to 3 inches bgs) and deep surface (3 to 12 inches bgs) soil. Nitroglycerin and DNTs were either not detected or were detected at concentrations less than screening levels in all of the surface soil samples. Several PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene] were detected at concentrations that exceeded both Maine RAGS and USEPA RSLs by an order of magnitude or more were limited to the shallow surface soil samples collected from 0 to 3 inches. Appendix A contains the table of positive detections from the SI, in which concentrations exceeding the RAGs and RSLs are highlighted.

Groundwater was not investigated during the SI. Only shallow surface soils (0 to 3 inches bgs) appear to be of primary concern in areas which have not been disturbed by construction activities because concentrations of metals and PAHs which were an order of magnitude of greater than the PAL were limited to the shallow surface soil (0 to 3 inches bgs) during the SI. Because PALs exceedances for metals and PAHs were infrequent and, where occurring, less than an order of magnitude, in the deep surface soil, it does not appear that contamination at levels of concern has migrated to deep surface soils in areas which have not been disturbed by construction activities (3 to 12 inches bgs) at concentrations of concern; therefore, the migration pathway from subsurface soil (greater than 1 foot bgs) to groundwater is not complete in areas which have not been disturbed.

In areas which have been disturbed by construction activities, it is likely that the 0 to 3 inch interval has been combined to some extent with soil at depths greater than 3 inches bgs. This was not addressed during the SI; for the RI, the site conceptual model for soil in these areas (shown on Figure 4) is regarded differently than for soil in undisturbed areas. Because the soil has been disturbed in these areas, it is possible that subsurface soils (i.e., greater than 1 foot bgs) have been impacted, since impacted soil (from 0 to 3 inches bgs) was likely physically mixed with both deeper surface and potentially subsurface soils through construction activities. Therefore, the sampling plan for soils which are in disturbed areas is reflective of this concern. The sampling plan is detailed in Section 7.

This RI will address only surface soil to 12 inches bgs in undisturbed areas and surface soil and subsurface soil to a maximum depth of 4 feet bgs in disturbed areas at SKT. Sediment and surface water at SKT will be addressed under separate cover.

A former incinerator was located at Site 9, which overlaps the northwest portion of the SKT. Ash was also buried at Site 9 from incinerator operations. A removal action occurred at Site 9 from 2006 to 2008 during which the majority of an ash landfill was excavated from the site (Figure 4). However, due to scope restrictions the excavation ended and clean backfill was put in place prior to all ash being removed. .. The extent of visible ash was delineated at Site 9 during the November 2010 field investigation. The data gap investigation and human health risk assessment report for the Site 9 investigation is currently in progress.

Site 6 is not considered a potential source of contamination to the SKT, and Site 11 is not considered a potential source of contamination to the SKT.

4.5 SOURCE MEDIA, POTENTIAL MIGRATION ROUTES, AND POTENTIAL RECEPTORS

The MCs of concern are lead from shotgun ammunition and PAHs from the clay pigeons. The source areas of potential MC contamination at the SKT are in and around the likely shotfall zone and the firing point area within which metals, propellants (nitroglycerin and DNT), and PAHs could have contaminated soil. The likely shotfall zone, the area between 375 to 680 feet from the firing point, is the area where the highest concentrations of MC are expected; although the potential for MC exists within the entire SDZ (900-foot radius from the shooting field). However, it is not likely that the range of the clay pigeons would extend farther out then the likely shotfall zone. Therefore, it is unclear whether PAHs are a SKT-related concern outside of the likely shotfall zone, whereas lead is a concern beyond the boundary of the likely shotfall zone.

The potential for contribution to environmental impacts to soil at SKT from other NASB-related operations/activities make it difficult to assess PAH contributory effects from the SKT. Historical activities have resulted in limited metals and PAHs, primarily associated with shallow surface soil, with lead shot encountered in one location near the firing point and pigeon fragments present near the firing point in two locations, and within the Site 6 boundary in one location. In areas where soil has been disturbed, especially north of the Impoundment Ponds, soil which was originally present during the time when the SKT was in operation was probably moved around, i.e., regraded, to accommodate construction activities. The areas where regrading has occurred has not been documented formally, but it is assumed that where parking lots, buildings, and areas cleared of trees are present, that soil may have been moved to some extent. Therefore, in these areas (Figures 1 through 3), soil impacted by SKT activities could be present at depths greater than 12 inches bgs due to construction activities.

The media at Site 6 and Site 11, and within the Site 9 Ash Excavation Area are not considered sources for contaminant migration, because the original soil was removed, and the sites were regraded. Therefore, no sampling is proposed within the Site 6 and Site 11 boundaries, and the Site 9 Ash Excavation Area.

During precipitation events, shallow surface soils may transport contamination to deep surface soils through infiltration or as overland runoff toward the Impoundment Ponds. Once at the Impoundment Ponds, soil is deposited at the bottom of the ponds as sediment or remains in the water column as suspended sediment load. Due to the complexity of potential sources of contaminants in sediment and surface water in the Impoundment Ponds, these media and potential migration routes will be addressed through investigation under a separate cover. Only evaluating soil risks as a part of this RI will likely initially underestimate cumulative site risks to receptors also exposed to surface water and sediment. However, it is anticipated that a soil remedial action will be needed to be protective of human health and the environment at the Skeet Range and the Navy would like to mitigate those soil risks prior to conducting a comprehensive risk assessment of all site media. It is anticipated that overall site-wide risks following soil remediation will be nominal, and that any soil-to-sediment and soil-to-surface water pathway will be removed. Upon completion of the sediment and surface water investigations all site data (i.e., relevant soil, sediment, and surface water) will be evaluated collectively to determine site risks to those receptors potentially exposed to all three media.

Groundwater is assumed to not have been impacted by contaminants from SKT activities, because of the apparent incomplete migration pathway and because of the tendency of contaminants (primarily lead and PAHs) at SKT to remain immobile in soils. Therefore, groundwater is not considered a media of concern for this RI; however, after RI data are available the potential risk to groundwater will be discussed with the stakeholders.

Figure 4 is the conceptual site model (CSM). In the future, most of the SKT will be slated for community mixed use, which includes residential use, business and technology industries use, and recreational use. Therefore, potential human receptors are residents, business and technology industry workers, and recreational users. Potential human exposure pathways are ingestion, dermal contact, and inhalation of shallow surface soil. Potential ecological exposure pathways are possible via ingestion, dermal contact, and inhalation of shallow surface soil or plants which have absorbed contaminants. The PSLs that were chosen were selected as a result of the evaluation of the receptors and exposure pathways discussed above, and the lowest criterion for each analyte was selected. Section 9 presents the PSLs and reference to each applicable criterion.

Five metals (antimony, arsenic, cobalt, lead, and manganese) and several PAHs exceeded PALs in surface soil during the SI. However, the metals aluminum, antimony, arsenic, barium, beryllium, chromium, cadmium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, vanadium, and zinc were detected in the SI in sediment samples at concentrations exceeding PALs, and the metals aluminum, barium, cadmium, iron, lead, and manganese were detected in the SI in surface water at concentrations exceeding PALs. Because potential migration pathways exist between surface soil, sediment, and surface water, surface soil samples in the RI will be analyzed for all TAL metals except for thallium and silver (hereafter referred to as Metals), rather than the limited list of metals detected in surface soils during the SI. Thallium and silver did not exceed PALs in any medium (sediment, surface water, shallow surface soil or deep surface soil) sampled in the SI; therefore, these metals are not a concern.

5.0 Data Quality Objectives/Systematic Planning Process Statements

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

Project quality objectives (PQOs) for the SKT RI are presented in this section. The PQOs document the environmental decisions that need to be made at a site, as well as the level of data quality necessary to support these decisions. To establish PQOs for the site, the USEPA's 7-step Data Quality Objectives (DQO) Process was followed (USEPA, 2005).

5.1 PROBLEM DEFINITION

As a result of historic activities at SKT, contaminants may be present in shallow surface and/or deep surface soil that may present a potentially unacceptable risk to current and future receptors. The nature of contamination from SKT activities was defined in the SI. The extent of impacted soil from SKT activities needs to be defined, and risks to human health and the environment must be evaluated.

5.2 IDENTIFY INFORMATION INPUTS

The following data was collected during the SI and/or will be collected at SKT during the RI:

1. Soil Lithology Data - will be used to characterize surface soils at the site, to refine the site conceptual model and to understand the fate and transport of contaminants in the environment. In areas where soil has been disturbed by construction activities (especially north of the Impoundment Ponds), a soil core will be collected to 4 feet bgs to attempt to identify native (i.e., undisturbed) material. If native soil is detected within 4 ft bgs in reworked sample location areas, then a soil sample will be collected over a two foot depth interval that included approximately 1 foot of native material and 1 foot of reworked material. If native soil is not encountered at 4 ft bgs then a sample will be collected from 1 to 3 ft bgs.

2. Laboratory-Analyzed Chemical Data – Surface soil was analyzed in the SI for TAL metals, PAHs and explosives. Surface and subsurface soil will be analyzed in the RI for TAL metals except for thallium and silver (hereafter referred to as Metals) and PAHs. Sediment and surface water were analyzed in the SI for TAL metals; no additional RI analyses are planned for these media at this time. Section #9 lists all chemicals to be analyzed. The sampling methods are presented in Section #8, and the analytical methods are presented in Section #9. SI and RI data will be used to assess risk to human and ecological receptors and to define the extent of surface soil contamination at SKT.

3. PSLs - The analytical data will be compared to the PSLs to select COPCs and to conduct the risk assessments. PSLs are identified in Section 9 and in this section the minimum value of all applicable criteria that were considered is presented.

4. Background Data – Site data will be compared to background using lines-of-evidence such as the pending MEDEP background PAH values which are expected to be added to Maine's Remedial Action Guidelines (RAGs) Appendix 1 and 2 tables. If a contaminant concentration exceeds the associated PSL but is within background then that contaminant will not be selected as a COPC for the site-specific risk assessment[1].

5. Spatial Location Data – Coordinates will be collected at each sampling location and the analytical data will be plotted spatially at each sample location. The analytical data for each sample location will then be interpreted based on those spatial relationships. This is important for SKT because it is possible that nearby site activities could have resulted in impacts to the SKT, which are not related to the SKT. When the data is evaluated in the RI, any discernable patterns, especially near other potential sources, will be flagged for further evaluation in the RI. If any data gaps exist in proximity to other potential point sources, those will be identified, then addressed in the uncertainty analysis.

5.3 DELINEATION OF STUDY BOUNDARY

The following items address the horizontal and vertical boundaries for the RI sampling.

- The population of interest is surface soil in areas which have not been disturbed, and all soil to 4 feet bgs or native material (whichever is shallower) where soil has potentially been disturbed (Figures 1 through 3). Surface soil within the SKT boundary (Figures 1 through 3) may have been contaminated directly by releases and indirectly by the subsequent migration of contaminants.

- The vertical boundaries for SKT are described below:
  - Shallow Surface Soil in areas where soil has not been disturbed: 0 to 3 inches bgs.
  - Deep Surface Soil in areas where soil has not been disturbed: 3 to 12 inches bgs.
  - Surface soil in areas where soil has been disturbed: 0 to 12 inches bgs

[1] In addition to the site-specific risk assessment a cumulative risk assessment, that includes risks from chemicals screened out at the COPC selection phase of the site-specific risk assessment due to background, will be completed to aid in risk management decisions. See Appendix B for more information.

- Subsurface Soil in areas where soil has been disturbed (shown on Figures 1 through 3): attempt to identify soil to native material or a depth of 4 feet bgs (whichever is shallower).

5.4 DECISION RULES

The following decision rules were developed for the RI.

A. If the concentration of any PAH or metal in any surface soil sample collected on the perimeter of the SKT boundary (horizontal and vertical) is greater than its respective PSL and background concentrations, then the project team will re-evaluate the CSM and DQOs to determine whether additional sampling is necessary to complete the delineation. Factors to be considered by the project team when re-evaluating the CSM, if necessary, include the extent of delineation achieved from the initial sampling versus the cost of additional sampling as well as the consequences of incomplete delineation. If all PAH and metals concentrations in all surface soil samples collected on the perimeter are less than PSLs, then it will be concluded that the PAH and/or metals contamination is delineated.

B. If human health risks associated with potential exposures to surface soils in any exposure unit (exposure units will be defined following sample analysis) exceed an Incremental Lifetime Cancer Risk (ILCR) of 1E-5 or a Hazard Index (HI) of 1 for the future hypothetical lifelong resident exposure scenario (as evaluated in accordance with the methodology in Appendix B), or if EPA target blood-lead concentration[2] criterion is exceeded, then convene with the project team to consider potential options for riskreduction. If human health risks associated with potential exposures to surface soil are less than an ILCR of 1E-5 and a HI of 1 and USEPA target blood-lead concentration criterion are met for the future hypothetical lifelong resident exposure scenario then conclude that human health risks associated with exposure to surface soil are acceptable.

C. If the Ecological Risk Assessment (ERA) evaluating surface soil roposed in Appendix C concludes that risks to plants, soil invertebrates, or wildlife are unacceptable in any exposure unit, then convene

[2] Lead will be evaluated using the USEPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in children Windows Version 1.1, Build 11. Exposure of adults (workers and recreational users) to lead will be evaluated by the adult exposure model (USEPA TRW). The results of the IEUBK modeling are given in terms of the probability that exposed children will exceed a 10 microgram per deciliter (µg/dL) blood-lead level. The output of the USEPA TRW is the probability that elevated fetal blood-lead concentrations (i.e., concentrations greater than 10 µg/dL) will result due to exposures to women of childbearing age. Those probabilities are compared to the U.S. EPA goal of limiting the probability of exceeding a 10 µg/dL blood-lead concentration to 5 percent.

with the project team to consider potential options for risk reduction, otherwise recommend no further action for protection of the environment.

5.5 PERFORMANCE OR ACCEPTANCE CRITERIA

The data will be concluded to be of sufficient type, number, and quality if they satisfy the data validation criteria and the usability assessment requirements. In general, this requires that the data be representative of the targeted surface soil population, that the data be generated by sufficiently sensitive analytical methods that are operating within Quality Control (QC) limits, and the data are considered to be comparable in terms of quality and representativeness in light of project objectives and decision rules. Laboratory QC limits and PSLs are presented in subsequent worksheets.

5.6 DETAILED PLAN FOR OBTAINING DATA

Section #7 presents the plan for obtaining data. Enough data will be collected to support a risk assessment for surface soils at SKT.

6.0 Field Quality Control Samples

Measurement Performance Criteria (MPC) Table – Field QC Samples

QC Sample	Analytical Group(s)	Frequency	Data Quality Indicators (DQIs)	MPC
Equipment Rinsate Blanks	Metals	One per 20 field samples per matrix per sampling equipment[1].	Accuracy/Bias/ Contamination	No analytes ≥ ½ Limit of Quantitation (LOQ)
	PAHs			
Field Duplicate	Metals	One per 10 field samples collected for fixed-base laboratory analysis.	Precision	Values > 5X LOQ: Relative Percent Difference (RPD) ≤ 30%[2]
	PAHs			RPD ≤ 30%[3]
Temperature Blank	Metals and PAHs	One per cooler	Representativeness	Mercury (soil only) and PAHs: Temperature must be ≤ 6 °C.

Notes:

1 – Equipment rinsate blanks will be collected if non-dedicated sampling equipment is used. For disposable equipment, one sample per type of disposable equipment will be collected.

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

3 – If duplicate values for PAHs are < 2x LOQ, professional judgment will be used for data qualification.

7.0 Sampling Design and Rationale

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

A judgmental sampling design was selected for SKT. The SKT sampling strategy consists of a biased sampling design aimed at supplementing the SI surface soil sample locations and delineating the spatial extent of contamination at the site in order to assess risk to human and ecological receptors. Biased sampling designs will be employed in the two distinct vertical horizons that will be sampled. Those horizons include shallow surface soil (0 to 3 inches) and deep surface soil (3 to 12 inches bgs) within the range fan area of both the pre-1950 and post-1950 range orientations in undisturbed areas. In disturbed areas, the horizons include surface soil (0 to 12 inches) and subsurface soil as discussed below. It will not be possible to collect surface soil samples at some areas within both range fan footprints due to the presence of structures, or concrete and asphalt paved areas.

A total of 166 new samples will be collected from 83 new locations within the SKT (Figure 5). Surface soil sample locations within the shotfall area have been chosen to fill gaps in the data collected during the SI. It should be noted that 24 of the individual surface soil samples collected during the SI (Table 1) were analyzed only for lead using XRF methods only (i.e., no fixed-base lab analysis was conducted). Those sample locations will be re-sampled so that comprehensive analytical results are obtained to define the extent of contamination in shallow surface soils at the SKT. It should also be noted that at 16 of the SI surface soil sample locations, only the 0 to 3 inch bgs interval was sampled. Those sample locations will be revisited to sample the 3 to 12 inch bgs interval so that comprehensive analytical results are obtained to define the extent of contamination in deep surface soils at the SKT. Sample locations on the periphery of the shotfall area are being collected to bound the contamination horizontally. It will not be possible to collect surface soil samples at some areas within both range fan footprints due to the presence of structures, or paved areas. These areas include the structures and paved areas in the northern and eastern sections of the pre-1950 SKT range fan. In areas where soil has been disturbed by construction activities (Figures 1 through 3) (especially north of the Impoundment Ponds), a soil core will be collected up to 4 feet bgs to attempt to identify native (i.e., undisturbed) material. If native material can be identified, then the 2-foot interval above native material will be collected and analyzed in the laboratory. If native material can't be identified, then the 1 to 3 foot interval will be collected and sent to the laboratory for analysis. A total of 27 sample locations have been identified for subsurface soil sampling. Three of these are previous SI sample locations (XRF-SS14, XRF-SS25, and XRF-SS05), and will be resampled from 0 to 12 inches bgs and the subsurface interval.

The media at Site 6 and Site 11 is not considered a source for contaminant migration, because the original soil was removed, and the site was regraded. Therefore, no sampling is proposed within the Site 6 boundary or the Site 11 boundary.

The media within the Ash Excavation Area at Site 9 is not considered a source for contaminant migration, because the original soil was removed, and backfill was put in place. Therefore, no sampling is proposed within the Ash Excavation Area. However, additional sample coverage is warranted within the Site 9 area to attempt to assess impacts from SKT within Site 9.

8.0 FIELD PROJECT IMPLEMENTATION (Field Project Instructions)

8.1 FIELD PROJECT TASKS

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

Summary of Project Tasks

Sampling Tasks:

- Mobilization/demobilization, sample locating and utility clearance
- Site-specific health and safety training
- Monitoring equipment calibration
- Soil sampling (including soil core collection)
- Equipment decontamination
- Investigation-derived waste (IDW) handling
- Field documentation Quality Assurance (QA)/QC
- Analytical Tasks

Mobilization/Demobilization, Sample Locating and Utility Clearance: Mobilization/demobilization activities include: field equipment procurement and transport to the work site, subcontractor procurement and coordination, utility awareness and clearance, location and setup of areas for decontamination and waste storage, acquisition of vehicles, and establishment of an on-site staging area. Equipment requirements will be finalized by the Tetra Tech FOL following the acceptance of the SAP. The Tetra Tech FOL will review the scope of work and assemble equipment (e.g., sampling, personal protection, and decontamination equipment) to implement and complete the field investigations.
This list of equipment will be reviewed by the Project Team and the Tetra Tech PM. The Tetra Tech FOL will be responsible for receiving and unpacking the equipment and ensuring that all equipment is operable and calibrated. The Tetra Tech FOL will be responsible for tracking equipment used in the field. The Tetra Tech FOL will be responsible for coordinating associated field activities with the analytical laboratory, Katahdin Analytical Services, Inc. (Katahdin). The Tetra Tech Project Chemist will be responsible for coordinating the analytical services and the acquisition and delivery of sample containers to the site.

Prior to mobilization, the Tetra Tech FOL will review the roles and responsibilities of each field team member and review the requirements of the various field activities. A series of meetings will be conducted to review the sampling and analytical requirements. Upon mobilization, the Tetra Tech FOL will ensure that all field personnel have read and understand this SAP and the associated Health and

safety Plan (HASP), and that all non-health and safety-related equipment is available and operational. The SSHO will ensure that all health and safety-related equipment is available and operational. The SSHO or designee will be responsible for reviewing the HASP with the field team members and subcontractors. Daily safety meetings will be held each morning by the Tetra Tech FOL to briefly address the days planned activities.

Upon completion of all site investigation activities, the Tetra Tech FOL and field crew will demobilize from the site and transport field equipment back to the Tetra Tech office or third party vendor, as necessary. All sample location pin flags will be removed from the sites, work areas will be thoroughly checked, and trash will be bagged and disposed of in a trash dumpster outside the field office.

Prior to utility clearance, Tetra Tech will mobilize to the site to mark the soil sample locations. The sample locations will be loaded into a Global Positioning System (GPS) unit with sub-meter accuracy and located onsite using this instrument. The utility clearance will be conducted in accordance with Tetra Tech Standard Operating Procedure (SOP) HS-1.0. All project-specific Tetra Tech SOPs are located in Appendix D.

Site-Specific Health and Safety Training: Each site worker will be required to have completed appropriate Hazardous Waste Operations and Emergency Response (HAZWOPER) training (40-hour course and annual 8-hour refresher) specified in Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120 (e). Project-specific safety requirements will be addressed in greater detail in the site-specific HASP.

Monitoring Equipment Calibration: Field equipment will be calibrated by the FOL or designee in accordance with manufacturer' guidance. Documentation of the field equipment calibration is required. Field equipment should be calibrated at the beginning and end of each day, unless otherwise stated by the equipment manufacturer. No field equipment [such as a photoionization detector (PID)] is planned that needs to be calibrated; however, the HASP may require field monitoring.

Soil Sampling: Soil cores will be collected in order to attempt to identify the native or undisturbed soil horizon. The cores will be collected to a maximum depth of 4 feet bgs preferably with a soil corer in accordance with Tetra Tech SOP SA-1.3. A hand auger may be used if the soil cover cannot achieve the required depth. Soil samples will be collected using stainless steel or disposable trowels, in accordance with Tetra Tech SOP SA-1.3. The soil sample will be described by the Tetra Tech field representative in accordance with Tetra Tech SOP GH-1.5 and handled in accordance with Tetra Tech SOP SA-6.1. Any qualitative visual signs of potential contamination (such as soil staining) will be noted on soil sample log sheets, as well as on the boring log.

Equipment Decontamination: All reusable sampling equipment (e.g., stainless steel trowels and hand augers, etc.) will be decontaminated prior to sampling and between samples, according to the sequence established in Tetra Tech SOP SA-7.1 (Decontamination of Field Sampling Equipment).

Investigation-Derived Waste Management: IDW will consist of decontamination water from cleaning field equipment, and will be containerized by Tetra Tech in accordance with Tetra Tech SOOP SA-7.1 in Department of Transportation (DOT)-approved (DOT specification 17C) 55-gallon drums and stored in a centralized location pending characterization for disposal. Disposable trowels and personal protective equipment will be properly bagged and disposed of.

Field Documentation QA/QC: Field documentation will be performed in accordance with Tetra Tech SOP SA-6.3. A summary of all field activities will be properly recorded in a bound logbook with consecutively number pages that will not be removed. Logbooks will be assigned to field personnel and will be stored in a secured area when not in use. Equipment rinsate blank and field duplicate samples will be collected as presented in Sections #6, 8.3, and 8.4. Details of these samples will be documented on QA sample log sheets.

Analytical Tasks: Chemical analyses for metals and PAHs will be performed by Katahdin, which is a Department of Defense (DoD) Environmental Laboratory Approval Program (ELAP) – certified for the target analytes and analytical groups that will be reported. A copy of this laboratory certification can be found in Appendix E. Analyses will be performed in accordance with the analytical methods identified in Section #8.4. The laboratory will strive to meet the PSLs specified in Section #9. The laboratory will perform the chemical analyses following laboratory-specific SOPs (Section #10). Results will be reported in analytical data packages and an electronic data deliverable (EDD).

The analytical data packages provided by Katahdin must be in a Contract Laboratory Program (CLP)-like format and must be fully validatable containing raw data, summary forms for all sample and laboratory method blank data, and summary forms containing all method-specific QC information (results, recoveries, RPDs, relative standard deviation [RSDs], and/or percent differences or percent drift [%Ds], etc.

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

The analytical data will be uploaded to the project database and eventually to the Naval Installation Restoration Information Solution (NIRIS).

DATA MANAGEMENT

Data management tasks, including data handling and management, data tracking and control, and data security will be conducted in accordance with Tetra Tech SOP CT-05.

DATA REVIEW

- Data verification and validation are described in Section #12.
- Usability assessment is described as follows:

A data usability assessment will be performed by key individuals (e.g., the project geologist, project chemist, statistician, and risk assessor) as appointed by the PM on behalf of the Project Team. The objective will be to evaluate aspects of data quality and usability in the context of the problem statement and decisions to be made to determine whether the project data are usable as intended. Key elements of this review, several of which relate to performance specifications in field and laboratory SOPs and individual SAP worksheets, are as follows:

- Precision – Ensuring project precision objectives are satisfied and that laboratory precision is no less precise than field precision.

- Accuracy – Ensuring project accuracy objectives are satisfied.

- Sensitivity – Ensuring analytical sensitivity goals were achieved.

- Completeness – Ensuring that all of the scheduled sampling and analysis was completed.

- Comparability – Ensuring secondary and primary data are comparable enough to satisfy project objectives and that current data are projected to be comparable to future data, as necessary.

- Representativeness – Ensuring samples were collected from the intended locations and depths, and at the specified times, and that the analyses were conducted as specified in this SAP.

These evaluations require reviews across data packages rather than the individual data package reviews conducted during data validation. For calculating temporal trends, data correlations, background comparisons, outlier identification, etc., non-detects will be represented by the Limit of Detection (LOD).

If significant usability limitations are identified, the Tetra Tech PM will determine how best to represent the data limitations. These limitations will be shared with the rest of the Project Team for their evaluation before finalization of the project report.

Documentation and Records:

- Documentation of sample location coordinates, borings logs, chain of custody forms, samples logs, and shipping documents for all samples.
- The EDDs and corresponding databases will be formatted in Navy EDD format.

Data Packages:

- Receipt of analytical data packages from the fixed-base laboratory.
- Generation of Tetra Tech data validation reports.

Data Review Tasks:

- The fixed-base laboratory will verify that all samples listed on the chain of custody are analyzed in accordance with methods specified on the chain of custody form, the laboratory scope of work, and in this SAP. Data verification and validation will be performed by Tetra Tech as provided in Section #12. A data validation report will be produced for each Sample Delivery Group (SDG).

- All field data records and validated data will be reviewed by Tetra Tech to determine the usability of the data. The outcome of this assessment will be conveyed to the project team for agreement before the project report is finalized. Data limitations pertaining to PQOs and PSLs will be identified, and corrective actions will be taken as necessary.

Field Project Implementation (Field Project Instructions), continued

8.2 FIELD SOPS REFERENCE TABLE

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

SOP Reference Number	Title/Author	Revision Date or Version Number	Location of SOP (if not included in the SAP)	Any planned deviation for Project Work
HS-1.0	Utility Locating and Excavation Clearance	12/03	NA	See Appendix D for SOP markups
SA-1.3	Soil Sampling	04/08		
GH-1.5	Borehole and Sample Logging	06/99		
SA-7.1	Decontamination of Field Equipment and Waste Handling	01/09		
SA-6.3	Field Documentation	03/09		
CT-05	Database Records and Quality Assurance	01/01		
SA-6.1	Non-Radiological Sample Handling	02/04		

Field Project Implementation (Field Project Instructions), continued

8.3 SAMPLE DETAILS TABLE

(UFP-QAPP Manual Sections 3.1.1 and 3.5.2.3)

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-XRF-SS01	NASB-SKT-XRF-SS01-0312-MMYY	Soil	0.25-1.0	Interval was not sampled during the SI	Metals and PAHs	1	HS--01, SA-1.3, CT-05, SA-6.1, SA-6.3, SA-7.1, GH-1.5
NASB-SKT-XRF-SS02	NASB-SKT-XRF-SS02-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS03	NASB-SKT-XRF-SS03-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS04	NASB-SKT-XRF-SS04-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS05	NASB-SKT-XRF-SS05-0012-MMYY		0-1.0	The 3 to 12 inch interval was not sampled during the SI, sample 0 to 12 inches in the RI because the area has been disturbed by construction activities.		1	
	NASB-SKT-XRF-SS05-NNNN-MMYY		2-foot interval above native material	Determine native soil horizon depth and vertical extent of contamination from SKT activities in areas where construction may have moved soil which was at the surface during SKT activities		1	
NASB-SKT-XRF-SS06	NASB-SKT-XRF-SS03-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS07	NASB-SKT-XRF-SS07-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS08	NASB-SKT-XRF-SS08-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS09	NASB-SKT-XRF-SS09-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS10	NASB-SKT-XRF-SS10-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS11	NASB-SKT-XRF-SS11-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS12	NASB-SKT-XRF-SS12-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS13	NASB-SKT-XRF-SS13-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS13-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS14	NASB-SKT-XRF-SS14-0012-MMYY		0.0-1.0	Sample was analyzed using XRF only in the SI, sample 0 to 12 inches in the RI because the area has been disturbed by construction activities.		1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
	NASB-SKT-XRF-SS14-NNNN-MMYY		2-foot interval above native material	Determine native soil horizon depth and vertical extent of contamination from SKT activities in areas where construction may have moved soil which was at the surface during SKT activities		1	
NASB-SKT-XRF-SS15	NASB-SKT-XRF-SS15-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS15-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS16	NASB-SKT-XRF-SS16-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS16-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS17	NASB-SKT-XRF-SS17-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS18	NASB-SKT-XRF-SS18-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS18-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS19	NASB-SKT-XRF-SS19-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS20	NASB-SKT-XRF-SS20-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS20-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS21	NASB-SKT-XRF-SS21-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS22	NASB-SKT-XRF-SS22-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS22-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS23	NASB-SKT-XRF-SS23-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS23-0312-MMYY		0.25-1.0	Sample was analyzed using XRF only in the SI		1	
NASB-SKT-XRF-SS24	NASB-SKT-XRF-SS24-0003-MMYY		0.0-0.25	Sample was analyzed using XRF only in the SI		1	
	NASB-SKT-XRF-SS24-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-XRF-SS25	NASB-SKT-XRF-SS25-0012-MMYY		0.0-0.1.0	Sample from 0 to 3 inches was analyzed using XRF only in the SI, and sample from 3 to 12 inches was not sampled during the SI. Sample 0 to 12 inches in the RI because the area has been disturbed by construction activities.		1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
	NASB-SKT-XRF-SS25-NNNN-MMYY		2-foot interval above native material	Determine native soil horizon depth and vertical extent of contamination from SKT activities in areas where construction may have moved soil which was at the surface during SKT activities		1	
NASB-SKT-XRF-SS26	NASB-SKT-XRF-SS26-0312-MMYY		0.25-1.0	Interval was not sampled during the SI		1	
NASB-SKT-SB27	NASB-SKT-SS27-0003		0.0-0.25	Define extent of contamination between firing point and likely shotfall zone		1	
	NASB-SKT-SB27-0312		0.25-1.0			1	
NASB-SKT-SB28	NASB-SKT-SS28-0003		0.0-0.25			1	
	NASB-SKT-SB28-0312		0.25-1.0			1	
NASB-SKT-SB29	NASB-SKT-SS29-0003		0.0-0.25			1	
	NASB-SKT-SB29-0312		0.25-1.0			1	
NASB-SKT-SB30	NASB-SKT-SS30-0003		0.0-0.25			1	
	NASB-SKT-SB30-0312		0.25-1.0			1	
NASB-SKT-SB31	NASB-SKT-SS31-0003		0.0-0.25			1	
	NASB-SKT-SB31-0312		0.25-1.0			1	
NASB-SKT-SB32	NASB-SKT-SS32-0003		0.0-0.25			1	
	NASB-SKT-SB32-0312		0.25-1.0			1	
NASB-SKT-SB33	NASB-SKT-SS33-0003		0.0-0.25			1	
	NASB-SKT-SB33-0312		0.25-1.0			1	
NASB-SKT-SB34	NASB-SKT-SS34-0003		0.0-0.25			1	
	NASB-SKT-SB34-0312		0.25-1.0			1	
NASB-SKT-SB35	NASB-SKT-SS35-0003		0.0-0.25			1	
	NASB-SKT-SB35-0312		0.25-1.0			1	
NASB-SKT-SB36	NASB-SKT-SS36-0003		0.0-0.25			1	
	NASB-SKT-SB36-0312		0.25-1.0			1	
NASB-SKT-SB37	NASB-SKT-SS37-0003		0.0-0.25			1	
	NASB-SKT-SB37-0312		0.25-1.0			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB38	NASB-SKT-SS38-0003		0.0-0.25			1	
	NASB-SKT-SB38-0312		0.25-1.0			1	
NASB-SKT-SB39	NASB-SKT-SS39-0003		0.0-0.25			1	
	NASB-SKT-SB39-0312		0.25-1.0			1	
NASB-SKT-SB40	NASB-SKT-SS40-0003		0.0-0.25			1	
	NASB-SKT-SB40-0312		0.25-1.0			1	
NASB-SKT-SB41	NASB-SKT-SS41-0003		0.0-0.25			1	
	NASB-SKT-SB41-0312		0.25-1.0			1	
NASB-SKT-SB42	NASB-SKT-SS42-0003		0.0-0.25			1	
	NASB-SKT-SB42-0312		0.25-1.0			1	
NASB-SKT-SB43	NASB-SKT-SS43-0003		0.0-0.25			1	
	NASB-SKT-SB43-0312		0.25-1.0			1	
NASB-SKT-SB44	NASB-SKT-SS44-0003		0.0-0.25			1	
	NASB-SKT-SB44-0312		0.25-1.0			1	
NASB-SKT-SB45	NASB-SKT-SS45-0003		0.0-0.25			1	
	NASB-SKT-SB45-0312		0.25-1.0			1	
NASB-SKT-SB46	NASB-SKT-SS46-0003		0.0-0.25			1	
	NASB-SKT-SB46-0312		0.25-1.0			1	
NASB-SKT-SB49	NASB-SKT-SS49-0003		0.0-0.25	Define extent of contamination within likely shotfall zone, and for samples located in areas where construction have occurred, determine native soil horizon depth and vertical extent of contamination from SKT activities in areas where construction may have moved soil which was at the surface during SKT activities.		1	
	NASB-SKT-SB49-0312		0.25-1.0			1	
NASB-SKT-SB50	NASB-SKT-SS50-0003		0.0-0.25			1	
	NASB-SKT-SB50-0312		0.25-1.0			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB51	NASB-SKT-SS51-0012		0.0-1.0			1	
	NASB-SKT-SB51-NNNN		2-foot interval above native material			1	
NASB-SKT-SB52	NASB-SKT-SS52-0012		0.0-1.0			1	
	NASB-SKT-SB52-NNNN		2-foot interval above native material			1	
NASB-SKT-SB53	NASB-SKT-SS53-0003		0.0-0.25			1	
	NASB-SKT-SB53-0312		0.25-1.0			1	
NASB-SKT-SB54	NASB-SKT-SS54-0003		0.0-0.25			1	
	NASB-SKT-SB54-0312		0.25-1.0			1	
NASB-SKT-SB55	NASB-SKT-SS55-0003		0.0-0.25			1	
	NASB-SKT-SB55-0312		0.25-1.0			1	
NASB-SKT-SB56	NASB-SKT-SS56-0003		0.0-0.25			1	
	NASB-SKT-SB56-0312		0.25-1.0			1	
NASB-SKT-SB57	NASB-SKT-SS57-0003		0.0-0.25			1	
	NASB-SKT-SB57-0312		0.25-1.0			1	
NASB-SKT-SB58	NASB-SKT-SS58-0003		0.0-0.25			1	
	NASB-SKT-SB58-0312		0.25-1.0			1	
NASB-SKT-SB59	NASB-SKT-SS59-0003		0.0-0.25			1	
	NASB-SKT-SB59-0312		0.25-1.0			1	
NASB-SKT-SB60	NASB-SKT-SS60-0003		0.0-0.25			1	
	NASB-SKT-SB60-0312		0.25-1.0			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB61	NASB-SKT-SS61-0003		0.0-0.25			1	
	NASB-SKT-SB61-0312		0.25-1.0			1	
NASB-SKT-SB62	NASB-SKT-SS62-0003		0.0-0.25			1	
	NASB-SKT-SB62-0312		0.25-1.0			1	
NASB-SKT-SB63	NASB-SKT-SS63-0003		0.0-0.25			1	
	NASB-SKT-SB63-0312		0.25-1.0			1	
NASB-SKT-SB64	NASB-SKT-SS64-0003		0.0-0.25			1	
	NASB-SKT-SB64-0312		0.25-1.0			1	
NASB-SKT-SB65	NASB-SKT-SS65-0003		0.0-0.25			1	
	NASB-SKT-SB65-0312		0.25-1.0			1	
NASB-SKT-SB66	NASB-SKT-SS66-0012		0.0-1.0			1	
	NASB-SKT-SB66-NNNN		2-foot interval above native material				
NASB-SKT-SB67	NASB-SKT-SS67-0003		0.0-0.25			1	
	NASB-SKT-SB67-0312		0.25-1.0			1	
NASB-SKT-SB47	NASB-SKT-SB47-0003		0.0-0.25	Define extent of contamination beyond likely shotfall zone to edge of SDZ, and for samples located in areas where construction have occurred, determine native soil horizon depth and vertical extent of contamination from SKT activities in areas where construction may have moved soil which was at the surface during SKT activities.			
	NASB-SKT-SB47-0312		0.25-1.0				
NASB-SKT-SB48	NASB-SKT-SB48-0003		0.0-0.25				
	NASB-SKT-SB48-0312		0.25-1.0				
NASB-SKT-SB68	NASB-SKT-SS68-0012		0.0-1.0			1	
	NASB-SKT-SB68-NNNN		2-foot interval above native material			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB69	NASB-SKT-SS69-0012		0.0-1.0			1	
	NASB-SKT-SB69-NNNN		2-foot interval above native material			1	
NASB-SKT-SB70	NASB-SKT-SS70-0012		0.0-1.0			1	
	NASB-SKT-SB70-NNNN		2-foot interval above native material			1	
NASB-SKT-SB71	NASB-SKT-SS71-0012		0.0-1.0			1	
	NASB-SKT-SB71-NNNN		2-foot interval above native material			1	
NASB-SKT-SB72	NASB-SKT-SS72-0012		0.0-1.0			1	
	NASB-SKT-SB72-NNNN		2-foot interval above native material			1	
NASB-SKT-SB73	NASB-SKT-SS73-0012		0.0-1.0			1	
	NASB-SKT-SB73-NNNN		2-foot interval above native material			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB74	NASB-SKT-SS74-0003		0.0-0.25			1	
	NASB-SKT-SB74-0312		0.25-1.0			1	
NASB-SKT-SB75	NASB-SKT-SS75-0012		0.0-1.0			1	
	NASB-SKT-SB75-NNNN		2-foot interval above native material			1	
NASB-SKT-SB76	NASB-SKT-SS76-0012		0.0-1.0			1	
	NASB-SKT-SB76-NNNN		2-foot interval above native material			1	
NASB-SKT-SB77	NASB-SKT-SS77-0012		0.0-1.0			1	
	NASB-SKT-SB77-NNNN		2-foot interval above native material			1	
NASB-SKT-SB78	NASB-SKT-SS78-0012		0.0-1.0			1	
	NASB-SKT-SB78-NNNN		2-foot interval above native material			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB79	NASB-SKT-SS79-0012		0.0-1.0			1	
	NASB-SKT-SB79-NNNN		2-foot interval above native material			1	
NASB-SKT-SB80	NASB-SKT-SS80-0003		0.0-0.25			1	
	NASB-SKT-SB80-0312		0.25-1.0			1	
NASB-SKT-SB81	NASB-SKT-SS81-0003		0.0-0.25			1	
	NASB-SKT-SB81-0312		0.25-1.0			1	
NASB-SKT-SB82	NASB-SKT-SS82-0012		0.0-1.0			1	
	NASB-SKT-SB82-NNNN		2-foot interval above native material			1	
NASB-SKT-SB83	NASB-SKT-SS83-0003		0.0-0.25			1	
	NASB-SKT-SB83-0312		0.25-1.0			1	
NASB-SKT-SB84	NASB-SKT-SS84-0003		0.0-0.25			1	
	NASB-SKT-SB84-0312		0.25-1.0			1	
NASB-SKT-SB85	NASB-SKT-SS85-0003		0.0-0.25			1	
	NASB-SKT-SB85-0312		0.25-1.0			1	
NASB-SKT-SB86	NASB-SKT-SS86-0003		0.0-0.25			1	
	NASB-SKT-SB86-0312		0.25-1.0			1	
NASB-SKT-SB87	NASB-SKT-SS87-0003		0.0-0.25			1	
	NASB-SKT-SB87-0312		0.25-1.0			1	
NASB-SKT-SB88	NASB-SKT-SS88-0003		0.0-0.25			1	
	NASB-SKT-SB88-0312		0.25-1.0			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB89	NASB-SKT-SS89-0003		0.0-0.25			1	
	NASB-SKT-SB89-0312		0.25-1.0			1	
NASB-SKT-SB90	NASB-SKT-SS90-0003		0.0-0.25			1	
	NASB-SKT-SB90-0312		0.25-1.0			1	
NASB-SKT-SB91	NASB-SKT-SS91-0003		0.0-0.25			1	
	NASB-SKT-SB91-0312		0.25-1.0			1	
NASB-SKT-SB92	NASB-SKT-SS92-0003		0.0-0.25			1	
	NASB-SKT-SB92-0312		0.25-1.0			1	
NASB-SKT-SB93	NASB-SKT-SS93-0003		0.0-0.25			1	
	NASB-SKT-SB93-0312		0.25-1.0			1	
NASB-SKT-SB94	NASB-SKT-SS94-0003		0.0-0.25			1	
	NASB-SKT-SB94-0312		0.25-1.0			1	
NASB-SKT-SB95	NASB-SKT-SS95-0003		0.0-0.25			1	
	NASB-SKT-SB95-0312		0.25-1.0			1	
NASB-SKT-SB96	NASB-SKT-SS96-0012		0.0-1.0			1	
	NASB-SKT-SB96-NNNN		2-foot interval above native material			1	
NASB-SKT-SB97	NASB-SKT-SS97-0012		0.0-1.0			1	
	NASB-SKT-SB97-NNNN		2-foot interval above native material			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB98	NASB-SKT-SS98-0012		0.0-1.0			1	
	NASB-SKT-SB98-NNNN		2-foot interval above native material			1	
NASB-SKT-SB99	NASB-SKT-SS99-0012		0.0-1.0			1	
	NASB-SKT-SB99-NNNN		2-foot interval above native material			1	
NASB-SKT-SB100	NASB-SKT-SS100-0012		0.0-1.0			1	
	NASB-SKT-SB100-NNNN		2-foot interval above native material			1	
NASB-SKT-SB101	NASB-SKT-SS101-0012		0.0-1.0			1	
	NASB-SKT-SB101-NNNN		2-foot interval above native material			1	
NASB-SKT-SB103	NASB-SKT-SS103-0003		0.0-0.25			1	
	NASB-SKT-SB103-0312		0.25-1.0			1	
NASB-SKT-SB104	NASB-SKT-SS104-0003		0.0-0.25			1	
	NASB-SKT-SB104-0312		0.25-1.0			1	
NASB-SKT-SB105	NASB-SKT-SS105-0003		0.0-0.25			1	
	NASB-SKT-SB105-0312		0.25-1.0			1	

Sampling Location	Sample ID	Matrix	Depth (feet bgs)	Rationale	Analytical Group	Number of Samples	Sampling SOP Reference
NASB-SKT-SB106	NASB-SKT-SS106-0003		0.0-0.25			1	
	NASB-SKT-SB106-0312		0.25-1.0			1	
NASB-SKT-SB107	NASB-SKT-SS107-0003		0.0-0.25			1	
	NASB-SKT-SB107-0312		0.25-1.0			1	
NASB-SKT-SB108	NASB-SKT-SS108-0003		0.0-0.25			1	
	NASB-SKT-SB108-0312		0.25-1.0			1	
NASB-SKT-SB109	NASB-SKT-SS109-0003		0.0-0.25			1	
	NASB-SKT-SB109-0312		0.25-1.0			1	
NASB-SKT-SB110	NASB-SKT-SS110-0012		0.0-1.0			1	
	NASB-SKT-SB110-NNNN		2-foot interval above native material			1	

Additional columns may be added if additional classification of samples is needed.

8.4 ANALYTICAL SOP REQUIREMENTS TABLE

Laboratory point of contact, e-mail address, and phone number: Kelly Perkins, kperkins@katahdinlabs.com 207-874-2400
Laboratory Name and Address:
Katahdin Analytical Services, 600 Technology Way Scarborough, ME 04074
Data Package Turnaround time: 21 calendar days
Tentative Sampling Dates: Winter 2011/2012

MATRIX	ANALYTICAL GROUP	ANALYTICAL AND PREPARATION METHOD/ SOP REFERENCE	CONTAINERS (number, size, and type)	SAMPLE VOLUME (units)	PRESERVATION REQUIREMENTS (chemical, temperature, light protected)	MAXIMUM HOLDING TIME (preparation/ analysis)
Soils	Metals	SW-846 3050B, 6010C, 6020A, 7471B/ CA-605, CA-608, CA-611, CA-627	4-ounce (oz) wide mouth jar	2 gram (g)	Mercury: Cool to ≤ 6 ^{o}C	180 days to analysis except for mercury; 28 days to analysis for mercury
	PAHs	SW-846 3540C or 3550C, 8270D SIM/CA-213, CA-512 or CA-526	8-oz wide mouth jar	30 g	Cool to ≤ 6 ^{o}C	14 days to extraction; 40 days to analysis
Aqueous QC samples	Metals	SW-846 3010A, 6020A, 6010C, 7470A/ CA-604, CA-608, CA-627	One - 500 milliliter (mL) polyethylene bottle	50 mL	Nitric acid (HNO_3) to pH <2	180 days to analysis except for mercury; 28 days to analysis for mercury
	PAHs	SW-846 3510C or 3520C, 8270D SIM/ CA-213, CA-502	Two 1-liter (L) amber glass bottles	1000 mL	Cool to ≤ 6 ^{o}C	7 days to extraction; 40 days to analysis

9.0 Reference Limits and Evaluation Tables

Matrix : Soil

Parameter: Metals by SW-846 methods as indicated

Analyte	CAS Number	Project Screening Level (mg/kg)	PSL Reference[1]	Project Quantitation Limit Goal (mg/kg)	Katahdin		
					LOQ (mg/kg)	LOD (mg/kg)	Detection Limit (DL) (mg/kg)
ALUMINUM (6010C)	7429-90-5	7700	EPA	2570	30	10	0.71
ANTIMONY (6020A)	7440-36-0	0.27	EcoSSL	0.09	0.1	0.05	0.020
ARSENIC (6020A)	**7440-38-2**	**0.39**	**EPA**	**0.13**	**0.5**	**0.4**	**0.15**
BARIUM (6010C)	7440-39-3	330	EcoSSL	110	0.5	0.3	0.026
BERYLLIUM (6010C)	7440-41-7	10	ORNL	3.3	0.5	0.05	0.0068
CADMIUM (6010C)	**7440-43-9**	**0.36**	**EcoSSL**	**0.12**	**1.0**	**0.3**	**0.0079**
CALCIUM (6010C)	7440-70-2	--	--	--	10	8	1.8
CHROMIUM (6010C)	7440-47-3	0.29	EPA	8.7	1.5	0.4	0.026
COBALT (6010C)	**7440-48-4**	**2.3**	**EPA**	**0.77**	**3.0**	**0.4**	**0.029**
COPPER (6010C)	7440-50-8	28	EcoSSL	9.3	2.5	1	0.16
IRON (6010C)	7439-89-6	5500	EPA	1830	10	8	1.4
LEAD (6010C)	7439-92-1	11	EcoSSL	3.7	0.5	0.4	0.087
MERCURY (7471B)	7439-97-6	2.3	EPA	0.33	0.033	0.017	0.0052
MAGNESIUM (6010C)	7439-95-4	--	--	--	10	8	0.68
MANGANESE (6010C)	7439-96-5	220	EcoSSL	73.3	0.5	0.4	0.16
NICKEL (6010C)	7440-02-0	38	EcoSSL	12.7	4.0	0.4	0.044
POTASSIUM (6010C)	7440-09-7	--	--	NA	100	50	2.9
SELENIUM (6020A)	7782-49-2	0.52	EcoSSL	0.17	0.5	0.30	0.039
SODIUM (6010C)	7440-23-5	--	--	--	100	50	1.5
VANADIUM (6010C)	7440-62-2	7.8	EcoSSL	2.6	2.5	0.4	0.037
ZINC (6010C)	7440-66-6	46	EcoSSL	15.3	2.5	1.2	0.17

Matrix: Soil

Parameter: PAHs by SW-846 8270D Selective Ion Method (SIM)

Analyte	CAS Number	Project Screening Level (PSL) (mg/kg)	PSL Reference[1]	Project Quantitation Limit Goal (mg/kg)	Katahdin		
					LOQ (mg/kg)	LOD (mg/kg)	DL (mg/kg)
1-METHYLNAPHTHALENE	90-12-0	22	EPA	7	0.020	0.010	0.0017
2-METHYLNAPHTHALENE	91-57-6	29	EcoSSL	10	0.020	0.010	0.0022
ACENAPHTHENE	83-32-9	20	ORNL	7	0.020	0.010	0.0015
ACENAPHTHYLENE[2]	208-96-8	29	EcoSSL	10	0.020	0.010	0.0012
ANTHRACENE	120-12-7	2.5	CCME	0.8	0.020	0.010	0.0012
BENZO (A) ANTHRACENE	56-55-3	0.15	EPA	0.05	0.020	0.010	0.0019
BENZO (A) PYRENE	**50-32-8**	**0.015**	**EPA**	**0.005**	**0.020**	**0.010**	**0.0033**
BENZO (B) FLUOROANTHENE	205-99-2	0.15	EPA	0.05	0.020	0.010	0.0024
BENZO (G,H,I) PERYLENEPERYLENE[3]	191-24-2	1.1	EcoSSL	0.4	0.020	0.010	0.002
BENZO (K) FLUOROANTHENE	207-08-9	1.1	EcoSSL	0.4	0.020	0.010	0.0031
CHRYSENE	218-01-9	1.1	EcoSSL	0.4	0.020	0.010	0.0017
DIBENZO (A,H)ANTHRACENE	**53-70-3**	**0.015**	**EPA**	**0.005**	**0.020**	**0.010**	**0.0018**
FLUORANTHENE	206-44-0	29	EcoSSL	10	0.020	0.010	0.0018
FLUORENE	86-73-7	29	EcoSSL	10	0.020	0.010	0.0032
INDENO (1,2,3-CD)PYRENE	193-39-5	0.15	EPA	0.05	0.020	0.010	0.0019
NAPHTHALENE	91-20-3	1	LANL	0.3	0.020	0.010	0.0026
PHENANTHRENE	85-01-8	29	EcoSSL	10	0.020	0.010	0.0018
PYRENE	129-00-0	1.1	EcoSSL	0.4	0.020	0.010	0.0021

Bolded and highlighted rows indicate that the project screening level is less than the laboratory LOD.

Bolded rows indicate that the project screening level is less than the laboratory LOQ.

Any limitations on data use that result from having detection limits that are greater than project screening levels must be evaluated by the Project Team prior to making site decisions based on those data.

EPA risk-based screening values based on adverse non-carcinogenic effects were divided by 10 to account for potential cumulative adverse effects on target organs or systems.

Footnotes

1 Soil screening references:

Human Health
EPA – U.S. EPA Regions 3, 6 and 9 Residential Soil Screening Level (June 2011).

Ecological Sources in order of preference
EcoSSL – EPA Ecological Soil Screening Levels (U.S. EPA, 2003, 2005, 2006, 2007, 2008)
CCME – Canadian Council of Ministers of the Environment (1999, 2001, 2010)
ORNL – Oak Ridge National Laboratory Toxicological Benchmarks for plants and invertebrates (Efroymson et al., 1997a and 1997b)
Los Alamos – ECORISK Database (Los Alamos, 2009)

Appendix A contains a table (Table A-3) listing all candidate screening levels evaluated when selecting the PSLs listed in the table above.

Acronyms
CAS = Chemical Abstract Service
LOD = Limit of detection
LOQ = Limit of quantitation
mg/kg = milligrams per kilogram
TAL = Target Analyte List
PAH = Polycylic Aromatic Hydrocarbons
PSL = Project Screening Level

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)
CA-213	Analysis of Semivolatile Organic Compounds By: SW 846 Method 8270 – Modified For Selected Ion Monitoring (SIM), 04/10, Revision 8.	Definitive	Soil and aqueous QC samples /PAHs	Gas Chromatography (GC)/Mass Spectroscopy (MS)	Katahdin	N	N
CA-502	Preparation Of Aqueous Samples For Extractable Semivolatile Analysis, 10/09, Revision 6.	Definitive	Aqueous QC samples / PAHs Extraction	Not applicable (extraction)	Katahdin	N	N
CA-512	Preparation Of Sediment/Soil Samples By Sonication Using Method 3550 For Subsequent Extractable Semi-Volatiles Analysis, 08/10, Revision 8.	Definitive	Soil/ /PAHs Extraction	Not applicable (extraction)	Katahdin	N	N
CA-526	Preparation Of Sediment/Soil Samples By Soxhlet Extraction Using Method 3540 For Subsequent Extractable Semivolatile Analysis, 08/10, Revision 7.	Definitive	Soil/PAHs Extraction	Not applicable (extraction)	Katahdin	N	N
CA-604	Acid Digestion of Aqueous Samples by EPA Method 3010 for Inductively Coupled Plasma (ICP) and ICP-Mass Spectrometer (MS) Analysis of Total or Dissolved Metals, 04/10, Revision 5.	Definitive	Aqueous QC samples/Metals Digestion	Not applicable (digestion)	Katahdin	N	N
CA-605	Acid Digestion of Solid Samples by USEPA Method 3050 for Metals by ICP-AES and ICPMS, 09/10, Revision 5.	Definitive	Soil/Metals Digestion	Not applicable (digestion)	Katahdin	N	N
CA-608	Trace Metals Analysis By ICP-AES Using EPA Method 6010, 06/10, Revision 11.	Definitive	Soiland aqueous QC samples /Metals	Inductively Coupled Plasma (ICP) - Atomic Emission Spectroscopy (AES)	Katahdin	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)
CA-611	Digestion and Analysis of Solid Samples for Mercury by USEPA Method 7471, 12/10, Revision 8.	Definitive	Soil/Mercury	Mercury Analyzer	Katahdin	N	N
CA-615	Digestion and Analysis of Aqueous Samples for Mercury by USEPA Method 7470, 04/10, Revision 5.	Definitive	Aqueous QC samples /Mercury	Mercury Analyzer	Katahdin	N	N
CA-627	Trace Metals Analysis By ICP-MS Using USEPA Method 6020, 04/10, Revision 7.	Definitive	Soil aqueous QC samples /Metals	Inductively Coupled Plasma (ICP) – Mass Spectroscopy (MS)	Katahdin	N	N

11.0 Laboratory QC Samples Table

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

Matrix	Soil and aqueous field quality control samples
Analytical Group	PAHs
Analytical Method/ SOP Reference	SW-846 8270D SIM / CA-213

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
Method Blank	One per preparation batch of twenty or fewer samples of similar matrix.	No target compounds > ½ LOQ..	(1) Investigate source of Contamination. (2) Evaluate the samples and associated QC: i.e.If the blank results are above the LOQ, then report samples that are <LOD or > 10X the blank result. Reprepare a blank and the remaining samples.	Analyst, Supervisor	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
Surrogate	3 per sample: 2-Methylnaphthalene-D10 Fluorene-D10 Pyrene-D10.	%Rs must meet the following %Rs: 2-Methylnaphthalene-D10 Soil: 19-94 Aqueous: 43-92 Fluorene-d10 Soil: 20-96 Aqueous: 29-101 Pyrene-d10 Soil: 31-128 Aqueous: 53-166	(1) Check chromatogram for interference; if found, then flag data. (2) If not found, then check instrument performance; if problem is found, then correct and reanalyze. (3) If still out, then re-extract and analyze sample. (4) If reanalysis is out, then flag data.	Analyst, Supervisor	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Control Sample (LCS)	One per preparation batch of twenty or fewer samples of similar matrix.	%Rs must meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. If Laboratory Control Sample Duplicate (LCSD) performed - The RPD between LCS and LCSD must be ≤ 30%.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available. Refer to DOD Quality System Manual (QSM) Version 4.1 Table G-1 for number of marginal exceedences allowed. Contact Client if samples cannot be reprepared within hold time.	Analyst, Supervisor	Accuracy / Bias	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil and aqueous field quality control samples
Analytical Group	PAHs
Analytical Method/ SOP Reference	SW-846 8270D SIM / CA-213

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
Matrix Spike (MS)/Matrix Spike Duplicate (MSD) (not applicable for rinsate blanks)	One per SDG or every 20 samples.	%Rs should meet the DoD QSM Version 4.1 limits as per Appendix G of the DoD QSM. The RPD between MS and MSD should be ≤ 30%.	Corrective Action will not be taken for samples when recoveries are outside limits and surrogate and LCS criteria are met. If both the LCS and MS/MSD are unacceptable re-prepare the samples and QC.	Analyst, Supervisor	Precision/Accuracy/ Bias	Same as Method/SOP QC Acceptance Limits.
Internal Standard	Six per sample – 1,4-Dichlorobenzene-d4 Naphthalene-d8 Acenaphthene-d10 Phenanthrene-d10 Chrysene-d12 Perylene-d12	Retention times for internal standards must be ± 30 seconds and the responses within -50% to +100% of the ICAL midpoint.	Inspect mass spectrometer or gas chromatograph for malfunctions. Mandatory reanalysis of samples analyzed while system was malfunctioning.	Analyst, Supervisor	Accuracy/ Bias	Same as Method/SOP 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.

Please note that limits are updated periodically and may change from the issuance of the final SAP to the time data validation is performed. The limits used for validation of PAH data will be the limits that are current at the time of analysis.

Matrix	Soil and Aqueous field quality control samples
Analytical Group	Metals (ICP-AES) and Mercury
Analytical Method/ SOP Reference	SW-846 6010C/7470A/ 7471B CA-604, CA-608, CA-615

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
Method Blank	One per digestion batch of 20 or fewer samples.	No analytes detected > ½ the LOQ.	Correct the problem. If method blank is >½ the LOQ, then: 1) Report sample results that are <LOD or sample results >10x the blank concentration without corrective action. 2) For samples with results > LOD and < 10x the contaminated blank result, re-prepare/re-digest and reanalyze the method blank and associated samples.	Analyst, Supervisor	Bias/Contamination	Same as QC Acceptance Limits.
LCS	One per digestion batch of 20 or fewer samples.	Water and soil sample %Rs must be between 80 and 120%, allowing for the marginal exceedances presented in DoD QSM Table G-1..	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Same as QC Acceptance Limits.
Duplicate Sample (not applicable for rinsate blanks)	One per preparation batch of twenty or fewer samples of similar matrix.	The RPD should be within ≤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.
MS (not applicable for rinsate blanks)	One per digestion batch of 20 or fewer samples.	Recovery should be ± 20% of the true value if sample < 4x spike added.	Flag results for affected analytes for all associated samples with ”N”.	Analyst, Supervisor	Accuracy/Bias	Same as QC Acceptance Limits.

Matrix	Soil and Aqueous field quality control samples
Analytical Group	Metals (ICP-AES) and Mercury
Analytical Method/ SOP Reference	SW-846 6010C/7470A/ 7471B CA-604, CA-608, CA-615

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
ICP Serial Dilution (not applicable for rinsate blanks, and not applicable for mercury)	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x the LOQ, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst, Supervisor	Accuracy/Bias	Same as QC Acceptance Limits.
Post Digestion Spike (does not apply to mercury)	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 interference. Spike addition should produce a concentration of 10-100x LOQ.	Flag results of samples of same matrix as estimates in SDG narrative.	Analyst, Supervisor	Precision	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 (ICP-MS)
Analytical Method/ SOP Reference	SW846 6020A / CA-627

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
Method Blank	One per digestion batch of 20 or fewer samples of similar matrix.	No target metals > ½ LOQ.	Correct the problem. Report sample results that are <LOD or >10x the blank concentration. Reprepare and reanalyze the method blank and all associated samples with results > LOD and < 10x the contaminated blank result.	Analyst, Supervisor	Bias/contamination	Same as Method/SOP QC Acceptance Limits.
LCS	One per digestion batch of 20 or fewer samples of similar matrix.	Water and Soil: %R must be within 80-120%, allowing for the marginal exceedances presented in DoD QSM Table G-1.	Redigest and reanalyze all associated samples for affected analyte.	Analyst, Supervisor	Accuracy/Bias/ Contamination	Same as Method/SOP QC Acceptance Limits.
MS (not applicable for rinsate blanks)	One per sample delivery group (SDG) or every 20 samples.	%R should be within 80-120%if sample < 4x spike added.	Flag results for affected analytes for all associated samples with ”N”.	Analyst, Supervisor	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Post-digestion Spike (not applicable for rinsate blanks)	Project-specific frequency: When MS recovery fails or analyte concentration in all samples < 50x LOD	%R should be within 75-125%.	Run associated samples by method of standard addition or flag results.	Analyst, Supervisor	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
Laboratory Duplicate (not applicable for rinsate blanks)	One per sample delivery group (SDG) or every 20 samples.	If values are ≥ 5x LOQ, RPD should be ≤ 20%. If values are < 5x LOQ, Absolute Difference should be ≤ LOQ.	Flag results for affected analytes for all associated samples.	Analyst, Supervisor	Precision	Same as Method/SOP QC Acceptance Limits.

Matrix	Soil
Analytical Group	Metals (ICP-MS)
Analytical Method/ SOP Reference	SW846 6020A / CA-627

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria (MPC)
ICP Serial Dilution (not applicable for rinsate blanks)	One per preparation batch of twenty or fewer samples of similar matrix.	If original sample result is at least 50x LOQ, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.	Analyst, Supervisor	Accuracy/Bias	Same as Method/SOP QC Acceptance Limits.
IS	Appropriate IS required for all analytes in all samples. Mass of IS must be <50 amu different from that of analyte	For each sample, IS intensity within 30-120% of that of initial calibration standard.	Reanalyze affected samples.	Analyst, Supervisor	Accuracy/Bias	Same as Method/SOP 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

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, Katahdin 2 - Data Validators, Tetra Tech	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, Katahdin	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, Katahdin	Internal
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

Data Review Input	Description	Responsible for Verification (name, organization)	Internal/ 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 ensure sample integrity from sample collection to analysis.	Data Validators, Tetra Tech	External
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 PSLs to the laboratory EDDs. Flag samples and notify the Tetra Tech PM of samples that exceed PSLs listed in 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 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 Measurement Performance Criteria (MPCs) and determine the impact of any deviations on the technical usability of the data.	Data Validators, Tetra Tech	External

12.1 VALIDATION SUMMARY

One hundred percent of the laboratory metals data will undergo a USEPA Region I Tier III validation, as defined in the Region I Environmental Protection Agency Northeast (EPA-NE) Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part I, Attachment B (USEPA, 1996a). Project-specific criteria for metals by SW-846 6010C, 6020A, 7470A, and 7471B listed in this SAP and the DoD QSM will be used to validate the metals data. The logic outlined in Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part IV, November 2008 (USEPA, November 2008) will be used to apply qualifiers to data to the extent possible. The final data validation report will include a technical memorandum, qualified analytical results, results as reported by the laboratory, Region I worksheets (where appropriate), and documentation to support data qualification. All data will be flagged by an appropriate qualifying symbol.

One hundred percent of the laboratory PAH data will undergo a USEPA Region I Tier III validation, as defined in the Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part I, Attachment B (USEPA, 1996a). Project-specific criteria for PAHs by SW-846 8270D SIM are listed in this SAP and the DoD QSM will be used to validate PAH data. The logic outlined in Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part II, December 1996 (USEPA, 1996b) will be used to apply qualifiers to data to the extent possible. The final data validation report will include a technical memorandum, qualified analytical results, results reported by the laboratory, Region I worksheets (where appropriate), and documentation to support data qualification. All data will be flagged by an appropriate qualifying symbol.

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TABLE 1

SITE INSPECTION SOIL SAMPLE COLLECTION AND ANALYSIS SUMMARY
SKEET RANGE
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

SAMPLE LOCATION[1]	SAMPLE ID	SAMPLE DEPTH (feet bgs)	JULY 2009 XRF SAMPLE TO CONFIRM SITE FOOTPRINT	SAMPLE RESULT USED IN SITE INVESTIGATION					
				JULY 2009 XRF CALCULATED LEAD RESULT USE RATIONALE	DECEMBER 2009 FIXED BASE LABORATORY ANALYSIS				
					TAL METALS (SW 846-6010B)	pH, CEC, TOC	Nitroglycerin (SW 846-8332)	DINITROLUENE (SW 846-8330A)	PAHs (USEPA-8270C SIM)
SKT-SS01	NASB-SKT-SS01-0003	0 - 0.25	X	not used - FBL data available	X	--	X	X	X
SKT-SS02	NASB-SKT-SS02-0003	0 - 0.25	X	not used - FBL data available	X	--	X	X	X
SKT-SS03	NASB-SKT-SS03-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS04	NASB-SKT-SS04-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS05	NASB-SKT-SS05-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS06	NASB-SKT-SS06-0003	0 - 0.25	X	not used - FBL data available	X	X	--	--	X
SKT-SS06	NASB-SKT-SS06-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS07N	NASB-SKT-SS07N-0003	0 - 0.25	X	not used - background sample	--	--	--	--	--
SKT-SS07S	NASB-SKT-SS07S-0003	0 - 0.25	X	not used - background sample	--	--	--	--	--
SKT-SS07E	NASB-SKT-SS07E-0003	0 - 0.25	X	not used - background sample	--	--	--	--	--
SKT-SS07W	NASB-SKT-SS07W-0003	0 - 0.25	X	not used - background sample	--	--	--	--	--
SKT-SS07	NASB-SKT-SS07-0003	0 - 0.25	X	not used - background sample	X	X	--	--	X
SKT-SS07	NASB-SKT-SS07-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS08	NASB-SKT-SS08-0003	0 - 0.25	X	not used - FBL data available	X	X	--	--	X
SKT-SS08	NASB-SKT-SS08-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS09	NASB-SKT-SS09-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS10	NASB-SKT-SS10-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS11	NASB-SKT-SS11-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS12	NASB-SKT-SS12-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS13	NASB-SKT-SS13-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS13	NASB-SKT-SS13-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS14	NASB-SKT-SS14-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS14	NASB-SKT-SS14-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS15	NASB-SKT-SS15-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS15	NASB-SKT-SS15-0312	0.25 - 1.0	X	not used due to poor XRF correlation in sample >100 mg/kg	--	--	--	--	--
SKT-SS16	NASB-SKT-SS16-0003	0 - 0.25	X	not used due to poor XRF correlation in sample >100 mg/kg	--	--	--	--	--
SKT-SS16	NASB-SKT-SS16-0312	0.25 - 1.0	X	not used due to poor XRF correlation in sample >100 mg/kg	--	--	--	--	--
SKT-SS17	NASB-SKT-SS17-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS17	NASB-SKT-SS17-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS18	NASB-SKT-SS18-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS18	NASB-SKT-SS18-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS19	NASB-SKT-SS19-0003	0 - 0.25	X	not used - FBL data available	X	X	X	X	X
SKT-SS19	NASB-SKT-SS19-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS20	NASB-SKT-SS20-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS20	NASB-SKT-SS20-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS21	NASB-SKT-SS21-0003	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SS21	NASB-SKT-SS21-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS22	NASB-SKT-SS22-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS22	NASB-SKT-SS22-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS23	NASB-SKT-SS23-0003	0 - 0.25	X	not used due to poor XRF correlation in sample >100 mg/kg	--	--	--	--	--
SKT-SS23	NASB-SKT-SS23-0312	0.25 - 1.0	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS24	NASB-SKT-SS24-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS25	NASB-SKT-SS25-0003	0 - 0.25	X	**XRF calculated lead result used**	--	--	--	--	--
SKT-SS26	NASB-SKT-SS26-0003	0 - 0.25	--	not analyzed using XRF - FBL data available	X	--	X	X	X
SKT-SB01	NASB-SKT-SB01-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	X	X	X
SKT-SB01	NASB-SKT-SB01-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	X	X	X
SKT-SB02	NASB-SKT-SB02-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	X	X	X
SKT-SB02	NASB-SKT-SB02-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	X	X	X
SKT-SB03	NASB-SKT-SB03-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X

TABLE 1

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SKEET RANGE
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

SAMPLE LOCATION[1]	SAMPLE ID	SAMPLE DEPTH (feet bgs)	JULY 2009 XRF SAMPLE TO CONFIRM SITE FOOTPRINT	SAMPLE RESULT USED IN SITE INVESTIGATION					
				JULY 2009 XRF CALCULATED LEAD RESULT USE RATIONALE	DECEMBER 2009 FIXED BASE LABORATORY ANALYSIS				
					TAL METALS (SW 846-6010B)	pH, CEC, TOC	Nitroglycerin (SW 846-8332)	DINITROLUENE (SW 846-8330A)	PAHs (USEPA-8270C SIM)
SKT-SB03	NASB-SKT-SB03-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB03	NASB-SKT-SB03-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X
SKT-SB04	NASB-SKT-SB04-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB04	NASB-SKT-SB04-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X
SKT-SB05	NASB-SKT-SB05-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB05	NASB-SKT-SB05-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X
SKT-SB06	NASB-SKT-SB06-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB06	NASB-SKT-SB06-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X
SKT-SB07	NASB-SKT-SB07-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB07	NASB-SKT-SB07-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X
SKT-SB08	NASB-SKT-SB08-0003/0312	0 - 0.25	X	not used - FBL data available	X	--	--	--	X
SKT-SB08	NASB-SKT-SB08-0003/0312	0.25 - 1.0	X	not used - FBL data available	X	--	--	--	X

X = Indicates sample was collected and analyzed as proposed in the Uniform Federal Policy Sampling and Analysis Plan (UFP-SAP) (Tetra Tech, 2009)
bgs = Below ground surface.
CEC = Cation exchange capacity.
FBL = Fixed-base laboratory.
HA = Hand auger.
PD = Ponar Dredge.
PS = Polyethylene scoop.
SS = Surface soil.
SB = Soil
SKT = Skeet Range.
1. SKT-SS01 through SKT-SS08 are a different sample locations than SKT-SB01 through SKT-SB08.

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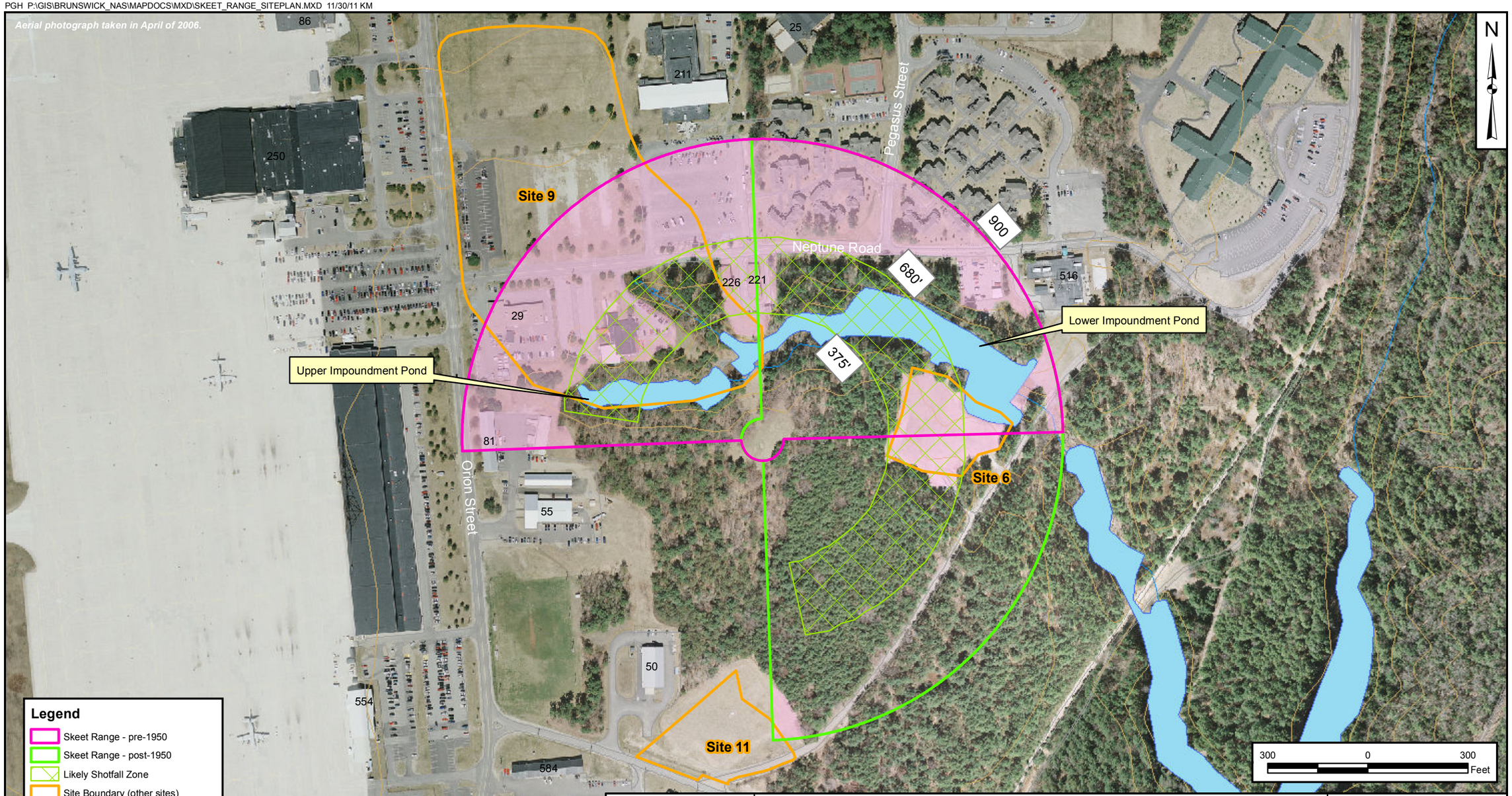

DRAWN BY J. ENGLISH	DATE 09/03/10	TETRA TECH	CONTRACT NUMBER N62472-03-D-0057
CHECKED BY S. WARINO	DATE 11/30/11	SKEET RANGE SITE PLAN FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
REVISED BY K. MOORE	DATE 11/30/11		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 1 / REV 1

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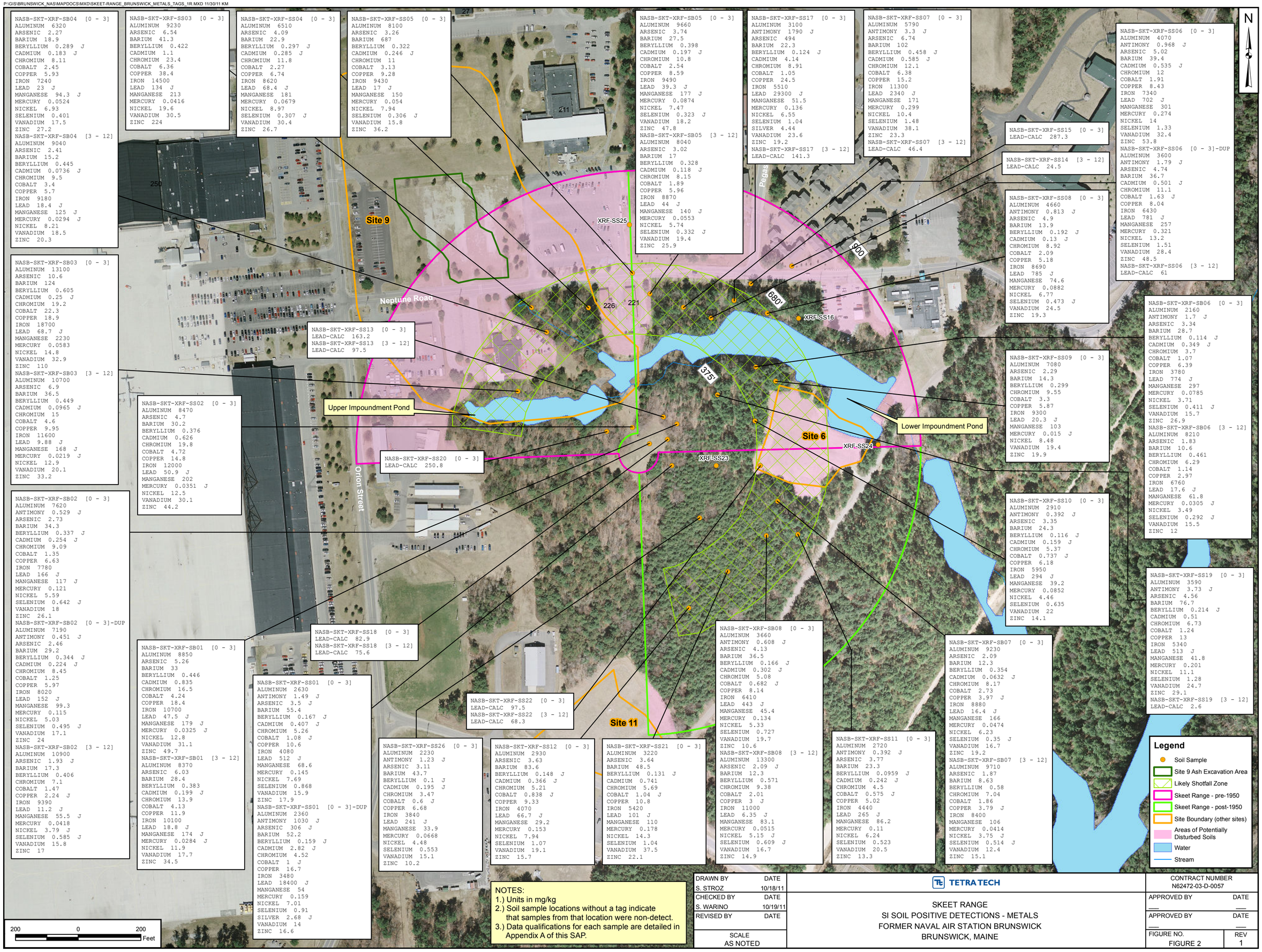


NASB-SKT-XRF-SB04 [0 - 3]
ALUMINUM 6320
ARSENIC 2.27
BARIUM 18.9
BERYLLIUM 0.289 J
CADMIUM 0.183 J
CHROMIUM 8.11
COBALT 2.45
COPPER 5.93
IRON 7240
LEAD 23 J
MANGANESE 94.3 J
MERCURY 0.0524
NICKEL 6.93
SELENIUM 0.401
VANADIUM 17.5
ZINC 27.2
NASB-SKT-XRF-SB04 [3 - 12]
ALUMINUM 9040
ARSENIC 2.41
BARIUM 15.2
BERYLLIUM 0.445
CADMIUM 0.0736 J
CHROMIUM 9.5
COBALT 3.4
COPPER 5.7
IRON 9180
LEAD 18.4 J
MANGANESE 125 J
MERCURY 0.0294 J
NICKEL 8.21
VANADIUM 18.5
ZINC 20.3

NASB-SKT-XRF-SS03 [0 - 3]
ALUMINUM 9230
ARSENIC 6.54
BARIUM 41.3
BERYLLIUM 0.422
CADMIUM 1.1
CHROMIUM 23.4
COBALT 6.36
COPPER 38.4
IRON 14500
LEAD 134 J
MANGANESE 213
MERCURY 0.0416
NICKEL 19.6
VANADIUM 30.5
ZINC 224

NASB-SKT-XRF-SS04 [0 - 3]
ALUMINUM 6510
ARSENIC 4.09
BARIUM 22.9
BERYLLIUM 0.297 J
CADMIUM 0.285 J
CHROMIUM 11.8
COBALT 2.27
COPPER 6.74
IRON 8620
LEAD 68.4 J
MANGANESE 181
MERCURY 0.0679
NICKEL 8.97
SELENIUM 0.307 J
VANADIUM 30.4
ZINC 26.7

NASB-SKT-XRF-SS05 [0 - 3]
ALUMINUM 8100
ARSENIC 3.26
BARIUM 687
BERYLLIUM 0.322
CADMIUM 0.246 J
CHROMIUM 11
COBALT 3.13
COPPER 9.28
IRON 9430
LEAD 17 J
MANGANESE 150
MERCURY 0.054
NICKEL 7.94
SELENIUM 0.306 J
VANADIUM 15.8
ZINC 36.2

NASB-SKT-XRF-SB05 [0 - 3]
ALUMINUM 9660
ARSENIC 3.74
BARIUM 27.5
BERYLLIUM 0.398
CADMIUM 0.197 J
CHROMIUM 10.8
COBALT 2.54
COPPER 8.59
IRON 9490
LEAD 39.3 J
MANGANESE 177 J
MERCURY 0.0874
NICKEL 7.47
SELENIUM 0.323 J
VANADIUM 18.2
ZINC 47.8
NASB-SKT-XRF-SB05 [3 - 12]
ALUMINUM 8040
ARSENIC 3.02
BARIUM 17
BERYLLIUM 0.328
CADMIUM 0.118 J
CHROMIUM 8.15
COBALT 1.89
COPPER 5.96
IRON 8870
LEAD 44 J
MANGANESE 140 J
MERCURY 0.0553
NICKEL 5.74
SELENIUM 0.332 J
VANADIUM 19.4
ZINC 25.9

NASB-SKT-XRF-SS17 [0 - 3]
ALUMINUM 3100
ANTIMONY 1790 J
ARSENIC 494
BARIUM 22.3
BERYLLIUM 0.124 J
CADMIUM 4.14
CHROMIUM 8.91
COBALT 1.05
COPPER 24.5
IRON 5510
LEAD 29300 J
MANGANESE 51.5
MERCURY 0.136
NICKEL 6.55
SELENIUM 1.04
SILVER 4.44
VANADIUM 23.6
ZINC 19.2
NASB-SKT-XRF-SS17 [3 - 12]
LEAD-CALC 141.3

NASB-SKT-XRF-SS07 [0 - 3]
ALUMINUM 5790
ANTIMONY 3.3 J
ARSENIC 6.74
BARIUM 102
BERYLLIUM 0.458 J
CADMIUM 0.585 J
CHROMIUM 12.1
COBALT 6.38
COPPER 15.2
IRON 11300
LEAD 2340 J
MANGANESE 171
MERCURY 0.299
NICKEL 10.4
SELENIUM 1.48
VANADIUM 38.1
ZINC 23.3
NASB-SKT-XRF-SS07 [3 - 12]
LEAD-CALC 46.4

NASB-SKT-XRF-SS06 [0 - 3]
ALUMINUM 4070
ANTIMONY 0.968 J
ARSENIC 5.02
BARIUM 39.4
CADMIUM 0.535 J
CHROMIUM 12
COBALT 1.91
COPPER 8.43
IRON 7340
LEAD 702 J
MANGANESE 301
MERCURY 0.274
NICKEL 14
SELENIUM 1.33
VANADIUM 32.4
ZINC 53.8
NASB-SKT-XRF-SS06 [0 - 3]-DUP
ALUMINUM 3600
ANTIMONY 1.79 J
ARSENIC 4.74
BARIUM 36.7
CADMIUM 0.501 J
CHROMIUM 11.1
COBALT 1.63 J
COPPER 8.04
IRON 6430
LEAD 781 J
MANGANESE 257
MERCURY 0.321
NICKEL 13.2
SELENIUM 1.51
VANADIUM 28.4
ZINC 48.5
NASB-SKT-XRF-SS06 [3 - 12]
LEAD-CALC 61

NASB-SKT-XRF-SS15 [0 - 3]
LEAD-CALC 287.3

NASB-SKT-XRF-SS14 [3 - 12]
LEAD-CALC 24.5

NASB-SKT-XRF-SS08 [0 - 3]
ALUMINUM 4660
ANTIMONY 0.813 J
ARSENIC 4.9
BARIUM 13.9
BERYLLIUM 0.192 J
CADMIUM 0.13 J
CHROMIUM 8.92
COBALT 2.09
COPPER 5.18
IRON 8690
LEAD 785 J
MANGANESE 74.6
MERCURY 0.0882
NICKEL 6.77
SELENIUM 0.473 J
VANADIUM 24.5
ZINC 19.3

NASB-SKT-XRF-SB06 [0 - 3]
ALUMINUM 2160
ANTIMONY 1.7 J
ARSENIC 3.34
BARIUM 28.7
BERYLLIUM 0.114 J
CADMIUM 0.349 J
CHROMIUM 3.7
COBALT 1.07
COPPER 6.39
IRON 3780
LEAD 774 J
MANGANESE 297
MERCURY 0.0785
NICKEL 3.71
SELENIUM 0.411 J
VANADIUM 15.7
ZINC 26.9
NASB-SKT-XRF-SB06 [3 - 12]
ALUMINUM 8210
ARSENIC 1.83
BARIUM 10.6
BERYLLIUM 0.461
CHROMIUM 6.29
COBALT 1.14
COPPER 2.97
IRON 6760
LEAD 17.6 J
MANGANESE 61.8
MERCURY 0.0305 J
NICKEL 3.49
SELENIUM 0.292 J
VANADIUM 15.5
ZINC 12

NASB-SKT-XRF-SS09 [0 - 3]
ALUMINUM 7080
ARSENIC 2.29
BARIUM 14.3
BERYLLIUM 0.299
CHROMIUM 9.55
COBALT 3.3
COPPER 5.87
IRON 9300
LEAD 20.3 J
MANGANESE 103
MERCURY 0.015 J
NICKEL 8.48
VANADIUM 19.4
ZINC 19.9

NASB-SKT-XRF-SS10 [0 - 3]
ALUMINUM 2910
ANTIMONY 0.392 J
ARSENIC 3.35
BARIUM 24.3
BERYLLIUM 0.116 J
CADMIUM 0.159 J
CHROMIUM 5.37
COBALT 0.737 J
COPPER 6.18
IRON 5950
LEAD 294 J
MANGANESE 39.2
MERCURY 0.0852
NICKEL 4.46
SELENIUM 0.635
VANADIUM 22
ZINC 14.1

NASB-SKT-XRF-SS19 [0 - 3]
ALUMINUM 3590
ANTIMONY 3.73 J
ARSENIC 4.56
BARIUM 76.7
BERYLLIUM 0.214 J
CADMIUM 0.51
CHROMIUM 6.73
COBALT 1.24
COPPER 13
IRON 5340
LEAD 513 J
MANGANESE 41.8
MERCURY 0.201
NICKEL 11.1
SELENIUM 1.28
VANADIUM 24.7
ZINC 29.1
NASB-SKT-XRF-SS19 [3 - 12]
LEAD-CALC 2.6

NASB-SKT-XRF-SB03 [0 - 3]
ALUMINUM 13100
ARSENIC 10.6
BARIUM 124
BERYLLIUM 0.605
CADMIUM 0.25 J
CHROMIUM 19.2
COBALT 22.3
COPPER 18.9
IRON 18700
LEAD 68.7 J
MANGANESE 2230
MERCURY 0.0583
NICKEL 14.8
VANADIUM 32.9
ZINC 110
NASB-SKT-XRF-SB03 [3 - 12]
ALUMINUM 10700
ARSENIC 6.9
BARIUM 36.5
BERYLLIUM 0.449
CADMIUM 0.0965 J
CHROMIUM 15
COBALT 4.6
COPPER 9.95
IRON 11600
LEAD 9.88 J
MANGANESE 168 J
MERCURY 0.0219 J
NICKEL 12.9
VANADIUM 20.1
ZINC 33.2

NASB-SKT-XRF-SS13 [0 - 3]
LEAD-CALC 163.2
NASB-SKT-XRF-SS13 [3 - 12]
LEAD-CALC 97.5

NASB-SKT-XRF-SS02 [0 - 3]
ALUMINUM 8470
ARSENIC 4.7
BARIUM 30.2
BERYLLIUM 0.376
CADMIUM 0.626
CHROMIUM 19.8
COBALT 4.72
COPPER 14.8
IRON 12000
LEAD 50.9 J
MANGANESE 202
MERCURY 0.0351 J
NICKEL 12.5
VANADIUM 30.1
ZINC 44.2

NASB-SKT-XRF-SS20 [0 - 3]
LEAD-CALC 250.8

NASB-SKT-XRF-SB02 [0 - 3]
ALUMINUM 7620
ANTIMONY 0.529 J
ARSENIC 2.73
BARIUM 34.3
BERYLLIUM 0.337 J
CADMIUM 0.254 J
CHROMIUM 9.09
COBALT 1.35
COPPER 6.63
IRON 7780
LEAD 166 J
MANGANESE 117 J
MERCURY 0.121
NICKEL 5.59
SELENIUM 0.642 J
VANADIUM 18
ZINC 26.1
NASB-SKT-XRF-SB02 [0 - 3]-DUP
ALUMINUM 7190
ANTIMONY 0.451 J
ARSENIC 2.46
BARIUM 29.2
BERYLLIUM 0.344 J
CADMIUM 0.224 J
CHROMIUM 8.45
COBALT 1.25
COPPER 5.97
IRON 8020
LEAD 152 J
MANGANESE 99.3
MERCURY 0.115
NICKEL 5.03
SELENIUM 0.495 J
VANADIUM 17.1
ZINC 24
NASB-SKT-XRF-SB02 [3 - 12]
ALUMINUM 10900
ARSENIC 1.93 J
BARIUM 17.3
BERYLLIUM 0.406
CHROMIUM 7.1
COBALT 1.47
COPPER 2.24 J
IRON 9390
LEAD 11.2 J
MANGANESE 55.5 J
MERCURY 0.0418
NICKEL 3.79 J
SELENIUM 0.585 J
VANADIUM 15.8
ZINC 17

NASB-SKT-XRF-SB01 [0 - 3]
ALUMINUM 8850
ARSENIC 5.26
BARIUM 33
BERYLLIUM 0.446
CADMIUM 0.835
CHROMIUM 16.5
COBALT 4.24
COPPER 18.4
IRON 10700
LEAD 47.5 J
MANGANESE 179 J
MERCURY 0.0325 J
NICKEL 12.8
VANADIUM 31.1
ZINC 49.7
NASB-SKT-XRF-SB01 [3 - 12]
ALUMINUM 8370
ARSENIC 6.03
BARIUM 28.4
BERYLLIUM 0.383
CADMIUM 0.199 J
CHROMIUM 13.9
COBALT 4.13
COPPER 11.9
IRON 10100
LEAD 18.8 J
MANGANESE 174 J
MERCURY 0.0284 J
NICKEL 11.9
VANADIUM 17.7
ZINC 34.5

NASB-SKT-XRF-SS18 [0 - 3]
LEAD-CALC 82.9
NASB-SKT-XRF-SS18 [3 - 12]
LEAD-CALC 75.6

NASB-SKT-XRF-SS01 [0 - 3]
ALUMINUM 2630
ANTIMONY 1.49 J
ARSENIC 3.5 J
BARIUM 55.4
BERYLLIUM 0.167 J
CADMIUM 0.407 J
CHROMIUM 5.26
COBALT 1.08 J
COPPER 10.6
IRON 4080
LEAD 512 J
MANGANESE 68.6
MERCURY 0.145
NICKEL 7.69
SELENIUM 0.868
VANADIUM 15.9
ZINC 17.9
NASB-SKT-XRF-SS01 [0 - 3]-DUP
ALUMINUM 2360
ANTIMONY 1030 J
ARSENIC 306 J
BARIUM 52.2
BERYLLIUM 0.159 J
CADMIUM 2.82 J
CHROMIUM 4.52
COBALT 1 J
COPPER 16.7
IRON 3480
LEAD 18400 J
MANGANESE 54
MERCURY 0.159
NICKEL 7.01
SELENIUM 0.91
SILVER 2.68 J
VANADIUM 14
ZINC 16.6

NASB-SKT-XRF-SS22 [0 - 3]
LEAD-CALC 97.5
NASB-SKT-XRF-SS22 [3 - 12]
LEAD-CALC 68.3

NASB-SKT-XRF-SS26 [0 - 3]
ALUMINUM 2230
ANTIMONY 1.23 J
ARSENIC 3.11
BARIUM 43.7
BERYLLIUM 0.1 J
CADMIUM 0.195 J
CHROMIUM 3.47
COBALT 0.6 J
COPPER 6.68
IRON 3840
LEAD 241 J
MANGANESE 33.9
MERCURY 0.0668
NICKEL 4.48
SELENIUM 0.553
VANADIUM 15.1
ZINC 10.2

NASB-SKT-XRF-SS12 [0 - 3]
ALUMINUM 2930
ARSENIC 3.63
BARIUM 83.6
BERYLLIUM 0.148 J
CADMIUM 0.366 J
CHROMIUM 5.21
COBALT 0.838 J
COPPER 9.33
IRON 4070
LEAD 66.7 J
MANGANESE 29.2
MERCURY 0.153
NICKEL 7.94
SELENIUM 1.07
VANADIUM 19.1
ZINC 15.7

NASB-SKT-XRF-SS21 [0 - 3]
ALUMINUM 3220
ARSENIC 3.64
BARIUM 48.5
BERYLLIUM 0.131 J
CADMIUM 0.741
CHROMIUM 5.69
COBALT 1.04 J
COPPER 10.8
IRON 5420
LEAD 101 J
MANGANESE 110
MERCURY 0.178
NICKEL 14.3
SELENIUM 1.04
VANADIUM 37.5
ZINC 22.1

NASB-SKT-XRF-SB08 [0 - 3]
ALUMINUM 3660
ANTIMONY 0.608 J
ARSENIC 4.13
BARIUM 36.5
BERYLLIUM 0.166 J
CADMIUM 0.302 J
CHROMIUM 5.08
COBALT 0.682 J
COPPER 8.14
IRON 6410
LEAD 443 J
MANGANESE 45.4
MERCURY 0.134
NICKEL 5.33
SELENIUM 0.727
VANADIUM 19.7
ZINC 10.6
NASB-SKT-XRF-SB08 [3 - 12]
ALUMINUM 13300
ARSENIC 2.09 J
BARIUM 12.3
BERYLLIUM 0.571
CHROMIUM 9.38
COBALT 2.01
COPPER 3 J
IRON 11000
LEAD 6.35 J
MANGANESE 83.1
MERCURY 0.0515
NICKEL 5.15 J
SELENIUM 0.609 J
VANADIUM 16.7
ZINC 14.9

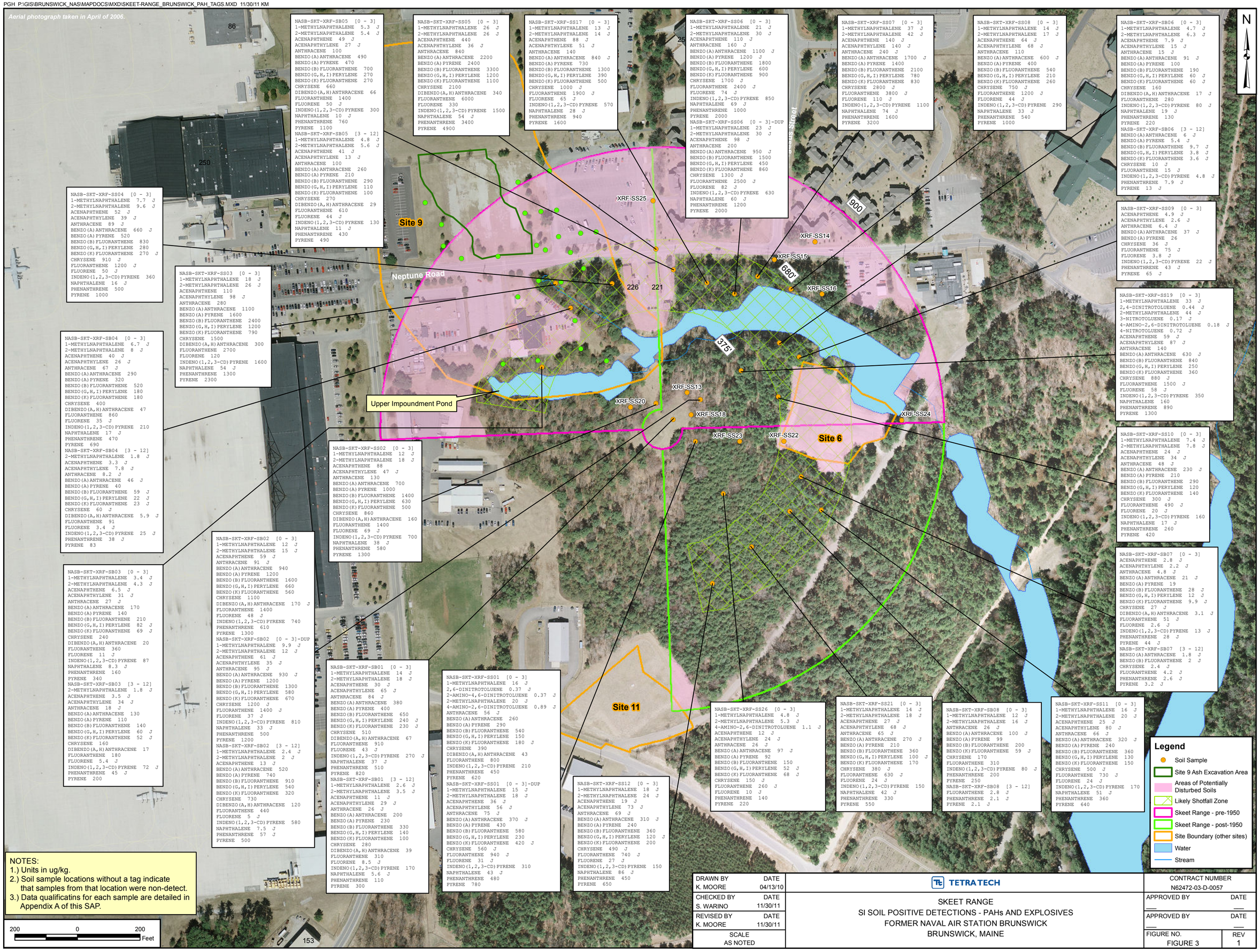
NASB-SKT-XRF-SS11 [0 - 3]
ALUMINUM 2720
ANTIMONY 0.392 J
ARSENIC 3.77
BARIUM 23.3
BERYLLIUM 0.0959 J
CADMIUM 0.242 J
CHROMIUM 4.5
COBALT 0.575 J
COPPER 5.02
IRON 4440
LEAD 265 J
MANGANESE 86.2
MERCURY 0.11
NICKEL 6.24
SELENIUM 0.523
VANADIUM 20.5
ZINC 13.3

NASB-SKT-XRF-SB07 [0 - 3]
ALUMINUM 9230
ARSENIC 2.09
BARIUM 12.3
BERYLLIUM 0.354
CADMIUM 0.0632 J
CHROMIUM 8.17
COBALT 2.73
COPPER 3.97 J
IRON 8880
LEAD 16.4 J
MANGANESE 166
MERCURY 0.0474
NICKEL 6.23
SELENIUM 0.35 J
VANADIUM 16.7
ZINC 19.2
NASB-SKT-XRF-SB07 [3 - 12]
ALUMINUM 9710
ARSENIC 1.87
BARIUM 8.63
BERYLLIUM 0.58
CHROMIUM 7.04
COBALT 1.86
COPPER 3.79 J
IRON 8400
MANGANESE 106
MERCURY 0.0414
NICKEL 3.75 J
SELENIUM 0.514 J
VANADIUM 12.4
ZINC 15.1

NOTES:
1.) Units in mg/kg
2.) Soil sample locations without a tag indicate that samples from that location were non-detect.
3.) Data qualifications for each sample are detailed in Appendix A of this SAP.

DRAWN BY S. STROZ	DATE 10/18/11	TETRA TECH	CONTRACT NUMBER N62472-03-D-0057
CHECKED BY S. WARINO	DATE 10/19/11	SKEET RANGE SI SOIL POSITIVE DETECTIONS - METALS FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
REVISED BY	DATE		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 2 / REV 1

PGH P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\SKEET-RANGE_BRUNSWICK_PAH_TAGS.MXD 11/30/11 KM



NASB-SKT-XRF-SB05 [0 - 3]
1-METHYLNAPHTHALENE 5.3 J
2-METHYLNAPHTHALENE 5.4 J
ACENAPHTHENE 49 J
ACENAPHTHYLENE 27 J
ANTHRACENE 100
BENZO(A)ANTHRACENE 490
BENZO(A)PYRENE 470
BENZO(B)FLUORANTHENE 700
BENZO(G,H,I)PERYLENE 270
BENZO(K)FLUORANTHENE 270
CHRYSENE 660
DIBENZO(A,H)ANTHRACENE 66
FLUORANTHENE 1400
FLUORENE 50 J
INDENO(1,2,3-CD)PYRENE 300
NAPHTHALENE 10 J
PHENANTHRENE 760
PYRENE 1100
NASB-SKT-XRF-SB05 [3 - 12]
1-METHYLNAPHTHALENE 4.8 J
2-METHYLNAPHTHALENE 5.6 J
ACENAPHTHENE 41 J
ACENAPHTHYLENE 13 J
ANTHRACENE 100
BENZO(A)ANTHRACENE 260
BENZO(A)PYRENE 210
BENZO(B)FLUORANTHENE 290
BENZO(G,H,I)PERYLENE 110
BENZO(K)FLUORANTHENE 100
CHRYSENE 270
DIBENZO(A,H)ANTHRACENE 29
FLUORANTHENE 610
FLUORENE 44 J
INDENO(1,2,3-CD)PYRENE 130
NAPHTHALENE 11 J
PHENANTHRENE 430
PYRENE 490

NASB-SKT-XRF-SS05 [0 - 3]
1-METHYLNAPHTHALENE 26 J
2-METHYLNAPHTHALENE 26 J
ACENAPHTHENE 440
ACENAPHTHYLENE 36 J
ANTHRACENE 840
BENZO(A)ANTHRACENE 2200
BENZO(A)PYRENE 2400
BENZO(B)FLUORANTHENE 3300
BENZO(G,H,I)PERYLENE 1200
BENZO(K)FLUORANTHENE 1100
CHRYSENE 2100
DIBENZO(A,H)ANTHRACENE 340
FLUORANTHENE 6000
FLUORENE 330
INDENO(1,2,3-CD)PYRENE 1500
NAPHTHALENE 54 J
PHENANTHRENE 3400
PYRENE 4900

NASB-SKT-XRF-SS17 [0 - 3]
1-METHYLNAPHTHALENE 13 J
2-METHYLNAPHTHALENE 14 J
ACENAPHTHENE 88 J
ACENAPHTHYLENE 51 J
ANTHRACENE 140
BENZO(A)ANTHRACENE 840 J
BENZO(A)PYRENE 730
BENZO(B)FLUORANTHENE 1300
BENZO(G,H,I)PERYLENE 390
BENZO(K)FLUORANTHENE 500
CHRYSENE 1000 J
FLUORANTHENE 1900 J
FLUORENE 65 J
INDENO(1,2,3-CD)PYRENE 570
NAPHTHALENE 28 J
PHENANTHRENE 940
PYRENE 1600

NASB-SKT-XRF-SS06 [0 - 3]
1-METHYLNAPHTHALENE 21 J
2-METHYLNAPHTHALENE 30 J
ACENAPHTHENE 110 J
ANTHRACENE 160 J
BENZO(A)ANTHRACENE 1100 J
BENZO(A)PYRENE 1200 J
BENZO(B)FLUORANTHENE 1800
BENZO(G,H,I)PERYLENE 600
BENZO(K)FLUORANTHENE 900
CHRYSENE 1700 J
FLUORANTHENE 2400 J
FLUORENE 74 J
INDENO(1,2,3-CD)PYRENE 850
NAPHTHALENE 69 J
PHENANTHRENE 1000
PYRENE 2000
NASB-SKT-XRF-SS06 [0 - 3]-DUP
1-METHYLNAPHTHALENE 23 J
2-METHYLNAPHTHALENE 30 J
ACENAPHTHENE 98 J
ANTHRACENE 200
BENZO(A)ANTHRACENE 950 J
BENZO(B)FLUORANTHENE 1500
BENZO(G,H,I)PERYLENE 450
BENZO(K)FLUORANTHENE 860
CHRYSENE 1300 J
FLUORANTHENE 2500 J
FLUORENE 82 J
INDENO(1,2,3-CD)PYRENE 630
NAPHTHALENE 60 J
PHENANTHRENE 1200
PYRENE 2000

NASB-SKT-XRF-SS07 [0 - 3]
1-METHYLNAPHTHALENE 37 J
2-METHYLNAPHTHALENE 42 J
ACENAPHTHENE 140 J
ACENAPHTHYLENE 140 J
ANTHRACENE 240 J
BENZO(A)ANTHRACENE 1700 J
BENZO(A)PYRENE 1400
BENZO(B)FLUORANTHENE 2100
BENZO(G,H,I)PERYLENE 780
BENZO(K)FLUORANTHENE 830
CHRYSENE 2800 J
FLUORANTHENE 3800 J
FLUORENE 110 J
INDENO(1,2,3-CD)PYRENE 1100
NAPHTHALENE 74 J
PHENANTHRENE 1600
PYRENE 3200

NASB-SKT-XRF-SS08 [0 - 3]
1-METHYLNAPHTHALENE 14 J
2-METHYLNAPHTHALENE 17 J
ACENAPHTHENE 64 J
ACENAPHTHYLENE 68 J
ANTHRACENE 110
BENZO(A)ANTHRACENE 600 J
BENZO(A)PYRENE 400
BENZO(B)FLUORANTHENE 540
BENZO(G,H,I)PERYLENE 210
BENZO(K)FLUORANTHENE 260
CHRYSENE 750 J
FLUORANTHENE 1200 J
FLUORENE 44 J
INDENO(1,2,3-CD)PYRENE 290
NAPHTHALENE 33 J
PHENANTHRENE 540
PYRENE 1000

NASB-SKT-XRF-SB06 [0 - 3]
1-METHYLNAPHTHALENE 4.7 J
2-METHYLNAPHTHALENE 6.3 J
ACENAPHTHENE 7.9 J
ACENAPHTHYLENE 15 J
ANTHRACENE 15 J
BENZO(A)ANTHRACENE 91 J
BENZO(A)PYRENE 100
BENZO(B)FLUORANTHENE 190
BENZO(G,H,I)PERYLENE 60 J
BENZO(K)FLUORANTHENE 60 J
CHRYSENE 160
DIBENZO(A,H)ANTHRACENE 17 J
FLUORANTHENE 280
INDENO(1,2,3-CD)PYRENE 80 J
NAPHTHALENE 19 J
PHENANTHRENE 130
PYRENE 220
NASB-SKT-XRF-SB06 [3 - 12]
BENZO(A)ANTHRACENE 6 J
BENZO(A)PYRENE 5.4 J
BENZO(B)FLUORANTHENE 9.7 J
BENZO(G,H,I)PERYLENE 3.8 J
BENZO(K)FLUORANTHENE 3.6 J
CHRYSENE 10 J
FLUORANTHENE 15 J
INDENO(1,2,3-CD)PYRENE 4.8 J
PHENANTHRENE 7.9 J
PYRENE 13 J

NASB-SKT-XRF-SS09 [0 - 3]
ACENAPHTHENE 4.9 J
ACENAPHTHYLENE 2.6 J
ANTHRACENE 6.4 J
BENZO(A)ANTHRACENE 37 J
BENZO(A)PYRENE 26
CHRYSENE 36 J
FLUORANTHENE 75 J
FLUORENE 3.8 J
INDENO(1,2,3-CD)PYRENE 22 J
PHENANTHRENE 43 J
PYRENE 65 J

NASB-SKT-XRF-SS19 [0 - 3]
1-METHYLNAPHTHALENE 33 J
2,4-DINITROTOLUENE 0.44 J
2-METHYLNAPHTHALENE 44 J
3-NITROTOLUENE 0.17 J
4-AMINO-2,6-DINITROTOLUENE 0.18 J
4-NITROTOLUENE 0.72 J
ACENAPHTHENE 59 J
ACENAPHTHYLENE 87 J
ANTHRACENE 140
BENZO(A)ANTHRACENE 630 J
BENZO(B)FLUORANTHENE 840
BENZO(G,H,I)PERYLENE 250
BENZO(K)FLUORANTHENE 360
CHRYSENE 880 J
FLUORANTHENE 1500 J
FLUORENE 58 J
INDENO(1,2,3-CD)PYRENE 350
NAPHTHALENE 160
PHENANTHRENE 890
PYRENE 1300

NASB-SKT-XRF-SS10 [0 - 3]
1-METHYLNAPHTHALENE 7.4 J
2-METHYLNAPHTHALENE 7.8 J
ACENAPHTHENE 24 J
ACENAPHTHYLENE 34 J
ANTHRACENE 48 J
BENZO(A)ANTHRACENE 230 J
BENZO(A)PYRENE 210
BENZO(B)FLUORANTHENE 290
BENZO(G,H,I)PERYLENE 120
BENZO(K)FLUORANTHENE 140
CHRYSENE 300 J
FLUORANTHENE 490 J
FLUORENE 20 J
INDENO(1,2,3-CD)PYRENE 160
NAPHTHALENE 17 J
PHENANTHRENE 260
PYRENE 420

NASB-SKT-XRF-SB07 [0 - 3]
ACENAPHTHENE 2.8 J
ACENAPHTHYLENE 2.2 J
ANTHRACENE 4.8 J
BENZO(A)ANTHRACENE 21 J
BENZO(A)PYRENE 19
BENZO(B)FLUORANTHENE 28 J
BENZO(G,H,I)PERYLENE 12 J
BENZO(K)FLUORANTHENE 9.9 J
CHRYSENE 27 J
DIBENZO(A,H)ANTHRACENE 3.1 J
FLUORANTHENE 51 J
FLUORENE 2.6 J
INDENO(1,2,3-CD)PYRENE 13 J
PHENANTHRENE 28 J
PYRENE 44 J
NASB-SKT-XRF-SB07 [3 - 12]
BENZO(A)ANTHRACENE 1.8 J
BENZO(B)FLUORANTHENE 2 J
CHRYSENE 2.4 J
FLUORANTHENE 4.2 J
PHENANTHRENE 2.6 J
PYRENE 3.2 J

NASB-SKT-XRF-SS04 [0 - 3]
1-METHYLNAPHTHALENE 7.7 J
2-METHYLNAPHTHALENE 9.6 J
ACENAPHTHENE 52 J
ACENAPHTHYLENE 39 J
ANTHRACENE 89 J
BENZO(A)ANTHRACENE 660 J
BENZO(A)PYRENE 520
BENZO(B)FLUORANTHENE 830
BENZO(G,H,I)PERYLENE 280
BENZO(K)FLUORANTHENE 270 J
CHRYSENE 910 J
FLUORANTHENE 1200 J
FLUORENE 50 J
INDENO(1,2,3-CD)PYRENE 360
NAPHTHALENE 16 J
PHENANTHRENE 500
PYRENE 1000

NASB-SKT-XRF-SS03 [0 - 3]
1-METHYLNAPHTHALENE 18 J
2-METHYLNAPHTHALENE 26 J
ACENAPHTHENE 110
ACENAPHTHYLENE 98 J
ANTHRACENE 280
BENZO(A)ANTHRACENE 1100
BENZO(A)PYRENE 1600
BENZO(B)FLUORANTHENE 2400
BENZO(G,H,I)PERYLENE 1200
BENZO(K)FLUORANTHENE 790
CHRYSENE 1500
DIBENZO(A,H)ANTHRACENE 300
FLUORANTHENE 2700
FLUORENE 120
INDENO(1,2,3-CD)PYRENE 1600
NAPHTHALENE 54 J
PHENANTHRENE 1300
PYRENE 2300

NASB-SKT-XRF-SB04 [0 - 3]
1-METHYLNAPHTHALENE 6.7 J
2-METHYLNAPHTHALENE 8 J
ACENAPHTHENE 40 J
ACENAPHTHYLENE 26 J
ANTHRACENE 67 J
BENZO(A)ANTHRACENE 290
BENZO(A)PYRENE 320
BENZO(B)FLUORANTHENE 520
BENZO(G,H,I)PERYLENE 180
BENZO(K)FLUORANTHENE 180
CHRYSENE 400
DIBENZO(A,H)ANTHRACENE 47
FLUORANTHENE 860
FLUORENE 35 J
INDENO(1,2,3-CD)PYRENE 210
NAPHTHALENE 17 J
PHENANTHRENE 470
PYRENE 690
NASB-SKT-XRF-SB04 [3 - 12]
2-METHYLNAPHTHALENE 1.8 J
ACENAPHTHENE 3.3 J
ACENAPHTHYLENE 7.8 J
ANTHRACENE 8.2 J
BENZO(A)ANTHRACENE 46 J
BENZO(A)PYRENE 40
BENZO(B)FLUORANTHENE 59 J
BENZO(G,H,I)PERYLENE 22 J
BENZO(K)FLUORANTHENE 23 J
CHRYSENE 60 J
DIBENZO(A,H)ANTHRACENE 5.9 J
FLUORANTHENE 91
FLUORENE 3.4 J
INDENO(1,2,3-CD)PYRENE 25 J
PHENANTHRENE 38 J
PYRENE 83

NASB-SKT-XRF-SS02 [0 - 3]
1-METHYLNAPHTHALENE 12 J
2-METHYLNAPHTHALENE 18 J
ACENAPHTHENE 88
ACENAPHTHYLENE 47 J
ANTHRACENE 130
BENZO(A)ANTHRACENE 700
BENZO(A)PYRENE 1000
BENZO(B)FLUORANTHENE 1400
BENZO(G,H,I)PERYLENE 630
BENZO(K)FLUORANTHENE 500
CHRYSENE 860
DIBENZO(A,H)ANTHRACENE 160
FLUORANTHENE 1400
FLUORENE 69 J
INDENO(1,2,3-CD)PYRENE 700
NAPHTHALENE 38 J
PHENANTHRENE 580
PYRENE 1300

NASB-SKT-XRF-SB02 [0 - 3]
1-METHYLNAPHTHALENE 12 J
2-METHYLNAPHTHALENE 15 J
ACENAPHTHENE 59 J
ANTHRACENE 91 J
BENZO(A)ANTHRACENE 940
BENZO(A)PYRENE 1200
BENZO(B)FLUORANTHENE 1600
BENZO(G,H,I)PERYLENE 660
BENZO(K)FLUORANTHENE 560
CHRYSENE 1100
DIBENZO(A,H)ANTHRACENE 170 J
FLUORANTHENE 1400
FLUORENE 48 J
INDENO(1,2,3-CD)PYRENE 740
PHENANTHRENE 610
PYRENE 1300
NASB-SKT-XRF-SB02 [0 - 3]-DUP
1-METHYLNAPHTHALENE 9.9 J
2-METHYLNAPHTHALENE 12 J
ACENAPHTHENE 61 J
ACENAPHTHYLENE 35 J
ANTHRACENE 95 J
BENZO(A)ANTHRACENE 930 J
BENZO(A)PYRENE 1200
BENZO(B)FLUORANTHENE 1300
BENZO(G,H,I)PERYLENE 580
BENZO(K)FLUORANTHENE 670
CHRYSENE 1200 J
FLUORANTHENE 1400 J
FLUORENE 37 J
INDENO(1,2,3-CD)PYRENE 810
NAPHTHALENE 33 J
PHENANTHRENE 500
PYRENE 1200
NASB-SKT-XRF-SB02 [3 - 12]
1-METHYLNAPHTHALENE 2.4 J
2-METHYLNAPHTHALENE 2 J
ACENAPHTHENE 13 J
BENZO(A)ANTHRACENE 520
BENZO(A)PYRENE 740
BENZO(B)FLUORANTHENE 910
BENZO(G,H,I)PERYLENE 540
BENZO(K)FLUORANTHENE 320
CHRYSENE 730
DIBENZO(A,H)ANTHRACENE 120
FLUORANTHENE 440
FLUORENE 5 J
INDENO(1,2,3-CD)PYRENE 580
NAPHTHALENE 7.5 J
PHENANTHRENE 57 J
PYRENE 500

NASB-SKT-XRF-SB03 [0 - 3]
1-METHYLNAPHTHALENE 3.4 J
2-METHYLNAPHTHALENE 4.3 J
ACENAPHTHENE 6.5 J
ACENAPHTHYLENE 31 J
ANTHRACENE 27 J
BENZO(A)ANTHRACENE 170
BENZO(A)PYRENE 140
BENZO(B)FLUORANTHENE 210
BENZO(G,H,I)PERYLENE 82 J
BENZO(K)FLUORANTHENE 69 J
CHRYSENE 240
DIBENZO(A,H)ANTHRACENE 20
FLUORANTHENE 360
FLUORENE 11 J
INDENO(1,2,3-CD)PYRENE 87
NAPHTHALENE 8.3 J
PHENANTHRENE 160
PYRENE 340
NASB-SKT-XRF-SB03 [3 - 12]
2-METHYLNAPHTHALENE 1.8 J
ACENAPHTHENE 3.5 J
ACENAPHTHYLENE 34 J
ANTHRACENE 18 J
BENZO(A)ANTHRACENE 130
BENZO(A)PYRENE 110
BENZO(B)FLUORANTHENE 140
BENZO(G,H,I)PERYLENE 60 J
BENZO(K)FLUORANTHENE 52 J
CHRYSENE 160
DIBENZO(A,H)ANTHRACENE 17
FLUORANTHENE 180
FLUORENE 5.4 J
INDENO(1,2,3-CD)PYRENE 72 J
PHENANTHRENE 45 J
PYRENE 200

NASB-SKT-XRF-SB01 [0 - 3]
1-METHYLNAPHTHALENE 14 J
2-METHYLNAPHTHALENE 18 J
ACENAPHTHENE 30 J
ACENAPHTHYLENE 65 J
ANTHRACENE 84 J
BENZO(A)ANTHRACENE 380
BENZO(A)PYRENE 400
BENZO(B)FLUORANTHENE 650
BENZO(G,H,I)PERYLENE 240 J
BENZO(K)FLUORANTHENE 230 J
CHRYSENE 510
DIBENZO(A,H)ANTHRACENE 67
FLUORANTHENE 910
FLUORENE 43 J
INDENO(1,2,3-CD)PYRENE 270 J
NAPHTHALENE 37 J
PHENANTHRENE 510
PYRENE 820
NASB-SKT-XRF-SB01 [3 - 12]
1-METHYLNAPHTHALENE 2.6 J
2-METHYLNAPHTHALENE 3.5 J
ACENAPHTHENE 11 J
ACENAPHTHYLENE 29 J
ANTHRACENE 26 J
BENZO(A)ANTHRACENE 200
BENZO(A)PYRENE 230
BENZO(B)FLUORANTHENE 330
BENZO(G,H,I)PERYLENE 140
BENZO(K)FLUORANTHENE 100
CHRYSENE 280
DIBENZO(A,H)ANTHRACENE 39
FLUORANTHENE 310
FLUORENE 8.5 J
INDENO(1,2,3-CD)PYRENE 170
NAPHTHALENE 5.6 J
PHENANTHRENE 110
PYRENE 300

NASB-SKT-XRF-SS01 [0 - 3]
1-METHYLNAPHTHALENE 16 J
2,6-DINITROTOLUENE 0.37 J
2-AMINO-4,6-DINITROTOLUENE 0.37 J
2-METHYLNAPHTHALENE 20 J
4-AMINO-2,6-DINITROTOLUENE 0.89 J
ANTHRACENE 56 J
BENZO(A)ANTHRACENE 260
BENZO(A)PYRENE 290
BENZO(B)FLUORANTHENE 540
BENZO(G,H,I)PERYLENE 150
BENZO(K)FLUORANTHENE 180 J
CHRYSENE 390
DIBENZO(A,H)ANTHRACENE 43
FLUORANTHENE 800
INDENO(1,2,3-CD)PYRENE 210
PHENANTHRENE 450
PYRENE 620
NASB-SKT-XRF-SS01 [0 - 3]-DUP
1-METHYLNAPHTHALENE 15 J
2-METHYLNAPHTHALENE 18 J
ACENAPHTHENE 36 J
ACENAPHTHYLENE 56 J
ANTHRACENE 75 J
BENZO(A)ANTHRACENE 370 J
BENZO(A)PYRENE 430
BENZO(B)FLUORANTHENE 580
BENZO(G,H,I)PERYLENE 230
BENZO(K)FLUORANTHENE 420 J
CHRYSENE 560 J
FLUORANTHENE 940 J
FLUORENE 31 J
INDENO(1,2,3-CD)PYRENE 310
NAPHTHALENE 43 J
PHENANTHRENE 480
PYRENE 780

NASB-SKT-XRF-SS12 [0 - 3]
1-METHYLNAPHTHALENE 18 J
2-METHYLNAPHTHALENE 24 J
ACENAPHTHENE 19 J
ACENAPHTHYLENE 73 J
ANTHRACENE 69 J
BENZO(A)ANTHRACENE 310 J
BENZO(A)PYRENE 240
BENZO(B)FLUORANTHENE 360
BENZO(G,H,I)PERYLENE 120 J
BENZO(K)FLUORANTHENE 200
CHRYSENE 490 J
FLUORANTHENE 740 J
FLUORENE 27 J
INDENO(1,2,3-CD)PYRENE 150
NAPHTHALENE 86 J
PHENANTHRENE 450
PYRENE 650

NASB-SKT-XRF-SS26 [0 - 3]
1-METHYLNAPHTHALENE 4.8 J
2-METHYLNAPHTHALENE 5.3 J
4-AMINO-2,6-DINITROTOLUENE 1.1 J
ACENAPHTHENE 12 J
ACENAPHTHYLENE 24 J
ANTHRACENE 26 J
BENZO(A)ANTHRACENE 97 J
BENZO(A)PYRENE 92
BENZO(B)FLUORANTHENE 150
BENZO(G,H,I)PERYLENE 52 J
BENZO(K)FLUORANTHENE 68 J
CHRYSENE 150 J
FLUORANTHENE 260 J
FLUORENE 10 J
PHENANTHRENE 140
PYRENE 220

NASB-SKT-XRF-SS21 [0 - 3]
1-METHYLNAPHTHALENE 14 J
2-METHYLNAPHTHALENE 18 J
ACENAPHTHENE 27 J
ACENAPHTHYLENE 68 J
ANTHRACENE 65 J
BENZO(A)ANTHRACENE 270 J
BENZO(A)PYRENE 210
BENZO(B)FLUORANTHENE 360
BENZO(G,H,I)PERYLENE 100 J
BENZO(K)FLUORANTHENE 170
CHRYSENE 380 J
FLUORANTHENE 630 J
FLUORENE 24 J
INDENO(1,2,3-CD)PYRENE 150
NAPHTHALENE 42 J
PHENANTHRENE 330
PYRENE 550

NASB-SKT-XRF-SB08 [0 - 3]
1-METHYLNAPHTHALENE 12 J
2-METHYLNAPHTHALENE 16 J
ANTHRACENE 26 J
BENZO(A)ANTHRACENE 100 J
BENZO(A)PYRENE 99
BENZO(B)FLUORANTHENE 200
BENZO(K)FLUORANTHENE 59 J
CHRYSENE 170
FLUORANTHENE 310
INDENO(1,2,3-CD)PYRENE 80 J
PHENANTHRENE 200
PYRENE 250
NASB-SKT-XRF-SB08 [3 - 12]
FLUORANTHENE 2.8 J
PHENANTHRENE 2.1 J
PYRENE 2.1 J

NASB-SKT-XRF-SS11 [0 - 3]
1-METHYLNAPHTHALENE 16 J
2-METHYLNAPHTHALENE 20 J
ACENAPHTHENE 25 J
ACENAPHTHYLENE 80 J
ANTHRACENE 66 J
BENZO(A)ANTHRACENE 320 J
BENZO(A)PYRENE 240
BENZO(B)FLUORANTHENE 360
BENZO(G,H,I)PERYLENE 130
BENZO(K)FLUORANTHENE 150
CHRYSENE 500 J
FLUORANTHENE 730 J
FLUORENE 24 J
INDENO(1,2,3-CD)PYRENE 170
NAPHTHALENE 51 J
PHENANTHRENE 360
PYRENE 640

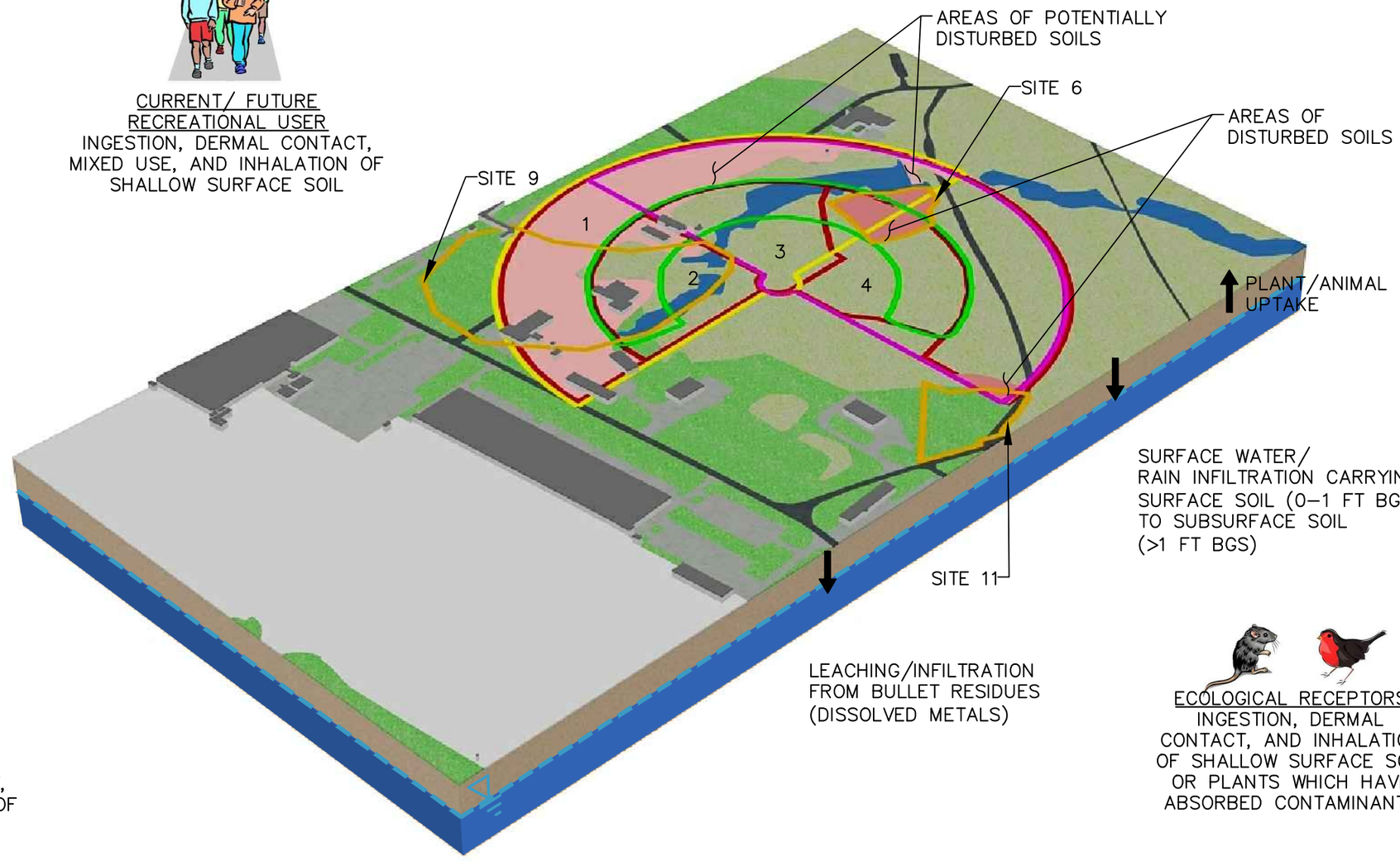
NOTES:
1.) Units in ug/kg.
2.) Soil sample locations without a tag indicate that samples from that location were non-detect.
3.) Data qualificatins for each sample are detailed in Appendix A of this SAP.

DRAWN BY K. MOORE	DATE 04/13/10	TETRA TECH	CONTRACT NUMBER N62472-03-D-0057
CHECKED BY S. WARINO	DATE 11/30/11	SKEET RANGE SI SOIL POSITIVE DETECTIONS - PAHs AND EXPLOSIVES FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
REVISED BY K. MOORE	DATE 11/30/11		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 3 / REV 1

CURRENT/ FUTURE
RECREATIONAL USER
INGESTION, DERMAL CONTACT,
MIXED USE, AND INHALATION OF
SHALLOW SURFACE SOIL

CURRENT/ FUTURE BUSINESS AND
TECHNOLOGY INDUSTRIES WORKER
INGESTION, DERMAL CONTACT,
MIXED USE, AND INHALATION OF
SHALLOW SURFACE SOIL

CURRENT/ FUTURE
RESIDENTIAL USER
INGESTION, DERMAL CONTACT,
MIXED USE, AND INHALATION OF
SHALLOW SURFACE SOIL



ECOLOGICAL RECEPTORS
INGESTION, DERMAL
CONTACT, AND INHALATION
OF SHALLOW SURFACE SOIL
OR PLANTS WHICH HAVE
ABSORBED CONTAMINANTS

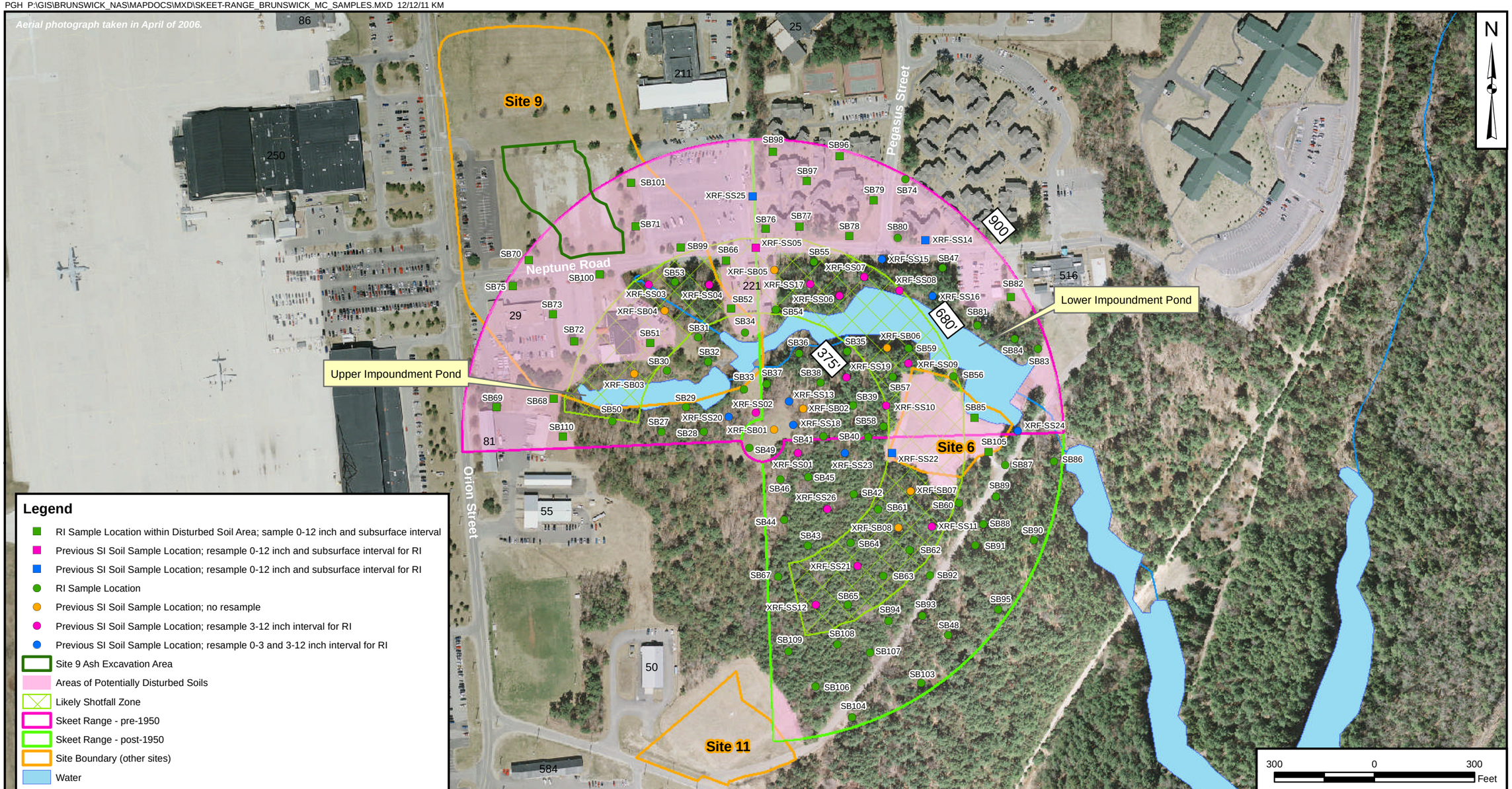
LEGEND

- SKEET RANGE – PRE 1950
- SKEET RANGE – POST 1950
- LIKELY SHOTFALL ZONE
- WATER TABLE (ESTIMATED)

DRAWN BY ND DATE 9/9/10	NAVFAC	CONCEPTUAL SITE MODEL SKEET RANGE FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	CONTRACT NO. CTO 069
CHECKED BY DATE			OWNER NO. 0645
REVISED BY DATE			APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 4 / REV. 1

R:\2407 – NAS Pensacola\CSM\2407CSM02.dwg PIT CARLY.KRAMER 12/8/2011 3:52:36 PM

PGH P:\GIS\BRUNSWICK_NAS\MAPDOCS\MXD\SKEET-RANGE_BRUNSWICK_MC_SAMPLES.MXD 12/12/11 KM



NOTES:
1.) Sample locations XRF-SS26 and lower are SI sample locations.
Sample locations SB27 and higher are proposed RI sample locations.
2.) Some SI sample locations need resampled.
See WKSt 8.3 for sampling rationale at SI and RI sample locations.

DRAWN BY K. MOORE	DATE 06/23/10	TETRA TECH	CONTRACT NUMBER N62472-03-D-0057
CHECKED BY S. WARINO	DATE 12/12/11	SKEET RANGE SI SAMPLE LOCATIONS AND PROPOSED RI SAMPLE LOCATIONS FORMER NAVAL AIR STATION BRUNSWICK BRUNSWICK, MAINE	APPROVED BY ___ DATE ___
REVISED BY K. MOORE	DATE 12/12/11		APPROVED BY ___ DATE ___
SCALE AS NOTED			FIGURE NO. FIGURE 5 / REV 1

APPENDIX A

SKEET RANGE SI DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW AND DEEP SURFACE SOIL, SITE 9 2010 SOIL DATA, AND QUALIFIED DATA TABLES

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SB01-0003	SB01-0312	SB01-0003	SB01-0312	SB02-0003		
								0 - 0.25 ft bgs		
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE
				Jul-09		Dec-09		Jul-09		
EXPLOSIVES (MG/KG)										
2,4-DINITROTOLUENE	3.5	1.6	C	0.3 UJ	0.3 UJ	NA	NA	0.3 UJ	0.3 UJ	NA
2,6-DINITROTOLUENE	1.6	6.1	N	0.3 UJ	0.3 UJ	NA	NA	0.3 UJ	0.3 UJ	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	0.3 U	0.3 U	NA	NA	0.3 U	0.3 U	NA
3-NITROTOLUENE	NC	0.61	N	0.3 U	0.3 U	NA	NA	0.3 U	0.3 U	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	0.3 UJ	0.3 UJ	NA	NA	0.3 UJ	0.3 UJ	NA
4-NITROTOLUENE	NC	30	C	0.3 U	0.3 U	NA	NA	0.3 U	0.3 U	NA
METALS (MG/KG)										
ALUMINUM	69000	7700	N	*8850*	*8370*	NA	NA	7620	7405	7190
ANTIMONY	14	3.1	N	0.301 UJ	0.272 UJ	NA	NA	0.529 J	0.49	0.451 J
ARSENIC	9	0.39	C	*5.26*	*6.03*	NA	NA	*2.73*	*2.595*	*2.46*
BARIUM	6800	1500	N	33	28.4	NA	NA	34.3	31.75	29.2
BERYLLIUM	68	16	N	0.446	0.383	NA	NA	0.337 J	0.3405	0.344 J
CADMIUM	2.1	7	N	0.835	0.199 J	NA	NA	0.254 J	0.239	0.224 J
CALCIUM	NC	NC		1290	1380	NA	NA	1720	1595	1470
CHROMIUM	100	0.29	C	*16.5*	*13.9*	NA	NA	*9.09*	*8.77*	*8.45*
COBALT	15	2.3	N	*4.24*	*4.13*	NA	NA	1.35	1.3	1.25
COPPER	480	310	N	18.4	11.9	NA	NA	6.63	6.3	5.97
IRON	31000	5500	N	*10700*	*10100*	NA	NA	*7780*	*7900*	*8020*
LEAD	170	400	N	47.5 J	18.8 J	NA	NA	166 J	159	152 J
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		2310 J	2140 J	NA	NA	540 J	514.5	489 J
MANGANESE	1100	180	N	179 J	174 J	NA	NA	117 J	108.15	99.3
MERCURY	10	1	N	0.0325 J	0.0284 J	NA	NA	0.121	0.118	0.115
NICKEL	100	150	N	12.8	11.9	NA	NA	5.59	5.31	5.03
POTASSIUM	NC	NC		1220 J	1130 J	NA	NA	320 J	300	280 J
SELENIUM	68	39	N	0.181 UJ	0.163 UJ	NA	NA	0.642 J	0.5685	0.495 J
SILVER	170	39	N	0.241 UJ	0.163 UJ	NA	NA	0.152 UJ	0.1485 U	0.145 UJ
SODIUM	NC	NC		87.4 J	111 J	NA	NA	75.8 U	74.1 U	72.4 U
VANADIUM	240	39	N	31.1	17.7	NA	NA	18	17.55	17.1
ZINC	10000	2300	N	49.7	34.5	NA	NA	26.1	25.05	24
MISCELLANEOUS PARAMETERS (MEQ/100)										
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)										
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)										
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)										
1-METHYLNAPHTHALENE	NC	22000	C	14 J	2.6 J	NA	NA	12 J	10.95	9.9 J
2-METHYLNAPHTHALENE	3600	31000	N	18 J	3.5 J	NA	NA	15 J	13.5	12 J
ACENAPHTHENE	110000	340000	N	30 J	11 J	NA	NA	59 J	60	61 J
ACENAPHTHYLENE	68000	340000	N	65 J	29 J	NA	NA	100 U	35 J	35 J
ANTHRACENE	430000	1700000	N	84 J	26 J	NA	NA	91 J	93	95 J
BENZO(A)ANTHRACENE	260	150	C	*380*	*200*	NA	NA	*940*	*935*	*930 J*
BENZO(A)PYRENE	26	15	C	*400*	*230*	NA	NA	*1200*	*1200*	*1200*
BENZO(B)FLUORANTHENE	260	150	C	*650*	*330*	NA	NA	*1600*	*1450*	*1300*
BENZO(G,H,I)PERYLENE	750000	170000	N	240 J	140	NA	NA	660	620	580
BENZO(K)FLUORANTHENE	2600	1500	C	230 J	100	NA	NA	560	615	670

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SB01-0003	SB01-0312	SB01-0003	SB01-0312	SB02-0003		
								0 - 0.25 ft bgs		
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE
				Jul-09		Dec-09		Jul-09		
CHRYSENE	26000	15000	C	510	280	NA	NA	1100	1150	1200 J
DIBENZO(A,H)ANTHRACENE	26	15	C	*67*	*39*	NA	NA	*170 J*	*90*	20 UJ
FLUORANTHENE	1000000	230000	N	910	310	NA	NA	1400	1400	1400 J
FLUORENE	120000	230000	N	43 J	8.5 J	NA	NA	48 J	42.5	37 J
INDENO(1,2,3-CD)PYRENE	260	150	C	*270 J*	*170*	NA	NA	*740*	*775*	*810*
NAPHTHALENE	1700	3600	C	37 J	5.6 J	NA	NA	100 U	33 J	33 J
PHENANTHRENE	97000	170000	N	510	110	NA	NA	610	555	500
PYRENE	750000	170000	N	820	300	NA	NA	1300	1250	1200
XRF (MG/KG)										
LEAD	170	400	N	NA	NA	36	27	NA	NA	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SB02-0312	SB02-0003			SB02-0312	SB03-0003	SB03-0312
					0 - 0.25 ft bgs					
				0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Dec-09				Jul-09	
EXPLOSIVES (MG/KG)										
2,4-DINITROTOLUENE	3.5	1.6	C	0.3 UJ	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	0.3 UJ	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	0.3 U	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	0.3 U	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	0.3 UJ	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	0.3 U	NA	NA	NA	NA	NA	NA
METALS (MG/KG)										
ALUMINUM	69000	7700	N	*10900*	NA	NA	NA	NA	*13100*	*10700*
ANTIMONY	14	3.1	N	0.295 UJ	NA	NA	NA	NA	0.317 UJ	0.275 UJ
ARSENIC	9	0.39	C	*1.93 J*	NA	NA	NA	NA	*10.6*	*6.9*
BARIUM	6800	1500	N	17.3	NA	NA	NA	NA	124	36.5
BERYLLIUM	68	16	N	0.406	NA	NA	NA	NA	0.605	0.449
CADMIUM	2.1	7	N	0.0591 U	NA	NA	NA	NA	0.25 J	0.0965 J
CALCIUM	NC	NC		738	NA	NA	NA	NA	1520	1280
CHROMIUM	100	0.29	C	*7.1*	NA	NA	NA	NA	*19.2*	*15*
COBALT	15	2.3	N	1.47	NA	NA	NA	NA	*22.3*	*4.6*
COPPER	480	310	N	2.24 J	NA	NA	NA	NA	18.9	9.95
IRON	31000	5500	N	*9390*	NA	NA	NA	NA	*18700*	*11600*
LEAD	170	400	N	11.2 J	NA	NA	NA	NA	68.7 J	9.88 J
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		590 J	NA	NA	NA	NA	2160 J	2810 J
MANGANESE	1100	180	N	55.5 J	NA	NA	NA	NA	*2230*	168 J
MERCURY	10	1	N	0.0418	NA	NA	NA	NA	0.0583	0.0219 J
NICKEL	100	150	N	3.79 J	NA	NA	NA	NA	14.8	12.9
POTASSIUM	NC	NC		277 J	NA	NA	NA	NA	1150 J	1600 J
SELENIUM	68	39	N	0.585 J	NA	NA	NA	NA	0.952 UJ	0.165 UJ
SILVER	170	39	N	0.177 UJ	NA	NA	NA	NA	0.0635 UJ	0.22 UJ
SODIUM	NC	NC		59.1 U	NA	NA	NA	NA	104 J	134 J
VANADIUM	240	39	N	15.8	NA	NA	NA	NA	32.9	20.1
ZINC	10000	2300	N	17	NA	NA	NA	NA	110	33.2
MISCELLANEOUS PARAMETERS (MEQ/100)										
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)										
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)										
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)										
1-METHYLNAPHTHALENE	NC	22000	C	2.4 J	NA	NA	NA	NA	3.4 J	76 U
2-METHYLNAPHTHALENE	3600	31000	N	2 J	NA	NA	NA	NA	4.3 J	1.8 J
ACENAPHTHENE	110000	340000	N	13 J	NA	NA	NA	NA	6.5 J	3.5 J
ACENAPHTHYLENE	68000	340000	N	82 U	NA	NA	NA	NA	31 J	34 J
ANTHRACENE	430000	1700000	N	82 U	NA	NA	NA	NA	27 J	18 J
BENZO(A)ANTHRACENE	260	150	C	*520*	NA	NA	NA	NA	*170*	130
BENZO(A)PYRENE	26	15	C	*740*	NA	NA	NA	NA	*140*	*110*
BENZO(B)FLUORANTHENE	260	150	C	*910*	NA	NA	NA	NA	*210*	140
BENZO(G,H,I)PERYLENE	750000	170000	N	540	NA	NA	NA	NA	82 J	60 J
BENZO(K)FLUORANTHENE	2600	1500	C	320	NA	NA	NA	NA	69 J	52 J

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) [1]	USEPA RSL [2]		NASB-SKT-XRF						
				SB02-0312	SB02-0003			SB02-0312	SB03-0003	SB03-0312
					0 - 0.25 ft bgs					
				0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Dec-09				Jul-09	
CHRYSENE	26000	15000	C	730	NA	NA	NA	NA	240	160
DIBENZO(A,H)ANTHRACENE	26	15	C	*120*	NA	NA	NA	NA	*20*	*17*
FLUORANTHENE	1000000	230000	N	440	NA	NA	NA	NA	360	180
FLUORENE	120000	230000	N	5 J	NA	NA	NA	NA	11 J	5.4 J
INDENO(1,2,3-CD)PYRENE	260	150	C	*580*	NA	NA	NA	NA	87	72 J
NAPHTHALENE	1700	3600	C	7.5 J	NA	NA	NA	NA	8.3 J	76 U
PHENANTHRENE	97000	170000	N	57 J	NA	NA	NA	NA	160	45 J
PYRENE	750000	170000	N	500	NA	NA	NA	NA	340	200
XRF (MG/KG)										
LEAD	170	400	N	NA	222	217.5	213	21	NA	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SB03-0003	SB03-0312	SB04-0003	SB04-0312	SB04-0003	SB04-0312	SB05-0003	SB05-0312
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Dec-09		Jul-09		Dec-09		Jul-09	
EXPLOSIVES (MG/KG)											
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA	NA	NA
METALS (MG/KG)											
ALUMINUM	69000	7700	N	NA	NA	6320	*9040*	NA	NA	*9660*	*8040*
ANTIMONY	14	3.1	N	NA	NA	0.369 UJ	0.294 UJ	NA	NA	0.283 UJ	0.277 UJ
ARSENIC	9	0.39	C	NA	NA	*2.27*	*2.41*	NA	NA	*3.74*	*3.02*
BARIUM	6800	1500	N	NA	NA	18.9	15.2	NA	NA	27.5	17
BERYLLIUM	68	16	N	NA	NA	0.289 J	0.445	NA	NA	0.398	0.328
CADMIUM	2.1	7	N	NA	NA	0.183 J	0.0736 J	NA	NA	0.197 J	0.118 J
CALCIUM	NC	NC		NA	NA	799	400	NA	NA	1000	427
CHROMIUM	100	0.29	C	NA	NA	*8.11*	*9.5*	NA	NA	*10.8*	*8.15*
COBALT	15	2.3	N	NA	NA	*2.45*	*3.4*	NA	NA	*2.54*	1.89
COPPER	480	310	N	NA	NA	5.93	5.7	NA	NA	8.59	5.96
IRON	31000	5500	N	NA	NA	*7240*	*9180*	NA	NA	*9490*	*8870*
LEAD	170	400	N	NA	NA	23 J	18.4 J	NA	NA	39.3 J	44 J
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		NA	NA	1280 J	1670 J	NA	NA	1490 J	960 J
MANGANESE	1100	180	N	NA	NA	94.3 J	125 J	NA	NA	177 J	140 J
MERCURY	10	1	N	NA	NA	0.0524	0.0294 J	NA	NA	0.0874	0.0553
NICKEL	100	150	N	NA	NA	6.93	8.21	NA	NA	7.47	5.74
POTASSIUM	NC	NC		NA	NA	678 J	811 J	NA	NA	638 J	394 J
SELENIUM	68	39	N	NA	NA	0.401	0.177 UJ	NA	NA	0.323 J	0.332 J
SILVER	170	39	N	NA	NA	0.148 U	0.177 UJ	NA	NA	0.17 UJ	0.166 UJ
SODIUM	NC	NC		NA	NA	73.9 U	58.9 U	NA	NA	69.7 J	55.4 U
VANADIUM	240	39	N	NA	NA	17.5	18.5	NA	NA	18.2	19.4
ZINC	10000	2300	N	NA	NA	27.2	20.3	NA	NA	47.8	25.9
MISCELLANEOUS PARAMETERS (MEQ/100)											
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)											
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)											
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)											
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	6.7 J	80 U	NA	NA	5.3 J	4.8 J
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	8 J	1.8 J	NA	NA	5.4 J	5.6 J
ACENAPHTHENE	110000	340000	N	NA	NA	40 J	3.3 J	NA	NA	49 J	41 J
ACENAPHTHYLENE	68000	340000	N	NA	NA	26 J	7.8 J	NA	NA	27 J	13 J
ANTHRACENE	430000	1700000	N	NA	NA	67 J	8.2 J	NA	NA	100	100
BENZO(A)ANTHRACENE	260	150	C	NA	NA	*290*	46 J	NA	NA	*490*	*260*
BENZO(A)PYRENE	26	15	C	NA	NA	*320*	*40*	NA	NA	*470*	*210*
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	*520*	59 J	NA	NA	*700*	*290*
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	180	22 J	NA	NA	270	110
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	180	23 J	NA	NA	270	100

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SB03-0003	SB03-0312	SB04-0003	SB04-0312	SB04-0003	SB04-0312	SB05-0003	SB05-0312
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Dec-09		Jul-09		Dec-09		Jul-09	
CHRYSENE	26000	15000	C	NA	NA	400	60 J	NA	NA	660	270
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	*47*	5.9 J	NA	NA	*66*	*29*
FLUORANTHENE	1000000	230000	N	NA	NA	860	91	NA	NA	1400	610
FLUORENE	120000	230000	N	NA	NA	35 J	3.4 J	NA	NA	50 J	44 J
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	*210*	25 J	NA	NA	*300*	130
NAPHTHALENE	1700	3600	C	NA	NA	17 J	80 U	NA	NA	10 J	11 J
PHENANTHRENE	97000	170000	N	NA	NA	470	38 J	NA	NA	760	430
PYRENE	750000	170000	N	NA	NA	690	83	NA	NA	1100	490
XRF (MG/KG)											
LEAD	170	400	N	32	20	NA	NA	29	34	NA	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SB05-0003	SB05-0312	SB06-0003	SB06-0312	SB06-0003	SB06-0312	SB07-0003	SB07-0312
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Dec-09	Dec-09	Jul-09	Jul-09	Dec-09	Dec-09	Jul-09	Jul-09
EXPLOSIVES (MG/KG)											
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA	NA	NA
METALS (MG/KG)											
ALUMINUM	69000	7700	N	NA	NA	2160	*8210*	NA	NA	*9230*	*9710*
ANTIMONY	14	3.1	N	NA	NA	1.7 J	0.378 UJ	NA	NA	0.283 UJ	0.282 UJ
ARSENIC	9	0.39	C	NA	NA	*3.34*	*1.83*	NA	NA	*2.09*	*1.87*
BARIUM	6800	1500	N	NA	NA	28.7	10.6	NA	NA	12.3	8.63
BERYLLIUM	68	16	N	NA	NA	0.114 J	0.461	NA	NA	0.354	0.58
CADMIUM	2.1	7	N	NA	NA	0.349 J	0.0756 U	NA	NA	0.0632 J	0.0563 U
CALCIUM	NC	NC		NA	NA	2170	530	NA	NA	234 J	188 J
CHROMIUM	100	0.29	C	NA	NA	*3.7*	*6.29*	NA	NA	*8.17*	*7.04*
COBALT	15	2.3	N	NA	NA	1.07	1.14	NA	NA	*2.73*	1.86
COPPER	480	310	N	NA	NA	6.39	2.97	NA	NA	3.97 J	3.79 J
IRON	31000	5500	N	NA	NA	3780	*6760*	NA	NA	*8880*	*8400*
LEAD	170	400	N	NA	NA	*774 J*	17.6 J	NA	NA	16.4 J	3.8 UJ
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		NA	NA	308 J	591 J	NA	NA	1210 J	641 J
MANGANESE	1100	180	N	NA	NA	*297*	61.8	NA	NA	166	106
MERCURY	10	1	N	NA	NA	0.0785	0.0305 J	NA	NA	0.0474	0.0414
NICKEL	100	150	N	NA	NA	3.71	3.49	NA	NA	6.23	3.75 J
POTASSIUM	NC	NC		NA	NA	134 J	176 J	NA	NA	404 J	199 J
SELENIUM	68	39	N	NA	NA	0.411 J	0.292 J	NA	NA	0.35 J	0.514 J
SILVER	170	39	N	NA	NA	0.166 U	0.151 U	NA	NA	0.226 UJ	0.169 UJ
SODIUM	NC	NC		NA	NA	83 U	75.6 U	NA	NA	56.6 U	56.3 U
VANADIUM	240	39	N	NA	NA	15.7	15.5	NA	NA	16.7	12.4
ZINC	10000	2300	N	NA	NA	26.9	12	NA	NA	19.2	15.1
MISCELLANEOUS PARAMETERS (MEQ/100)											
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)											
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)											
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)											
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	4.7 J	100 U	NA	NA	79 U	79 U
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	6.3 J	100 U	NA	NA	79 U	79 U
ACENAPHTHENE	110000	340000	N	NA	NA	7.9 J	100 U	NA	NA	2.8 J	79 U
ACENAPHTHYLENE	68000	340000	N	NA	NA	15 J	100 U	NA	NA	2.2 J	79 U
ANTHRACENE	430000	1700000	N	NA	NA	15 J	100 U	NA	NA	4.8 J	79 U
BENZO(A)ANTHRACENE	260	150	C	NA	NA	91 J	6 J	NA	NA	21 J	1.8 J
BENZO(A)PYRENE	26	15	C	NA	NA	*100*	5.4 J	NA	NA	*19*	16 U
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	*190*	9.7 J	NA	NA	28 J	2 J
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	60 J	3.8 J	NA	NA	12 J	79 U
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	60 J	3.6 J	NA	NA	9.9 J	79 U

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SB05-0003	SB05-0312	SB06-0003	SB06-0312	SB06-0003	SB06-0312	SB07-0003	SB07-0312
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Dec-09	Dec-09	Jul-09	Jul-09	Dec-09	Dec-09	Jul-09	Jul-09
CHRYSENE	26000	15000	C	NA	NA	160	10 J	NA	NA	27 J	2.4 J
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	*17 J*	20 U	NA	NA	3.1 J	16 U
FLUORANTHENE	1000000	230000	N	NA	NA	280	15 J	NA	NA	51 J	4.2 J
FLUORENE	120000	230000	N	NA	NA	110 U	100 U	NA	NA	2.6 J	79 U
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	80 J	4.8 J	NA	NA	13 J	79 U
NAPHTHALENE	1700	3600	C	NA	NA	19 J	100 U	NA	NA	79 U	79 U
PHENANTHRENE	97000	170000	N	NA	NA	130	7.9 J	NA	NA	28 J	2.6 J
PYRENE	750000	170000	N	NA	NA	220	13 J	NA	NA	44 J	3.2 J
XRF (MG/KG)											
LEAD	170	400	N	24	23	NA	NA	69	24	NA	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SB07-0003	SB07-0312	SB08-0003	SB08-0312	SB08-0003	SB08-0312	SS01-0003	SS01-0003
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
											SAMPLE
				Dec-09	Dec-09	Jul-09	Jul-09	Dec-09	Dec-09	Jul-09	Dec-09
EXPLOSIVES (MG/KG)											
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA	0.3 UJ	0.3 U
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA	0.37 J	0.26
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	0.37 J	0.26
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA	0.3 U	0.3 U
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	0.89 J	0.52
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA	0.3 U	0.3 U
METALS (MG/KG)											
ALUMINUM	69000	7700	N	NA	NA	3660	*13300*	NA	NA	2630	2495
ANTIMONY	14	3.1	N	NA	NA	0.608 J	0.308 UJ	NA	NA	1.49 J	*515.745*
ARSENIC	9	0.39	C	NA	NA	*4.13*	*2.09 J*	NA	NA	*3.5 J*	*154.75*
BARIUM	6800	1500	N	NA	NA	36.5	12.3	NA	NA	55.4	53.8
BERYLLIUM	68	16	N	NA	NA	0.166 J	0.571	NA	NA	0.167 J	0.163
CADMIUM	2.1	7	N	NA	NA	0.302 J	0.0617 U	NA	NA	0.407 J	1.6135
CALCIUM	NC	NC		NA	NA	307 J	185 J	NA	NA	1460	1345
CHROMIUM	100	0.29	C	NA	NA	*5.08*	*9.38*	NA	NA	*5.26*	*4.89*
COBALT	15	2.3	N	NA	NA	0.682 J	2.01	NA	NA	1.08 J	1.04
COPPER	480	310	N	NA	NA	8.14	3 J	NA	NA	10.6	13.65
IRON	31000	5500	N	NA	NA	*6410*	*11000*	NA	NA	4080	3780
LEAD	170	400	N	NA	NA	*443 J*	6.35 J	NA	NA	*512 J*	*9456*
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		NA	NA	236 J	857 J	NA	NA	369 J	349
MANGANESE	1100	180	N	NA	NA	45.4	83.1	NA	NA	68.6	61.3
MERCURY	10	1	N	NA	NA	0.134	0.0515	NA	NA	0.145	0.152
NICKEL	100	150	N	NA	NA	5.33	5.15 J	NA	NA	7.69	7.35
POTASSIUM	NC	NC		NA	NA	144 J	243 J	NA	NA	407 J	395.5
SELENIUM	68	39	N	NA	NA	0.727	0.609 J	NA	NA	0.868	0.889
SILVER	170	39	N	NA	NA	0.232 U	0.185 UJ	NA	NA	0.18 UJ	1.385
SODIUM	NC	NC		NA	NA	77.3 U	61.7 U	NA	NA	90.1 U	87 U
VANADIUM	240	39	N	NA	NA	19.7	16.7	NA	NA	15.9	14.95
ZINC	10000	2300	N	NA	NA	10.6	14.9	NA	NA	17.9	17.25
MISCELLANEOUS PARAMETERS (MEQ/100)											
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)											
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)											
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)											
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	12 J	84 U	NA	NA	16 J	15.5
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	16 J	84 U	NA	NA	20 J	19
ACENAPHTHENE	110000	340000	N	NA	NA	100 U	84 U	NA	NA	120 U	36 J
ACENAPHTHYLENE	68000	340000	N	NA	NA	100 U	84 U	NA	NA	120 U	56 J
ANTHRACENE	430000	1700000	N	NA	NA	26 J	84 U	NA	NA	56 J	65.5
BENZO(A)ANTHRACENE	260	150	C	NA	NA	100 J	84 U	NA	NA	*260*	*315*
BENZO(A)PYRENE	26	15	C	NA	NA	*99*	17 U	NA	NA	*290*	*360*
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	*200*	84 U	NA	NA	*540*	*560*
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	100 U	84 U	NA	NA	150	190
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	59 J	84 U	NA	NA	180 J	300

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) [1]	USEPA RSL [2]		NASB-SKT-XRF							
				SB07-0003	SB07-0312	SB08-0003	SB08-0312	SB08-0003	SB08-0312	SS01-0003	SS01-0003
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
											SAMPLE
				Dec-09	Dec-09	Jul-09	Jul-09	Dec-09	Dec-09	Jul-09	Dec-09
CHRYSENE	26000	15000	C	NA	NA	170	84 U	NA	NA	390	475
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	21 U	17 U	NA	NA	*43*	*27.25*
FLUORANTHENE	1000000	230000	N	NA	NA	310	2.8 J	NA	NA	800	870
FLUORENE	120000	230000	N	NA	NA	100 U	84 U	NA	NA	120 U	31 J
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	80 J	84 U	NA	NA	*210*	*260*
NAPHTHALENE	1700	3600	C	NA	NA	100 U	84 U	NA	NA	120 U	43 J
PHENANTHRENE	97000	170000	N	NA	NA	200	2.1 J	NA	NA	450	465
PYRENE	750000	170000	N	NA	NA	250	2.1 J	NA	NA	620	700
XRF (MG/KG)											
LEAD	170	400	N	36	18	NA	NA	102	24	NA	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SS01-0003		SS02-0003	SS02-0003	SS03-0003	SS03-0003	SS04-0003	SS04-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs						
				AVERAGE	DUPLICATE	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Dec-09		Jul-09	Dec-09	Jul-09	Dec-09	Jul-09	Dec-09
EXPLOSIVES (MG/KG)											
2,4-DINITROTOLUENE	3.5	1.6	C	0.3 UJ	NA	0.3 UJ	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	0.3 UJ	NA	0.3 UJ	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	0.3 U	NA	0.3 U	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	0.3 U	NA	0.3 U	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	0.3 UJ	NA	0.3 UJ	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	0.3 U	NA	0.3 U	NA	NA	NA	NA	NA
METALS (MG/KG)											
ALUMINUM	69000	7700	N	2360	NA	*8470*	NA	*9230*	NA	6510	NA
ANTIMONY	14	3.1	N	*1030 J*	NA	0.315 UJ	NA	0.373 UJ	NA	0.347 UJ	NA
ARSENIC	9	0.39	C	*306 J*	NA	*4.7*	NA	*6.54*	NA	*4.09*	NA
BARIUM	6800	1500	N	52.2	NA	30.2	NA	41.3	NA	22.9	NA
BERYLLIUM	68	16	N	0.159 J	NA	0.376	NA	0.422	NA	0.297 J	NA
CADMIUM	2.1	7	N	2.82 J	NA	0.626	NA	1.1	NA	0.285 J	NA
CALCIUM	NC	NC		1230	NA	1240	NA	2470	NA	1920	NA
CHROMIUM	100	0.29	C	*4.52*	NA	*19.8*	NA	*23.4*	NA	*11.8*	NA
COBALT	15	2.3	N	1 J	NA	*4.72*	NA	*6.36*	NA	2.27	NA
COPPER	480	310	N	16.7	NA	14.8	NA	38.4	NA	6.74	NA
IRON	31000	5500	N	3480	NA	*12000*	NA	*14500*	NA	*8620*	NA
LEAD	170	400	N	*18400 J*	NA	50.9 J	NA	134 J	NA	68.4 J	NA
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	NA	NA
MAGNESIUM	NC	NC		329 J	NA	2540 J	NA	3280 J	NA	1210 J	NA
MANGANESE	1100	180	N	54	NA	*202*	NA	*213*	NA	*181*	NA
MERCURY	10	1	N	0.159	NA	0.0351 J	NA	0.0416	NA	0.0679	NA
NICKEL	100	150	N	7.01	NA	12.5	NA	19.6	NA	8.97	NA
POTASSIUM	NC	NC		384 J	NA	1430 J	NA	1250 J	NA	526 J	NA
SELENIUM	68	39	N	0.91	NA	0.189 UJ	NA	0.224 U	NA	0.307 J	NA
SILVER	170	39	N	2.68 J	NA	0.252 UJ	NA	0.299 U	NA	0.277 UJ	NA
SODIUM	NC	NC		83.9 U	NA	93.7 J	NA	135 J	NA	69.4 U	NA
VANADIUM	240	39	N	14	NA	30.1	NA	30.5	NA	30.4	NA
ZINC	10000	2300	N	16.6	NA	44.2	NA	224	NA	26.7	NA
MISCELLANEOUS PARAMETERS (MEQ/100)											
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)											
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)											
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)											
1-METHYLNAPHTHALENE	NC	22000	C	15 J	NA	12 J	NA	18 J	NA	7.7 J	NA
2-METHYLNAPHTHALENE	3600	31000	N	18 J	NA	18 J	NA	26 J	NA	9.6 J	NA
ACENAPHTHENE	110000	340000	N	36 J	NA	88	NA	110	NA	52 J	NA
ACENAPHTHYLENE	68000	340000	N	56 J	NA	47 J	NA	98 J	NA	39 J	NA
ANTHRACENE	430000	1700000	N	75 J	NA	130	NA	280	NA	89 J	NA
BENZO(A)ANTHRACENE	260	150	C	*370 J*	NA	*700*	NA	*1100*	NA	*660 J*	NA
BENZO(A)PYRENE	26	15	C	*430*	NA	*1000*	NA	*1600*	NA	*520*	NA
BENZO(B)FLUORANTHENE	260	150	C	*580*	NA	*1400*	NA	*2400*	NA	*830*	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	230	NA	630	NA	1200	NA	280	NA
BENZO(K)FLUORANTHENE	2600	1500	C	420 J	NA	500	NA	790	NA	270 J	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF							
				SS01-0003		SS02-0003	SS02-0003	SS03-0003	SS03-0003	SS04-0003	SS04-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs						
				AVERAGE	DUPLICATE	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Dec-09		Jul-09	Dec-09	Jul-09	Dec-09	Jul-09	Dec-09
CHRYSENE	26000	15000	C	560 J	NA	860	NA	1500	NA	910 J	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	23 UJ	NA	*160*	NA	*300*	NA	19 UJ	NA
FLUORANTHENE	1000000	230000	N	940 J	NA	1400	NA	2700	NA	1200 J	NA
FLUORENE	120000	230000	N	31 J	NA	69 J	NA	120	NA	50 J	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	*310*	NA	*700*	NA	*1600*	NA	*360*	NA
NAPHTHALENE	1700	3600	C	43 J	NA	38 J	NA	54 J	NA	16 J	NA
PHENANTHRENE	97000	170000	N	480	NA	580	NA	1300	NA	500	NA
PYRENE	750000	170000	N	780	NA	1300	NA	2300	NA	1000	NA
XRF (MG/KG)											
LEAD	170	400	N	NA	210	NA	38	NA	56	NA	173

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SS05-0003	SS05-0003	SS06-0003	SS06-0312	SS06-0003		
								0 - 0.25 ft bgs		
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE
				Jul-09	Dec-09	Jul-09		Dec-09		
EXPLOSIVES (MG/KG)										
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA	NA
METALS (MG/KG)										
ALUMINUM	69000	7700	N	*8100*	NA	4070	3835	3600	NA	NA
ANTIMONY	14	3.1	N	0.302 UJ	NA	0.968 J	1.379	1.79 J	NA	NA
ARSENIC	9	0.39	C	*3.26*	NA	*5.02*	*4.88*	*4.74*	NA	NA
BARIUM	6800	1500	N	687	NA	39.4	38.05	36.7	NA	NA
BERYLLIUM	68	16	N	0.322	NA	0.139 U	0.1355 U	0.132 U	NA	NA
CADMIUM	2.1	7	N	0.246 J	NA	0.535 J	0.518	0.501 J	NA	NA
CALCIUM	NC	NC		888	NA	3230	3330	3430	NA	NA
CHROMIUM	100	0.29	C	*11*	NA	*12*	*11.55*	*11.1*	NA	NA
COBALT	15	2.3	N	*3.13*	NA	1.91	1.77	1.63 J	NA	NA
COPPER	480	310	N	9.28	NA	8.43	8.235	8.04	NA	NA
IRON	31000	5500	N	*9430*	NA	*7340*	*6885*	*6430*	NA	NA
LEAD	170	400	N	17 J	NA	*702 J*	*741.5*	*781 J*	NA	NA
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	61
MAGNESIUM	NC	NC		1550 J	NA	1060 J	980.5	901 J	NA	NA
MANGANESE	1100	180	N	150	NA	*301*	*279*	*257*	NA	NA
MERCURY	10	1	N	0.054	NA	0.274	0.2975	0.321	NA	NA
NICKEL	100	150	N	7.94	NA	14	13.6	13.2	NA	NA
POTASSIUM	NC	NC		845 J	NA	870 J	800.5	731 J	NA	NA
SELENIUM	68	39	N	0.306 J	NA	1.33	1.42	1.51	NA	NA
SILVER	170	39	N	0.181 UJ	NA	0.278 U	0.271 U	0.264 U	NA	NA
SODIUM	NC	NC		60.4 U	NA	139 U	135.5 U	132 U	NA	NA
VANADIUM	240	39	N	15.8	NA	32.4	30.4	28.4	NA	NA
ZINC	10000	2300	N	36.2	NA	53.8	51.15	48.5	NA	NA
MISCELLANEOUS PARAMETERS (MEQ/100)										
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	1.58 J	1.58 J	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)										
TOTAL ORGANIC CARBON	NC	NC		NA	NA	356000 J	356000 J	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)										
pH	NC	NC		NA	NA	4.02	4.02	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)										
1-METHYLNAPHTHALENE	NC	22000	C	26 J	NA	21 J	22	23 J	NA	NA
2-METHYLNAPHTHALENE	3600	31000	N	26 J	NA	30 J	30	30 J	NA	NA
ACENAPHTHENE	110000	340000	N	440	NA	110 J	104	98 J	NA	NA
ACENAPHTHYLENE	68000	340000	N	36 J	NA	190 U	185 U	180 U	NA	NA
ANTHRACENE	430000	1700000	N	840	NA	160 J	180	200	NA	NA
BENZO(A)ANTHRACENE	260	150	C	*2200*	NA	*1100 J*	*1025*	*950 J*	NA	NA
BENZO(A)PYRENE	26	15	C	*2400*	NA	*1200 J*	*609*	36 UJ	NA	NA
BENZO(B)FLUORANTHENE	260	150	C	*3300*	NA	*1800*	*1650*	*1500*	NA	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	1200	NA	600	525	450	NA	NA
BENZO(K)FLUORANTHENE	2600	1500	C	1100	NA	900	880	860	NA	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SS05-0003	SS05-0003	SS06-0003	SS06-0312	SS06-0003		
								0 - 0.25 ft bgs		
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	SAMPLE	AVERAGE	DUPLICATE
				Jul-09	Dec-09	Jul-09		Dec-09		
CHRYSENE	26000	15000	C	2100	NA	1700 J	1500	1300 J	NA	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	*340*	NA	38 UJ	37 U	36 UJ	NA	NA
FLUORANTHENE	1000000	230000	N	6000	NA	2400 J	2450	2500 J	NA	NA
FLUORENE	120000	230000	N	330	NA	74 J	78	82 J	NA	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	*1500*	NA	*850*	*740*	*630*	NA	NA
NAPHTHALENE	1700	3600	C	54 J	NA	69 J	64.5	60 J	NA	NA
PHENANTHRENE	97000	170000	N	3400	NA	1000	1100	1200	NA	NA
PYRENE	750000	170000	N	4900	NA	2000	2000	2000	NA	NA
XRF (MG/KG)										
LEAD	170	400	N	NA	22	NA	NA	NA	*1839*	30

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF-SS07-0003					
				SS07-0003	SS07-0312			SS07-0003	SS08-0003
					0.25 - 1 ft bgs				0 - 0.25 ft bgs
				0 - 0.25 ft bgs	SAMPLE	AVERAGE	DUPLICATE	0 - 0.25 ft bgs	SAMPLE
				Jul-09				Dec-09	Jul-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	5790	NA	NA	NA	NA	4660
ANTIMONY	14	3.1	N	*3.3 J*	NA	NA	NA	NA	0.813 J
ARSENIC	9	0.39	C	*6.74*	NA	NA	NA	NA	*4.9*
BARIUM	6800	1500	N	102	NA	NA	NA	NA	13.9
BERYLLIUM	68	16	N	0.458 J	NA	NA	NA	NA	0.192 J
CADMIUM	2.1	7	N	0.585 J	NA	NA	NA	NA	0.13 J
CALCIUM	NC	NC		6400	NA	NA	NA	NA	447
CHROMIUM	100	0.29	C	*12.1*	NA	NA	NA	NA	*8.92*
COBALT	15	2.3	N	*6.38*	NA	NA	NA	NA	2.09
COPPER	480	310	N	15.2	NA	NA	NA	NA	5.18
IRON	31000	5500	N	*11300*	NA	NA	NA	NA	*8690*
LEAD	170	400	N	*2340 J*	NA	NA	NA	NA	*785 J*
LEAD-CALC	170	400		NA	NA	46.4	46.4	NA	NA
MAGNESIUM	NC	NC		1150 J	NA	NA	NA	NA	1080 J
MANGANESE	1100	180	N	171	NA	NA	NA	NA	74.6
MERCURY	10	1	N	0.299	NA	NA	NA	NA	0.0882
NICKEL	100	150	N	10.4	NA	NA	NA	NA	6.77
POTASSIUM	NC	NC		683 J	NA	NA	NA	NA	505 J
SELENIUM	68	39	N	1.48	NA	NA	NA	NA	0.473 J
SILVER	170	39	N	0.487 U	NA	NA	NA	NA	0.143 UJ
SODIUM	NC	NC		509 J	NA	NA	NA	NA	71.5 U
VANADIUM	240	39	N	38.1	NA	NA	NA	NA	24.5
ZINC	10000	2300	N	23.3	NA	NA	NA	NA	19.3
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		1.02 J	NA	NA	NA	NA	0.608 J
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		197000 J	NA	NA	NA	NA	73800 J
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		5.28	NA	NA	NA	NA	3.73
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	37 J	NA	NA	NA	NA	14 J
2-METHYLNAPHTHALENE	3600	31000	N	42 J	NA	NA	NA	NA	17 J
ACENAPHTHENE	110000	340000	N	140 J	NA	NA	NA	NA	64 J
ACENAPHTHYLENE	68000	340000	N	140 J	NA	NA	NA	NA	68 J
ANTHRACENE	430000	1700000	N	240 J	NA	NA	NA	NA	110
BENZO(A)ANTHRACENE	260	150	C	*1700 J*	NA	NA	NA	NA	*600 J*
BENZO(A)PYRENE	26	15	C	*1400*	NA	NA	NA	NA	*400*
BENZO(B)FLUORANTHENE	260	150	C	*2100*	NA	NA	NA	NA	*540*
BENZO(G,H,I)PERYLENE	750000	170000	N	780	NA	NA	NA	NA	210
BENZO(K)FLUORANTHENE	2600	1500	C	830	NA	NA	NA	NA	260

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF-SS07-0003					
				SS07-0003	SS07-0312			SS07-0003	SS08-0003
					0.25 - 1 ft bgs				0 - 0.25 ft bgs
				0 - 0.25 ft bgs	SAMPLE	AVERAGE	DUPLICATE	0 - 0.25 ft bgs	SAMPLE
				Jul-09				Dec-09	Jul-09
CHRYSENE	26000	15000	C	2800 J	NA	NA	NA	NA	750 J
DIBENZO(A,H)ANTHRACENE	26	15	C	66 UJ	NA	NA	NA	NA	19 UJ
FLUORANTHENE	1000000	230000	N	3800 J	NA	NA	NA	NA	1200 J
FLUORENE	120000	230000	N	110 J	NA	NA	NA	NA	44 J
INDENO(1,2,3-CD)PYRENE	260	150	C	*1100*	NA	NA	NA	NA	*290*
NAPHTHALENE	1700	3600	C	74 J	NA	NA	NA	NA	33 J
PHENANTHRENE	97000	170000	N	1600	NA	NA	NA	NA	540
PYRENE	750000	170000	N	3200	NA	NA	NA	NA	1000
XRF (MG/KG)									
LEAD	170	400	N	NA	*1035*	32	28	24	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS08-0003		SS08-0312	SS08-0003	SS09-0003	SS09-0003
				0 - 0.25 ft bgs					
				AVERAGE	DUPLICATE	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09			Dec-09	Jul-09	Dec-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	NA	NA	NA	NA	7080	NA
ANTIMONY	14	3.1	N	NA	NA	NA	NA	0.263 UJ	NA
ARSENIC	9	0.39	C	NA	NA	NA	NA	*2.29*	NA
BARIUM	6800	1500	N	NA	NA	NA	NA	14.3	NA
BERYLLIUM	68	16	N	NA	NA	NA	NA	0.299	NA
CADMIUM	2.1	7	N	NA	NA	NA	NA	0.0525 U	NA
CALCIUM	NC	NC		NA	NA	NA	NA	453	NA
CHROMIUM	100	0.29	C	NA	NA	NA	NA	*9.55*	NA
COBALT	15	2.3	N	NA	NA	NA	NA	*3.3*	NA
COPPER	480	310	N	NA	NA	NA	NA	5.87	NA
IRON	31000	5500	N	NA	NA	NA	NA	*9300*	NA
LEAD	170	400	N	NA	NA	NA	NA	20.3 J	NA
LEAD-CALC	170	400		NA	NA	NA	0 U	NA	NA
MAGNESIUM	NC	NC		NA	NA	NA	NA	2060 J	NA
MANGANESE	1100	180	N	NA	NA	NA	NA	103	NA
MERCURY	10	1	N	NA	NA	NA	NA	0.015 J	NA
NICKEL	100	150	N	NA	NA	NA	NA	8.48	NA
POTASSIUM	NC	NC		NA	NA	NA	NA	1000 J	NA
SELENIUM	68	39	N	NA	NA	NA	NA	0.158 UJ	NA
SILVER	170	39	N	NA	NA	NA	NA	0.21 UJ	NA
SODIUM	NC	NC		NA	NA	NA	NA	52.5 U	NA
VANADIUM	240	39	N	NA	NA	NA	NA	19.4	NA
ZINC	10000	2300	N	NA	NA	NA	NA	19.9	NA
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	NA	NA	72 U	NA
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	NA	NA	72 U	NA
ACENAPHTHENE	110000	340000	N	NA	NA	NA	NA	4.9 J	NA
ACENAPHTHYLENE	68000	340000	N	NA	NA	NA	NA	2.6 J	NA
ANTHRACENE	430000	1700000	N	NA	NA	NA	NA	6.4 J	NA
BENZO(A)ANTHRACENE	260	150	C	NA	NA	NA	NA	37 J	NA
BENZO(A)PYRENE	26	15	C	NA	NA	NA	NA	*26*	NA
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	NA	NA	72 U	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	NA	NA	72 U	NA
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	NA	NA	72 U	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS08-0003		SS08-0312	SS08-0003	SS09-0003	SS09-0003
				0 - 0.25 ft bgs					
				AVERAGE	DUPLICATE	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09			Dec-09	Jul-09	Dec-09
CHRYSENE	26000	15000	C	NA	NA	NA	NA	36 J	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	NA	NA	14 UJ	NA
FLUORANTHENE	1000000	230000	N	NA	NA	NA	NA	75 J	NA
FLUORENE	120000	230000	N	NA	NA	NA	NA	3.8 J	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	NA	NA	22 J	NA
NAPHTHALENE	1700	3600	C	NA	NA	NA	NA	72 U	NA
PHENANTHRENE	97000	170000	N	NA	NA	NA	NA	43 J	NA
PYRENE	750000	170000	N	NA	NA	NA	NA	65 J	NA
XRF (MG/KG)									
LEAD	170	400	N	*555*	*553.5*	*552*	20	NA	25

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SS10-0003	SS10-0003	SS11-0003	SS11-0003	SS12-0003	SS12-0003	SS13-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09	Dec-09	Jul-09	Dec-09	Jul-09	Dec-09	Jul-09
EXPLOSIVES (MG/KG)										
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA	NA
METALS (MG/KG)										
ALUMINUM	69000	7700	N	2910	NA	2720	NA	2930	NA	NA
ANTIMONY	14	3.1	N	0.392 J	NA	0.392 J	NA	0.488 UJ	NA	NA
ARSENIC	9	0.39	C	*3.35*	NA	*3.77*	NA	*3.63*	NA	NA
BARIUM	6800	1500	N	24.3	NA	23.3	NA	83.6	NA	NA
BERYLLIUM	68	16	N	0.116 J	NA	0.0959 J	NA	0.148 J	NA	NA
CADMIUM	2.1	7	N	0.159 J	NA	0.242 J	NA	0.366 J	NA	NA
CALCIUM	NC	NC		265 J	NA	598	NA	310 J	NA	NA
CHROMIUM	100	0.29	C	*5.37*	NA	*4.5*	NA	*5.21*	NA	NA
COBALT	15	2.3	N	0.737 J	NA	0.575 J	NA	0.838 J	NA	NA
COPPER	480	310	N	6.18	NA	5.02	NA	9.33	NA	NA
IRON	31000	5500	N	*5950*	NA	4440	NA	4070	NA	NA
LEAD	170	400	N	294 J	NA	265 J	NA	66.7 J	NA	NA
LEAD-CALC	170	400		NA	NA	NA	NA	NA	NA	163.2
MAGNESIUM	NC	NC		371 J	NA	279 J	NA	222 J	NA	NA
MANGANESE	1100	180	N	39.2	NA	86.2	NA	29.2	NA	NA
MERCURY	10	1	N	0.0852	NA	0.11	NA	0.153	NA	NA
NICKEL	100	150	N	4.46	NA	6.24	NA	7.94	NA	NA
POTASSIUM	NC	NC		273 J	NA	230 J	NA	314 J	NA	NA
SELENIUM	68	39	N	0.635	NA	0.523	NA	1.07	NA	NA
SILVER	170	39	N	0.272 U	NA	0.228 U	NA	0.195 U	NA	NA
SODIUM	NC	NC		68.1 U	NA	76.1 U	NA	97.6 U	NA	NA
VANADIUM	240	39	N	22	NA	20.5	NA	19.1	NA	NA
ZINC	10000	2300	N	14.1	NA	13.3	NA	15.7	NA	NA
MISCELLANEOUS PARAMETERS (MEQ/100)										
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)										
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)										
pH	NC	NC		NA	NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)										
1-METHYLNAPHTHALENE	NC	22000	C	7.4 J	NA	16 J	NA	18 J	NA	NA
2-METHYLNAPHTHALENE	3600	31000	N	7.8 J	NA	20 J	NA	24 J	NA	NA
ACENAPHTHENE	110000	340000	N	24 J	NA	25 J	NA	19 J	NA	NA
ACENAPHTHYLENE	68000	340000	N	34 J	NA	80 J	NA	73 J	NA	NA
ANTHRACENE	430000	1700000	N	48 J	NA	66 J	NA	69 J	NA	NA
BENZO(A)ANTHRACENE	260	150	C	*230 J*	NA	*320 J*	NA	*310 J*	NA	NA
BENZO(A)PYRENE	26	15	C	*210*	NA	*240*	NA	*240*	NA	NA
BENZO(B)FLUORANTHENE	260	150	C	*290*	NA	*360*	NA	*360*	NA	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	120	NA	130	NA	120 J	NA	NA
BENZO(K)FLUORANTHENE	2600	1500	C	140	NA	150	NA	200	NA	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF						
				SS10-0003	SS10-0003	SS11-0003	SS11-0003	SS12-0003	SS12-0003	SS13-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09	Dec-09	Jul-09	Dec-09	Jul-09	Dec-09	Jul-09
CHRYSENE	26000	15000	C	300 J	NA	500 J	NA	490 J	NA	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	18 UJ	NA	21 UJ	NA	27 UJ	NA	NA
FLUORANTHENE	1000000	230000	N	490 J	NA	730 J	NA	740 J	NA	NA
FLUORENE	120000	230000	N	20 J	NA	24 J	NA	27 J	NA	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	*160*	NA	*170*	NA	150	NA	NA
NAPHTHALENE	1700	3600	C	17 J	NA	51 J	NA	86 J	NA	NA
PHENANTHRENE	97000	170000	N	260	NA	360	NA	450	NA	NA
PYRENE	750000	170000	N	420	NA	640	NA	650	NA	NA
XRF (MG/KG)										
LEAD	170	400	N	NA	301	NA	37	NA	179	44

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS13-0312	SS14-0003	SS14-0312	SS15-0003	SS15-0312	SS16-0003
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Jul-09	Jul-09	Jul-09	Jul-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	NA	NA	NA	NA	NA	NA
ANTIMONY	14	3.1	N	NA	NA	NA	NA	NA	NA
ARSENIC	9	0.39	C	NA	NA	NA	NA	NA	NA
BARIUM	6800	1500	N	NA	NA	NA	NA	NA	NA
BERYLLIUM	68	16	N	NA	NA	NA	NA	NA	NA
CADMIUM	2.1	7	N	NA	NA	NA	NA	NA	NA
CALCIUM	NC	NC		NA	NA	NA	NA	NA	NA
CHROMIUM	100	0.29	C	NA	NA	NA	NA	NA	NA
COBALT	15	2.3	N	NA	NA	NA	NA	NA	NA
COPPER	480	310	N	NA	NA	NA	NA	NA	NA
IRON	31000	5500	N	NA	NA	NA	NA	NA	NA
LEAD	170	400	N	NA	NA	NA	NA	NA	NA
LEAD-CALC	170	400		97.5	0 U	24.5	287.3	NA	NA
MAGNESIUM	NC	NC		NA	NA	NA	NA	NA	NA
MANGANESE	1100	180	N	NA	NA	NA	NA	NA	NA
MERCURY	10	1	N	NA	NA	NA	NA	NA	NA
NICKEL	100	150	N	NA	NA	NA	NA	NA	NA
POTASSIUM	NC	NC		NA	NA	NA	NA	NA	NA
SELENIUM	68	39	N	NA	NA	NA	NA	NA	NA
SILVER	170	39	N	NA	NA	NA	NA	NA	NA
SODIUM	NC	NC		NA	NA	NA	NA	NA	NA
VANADIUM	240	39	N	NA	NA	NA	NA	NA	NA
ZINC	10000	2300	N	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	NA	NA	NA	NA
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	NA	NA	NA	NA
ACENAPHTHENE	110000	340000	N	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	68000	340000	N	NA	NA	NA	NA	NA	NA
ANTHRACENE	430000	1700000	N	NA	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	260	150	C	NA	NA	NA	NA	NA	NA
BENZO(A)PYRENE	26	15	C	NA	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	NA	NA	NA	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS13-0312	SS14-0003	SS14-0312	SS15-0003	SS15-0312	SS16-0003
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Jul-09	Jul-09	Jul-09	Jul-09
CHRYSENE	26000	15000	C	NA	NA	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	NA	NA	NA	NA
FLUORANTHENE	1000000	230000	N	NA	NA	NA	NA	NA	NA
FLUORENE	120000	230000	N	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	NA	NA	NA	NA
NAPHTHALENE	1700	3600	C	NA	NA	NA	NA	NA	NA
PHENANTHRENE	97000	170000	N	NA	NA	NA	NA	NA	NA
PYRENE	750000	170000	N	NA	NA	NA	NA	NA	NA
XRF (MG/KG)									
LEAD	170	400	N	35	20	25	61	200	111

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS16-0312	SS17-0003	SS17-0312	SS17-0003	SS18-0003	SS18-0312
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Jul-09	Jul-09	Dec-09	Jul-09	Jul-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	NA	3100	NA	NA	NA	NA
ANTIMONY	14	3.1	N	NA	*1790 J*	NA	NA	NA	NA
ARSENIC	9	0.39	C	NA	*494*	NA	NA	NA	NA
BARIUM	6800	1500	N	NA	22.3	NA	NA	NA	NA
BERYLLIUM	68	16	N	NA	0.124 J	NA	NA	NA	NA
CADMIUM	2.1	7	N	NA	4.14	NA	NA	NA	NA
CALCIUM	NC	NC		NA	635	NA	NA	NA	NA
CHROMIUM	100	0.29	C	NA	*8.91*	NA	NA	NA	NA
COBALT	15	2.3	N	NA	1.05	NA	NA	NA	NA
COPPER	480	310	N	NA	24.5	NA	NA	NA	NA
IRON	31000	5500	N	NA	*5510*	NA	NA	NA	NA
LEAD	170	400	N	NA	*29300 J*	NA	NA	NA	NA
LEAD-CALC	170	400		NA	NA	NA	141.3	82.9	75.6
MAGNESIUM	NC	NC		NA	552 J	NA	NA	NA	NA
MANGANESE	1100	180	N	NA	51.5	NA	NA	NA	NA
MERCURY	10	1	N	NA	0.136	NA	NA	NA	NA
NICKEL	100	150	N	NA	6.55	NA	NA	NA	NA
POTASSIUM	NC	NC		NA	389 J	NA	NA	NA	NA
SELENIUM	68	39	N	NA	1.04	NA	NA	NA	NA
SILVER	170	39	N	NA	4.44	NA	NA	NA	NA
SODIUM	NC	NC		NA	82.3 U	NA	NA	NA	NA
VANADIUM	240	39	N	NA	23.6	NA	NA	NA	NA
ZINC	10000	2300	N	NA	19.2	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	NA	13 J	NA	NA	NA	NA
2-METHYLNAPHTHALENE	3600	31000	N	NA	14 J	NA	NA	NA	NA
ACENAPHTHENE	110000	340000	N	NA	88 J	NA	NA	NA	NA
ACENAPHTHYLENE	68000	340000	N	NA	51 J	NA	NA	NA	NA
ANTHRACENE	430000	1700000	N	NA	140	NA	NA	NA	NA
BENZO(A)ANTHRACENE	260	150	C	NA	*840 J*	NA	NA	NA	NA
BENZO(A)PYRENE	26	15	C	NA	*730*	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	260	150	C	NA	*1300*	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	390	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	2600	1500	C	NA	500	NA	NA	NA	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) [1]	USEPA RSL [2]		NASB-SKT-XRF					
				SS16-0312	SS17-0003	SS17-0312	SS17-0003	SS18-0003	SS18-0312
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Jul-09	Jul-09	Dec-09	Jul-09	Jul-09
CHRYSENE	26000	15000	C	NA	1000 J	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	22 UJ	NA	NA	NA	NA
FLUORANTHENE	1000000	230000	N	NA	1900 J	NA	NA	NA	NA
FLUORENE	120000	230000	N	NA	65 J	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	*570*	NA	NA	NA	NA
NAPHTHALENE	1700	3600	C	NA	28 J	NA	NA	NA	NA
PHENANTHRENE	97000	170000	N	NA	940	NA	NA	NA	NA
PYRENE	750000	170000	N	NA	1600	NA	NA	NA	NA
XRF (MG/KG)									
LEAD	170	400	N	136	NA	*628*	41	33	32

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS19-0003	SS19-0312	SS19-0003	SS20-0003	SS20-0312	SS21-0003
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Dec-09	Jul-09	Jul-09	Jul-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	0.44 J	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	0.3 UJ	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	0.3 U	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	0.17 J	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	0.18 J	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	0.72 J	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	3590	NA	NA	NA	NA	3220
ANTIMONY	14	3.1	N	*3.73 J*	NA	NA	NA	NA	0.446 UJ
ARSENIC	9	0.39	C	*4.56*	NA	NA	NA	NA	*3.64*
BARIUM	6800	1500	N	76.7	NA	NA	NA	NA	48.5
BERYLLIUM	68	16	N	0.214 J	NA	NA	NA	NA	0.131 J
CADMIUM	2.1	7	N	0.51	NA	NA	NA	NA	0.741
CALCIUM	NC	NC		966	NA	NA	NA	NA	1040
CHROMIUM	100	0.29	C	*6.73*	NA	NA	NA	NA	*5.69*
COBALT	15	2.3	N	1.24	NA	NA	NA	NA	1.04 J
COPPER	480	310	N	13	NA	NA	NA	NA	10.8
IRON	31000	5500	N	5340	NA	NA	NA	NA	5420
LEAD	170	400	N	*513 J*	NA	NA	NA	NA	101 J
LEAD-CALC	170	400		NA	NA	2.6	250.8	0 U	NA
MAGNESIUM	NC	NC		343 J	NA	NA	NA	NA	318 J
MANGANESE	1100	180	N	41.8	NA	NA	NA	NA	110
MERCURY	10	1	N	0.201	NA	NA	NA	NA	0.178
NICKEL	100	150	N	11.1	NA	NA	NA	NA	14.3
POTASSIUM	NC	NC		352 J	NA	NA	NA	NA	251 J
SELENIUM	68	39	N	1.28	NA	NA	NA	NA	1.04
SILVER	170	39	N	0.184 U	NA	NA	NA	NA	0.357 U
SODIUM	NC	NC		92 U	NA	NA	NA	NA	89.2 U
VANADIUM	240	39	N	24.7	NA	NA	NA	NA	37.5
ZINC	10000	2300	N	29.1	NA	NA	NA	NA	22.1
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		1.25 J	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		210000 J	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		3.52	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	33 J	NA	NA	NA	NA	14 J
2-METHYLNAPHTHALENE	3600	31000	N	44 J	NA	NA	NA	NA	18 J
ACENAPHTHENE	110000	340000	N	59 J	NA	NA	NA	NA	27 J
ACENAPHTHYLENE	68000	340000	N	87 J	NA	NA	NA	NA	68 J
ANTHRACENE	430000	1700000	N	140	NA	NA	NA	NA	65 J
BENZO(A)ANTHRACENE	260	150	C	*630 J*	NA	NA	NA	NA	*270 J*
BENZO(A)PYRENE	26	15	C	24 U	NA	NA	NA	NA	*210*
BENZO(B)FLUORANTHENE	260	150	C	*840*	NA	NA	NA	NA	*360*
BENZO(G,H,I)PERYLENE	750000	170000	N	250	NA	NA	NA	NA	100 J
BENZO(K)FLUORANTHENE	2600	1500	C	360	NA	NA	NA	NA	170

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF					
				SS19-0003	SS19-0312	SS19-0003	SS20-0003	SS20-0312	SS21-0003
				0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Dec-09	Jul-09	Jul-09	Jul-09
CHRYSENE	26000	15000	C	880 J	NA	NA	NA	NA	380 J
DIBENZO(A,H)ANTHRACENE	26	15	C	24 UJ	NA	NA	NA	NA	24 UJ
FLUORANTHENE	1000000	230000	N	1500 J	NA	NA	NA	NA	630 J
FLUORENE	120000	230000	N	58 J	NA	NA	NA	NA	24 J
INDENO(1,2,3-CD)PYRENE	260	150	C	*350*	NA	NA	NA	NA	150
NAPHTHALENE	1700	3600	C	160	NA	NA	NA	NA	42 J
PHENANTHRENE	97000	170000	N	890	NA	NA	NA	NA	330
PYRENE	750000	170000	N	1300	NA	NA	NA	NA	550
XRF (MG/KG)									
LEAD	170	400	N	NA	389	22	56	18	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF-SS21-0312					
				SS21-0312	SS21-0003	SS22-0003	SS22-0312	SS23-0003	SS23-0312
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Dec-09	Jul-09	Jul-09	Jul-09	Jul-09
EXPLOSIVES (MG/KG)									
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	NA	NA	NA	NA
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	NA	NA	NA	NA
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
3-NITROTOLUENE	NC	0.61	N	NA	NA	NA	NA	NA	NA
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	NA	NA	NA	NA
4-NITROTOLUENE	NC	30	C	NA	NA	NA	NA	NA	NA
METALS (MG/KG)									
ALUMINUM	69000	7700	N	NA	NA	NA	NA	NA	NA
ANTIMONY	14	3.1	N	NA	NA	NA	NA	NA	NA
ARSENIC	9	0.39	C	NA	NA	NA	NA	NA	NA
BARIUM	6800	1500	N	NA	NA	NA	NA	NA	NA
BERYLLIUM	68	16	N	NA	NA	NA	NA	NA	NA
CADMIUM	2.1	7	N	NA	NA	NA	NA	NA	NA
CALCIUM	NC	NC		NA	NA	NA	NA	NA	NA
CHROMIUM	100	0.29	C	NA	NA	NA	NA	NA	NA
COBALT	15	2.3	N	NA	NA	NA	NA	NA	NA
COPPER	480	310	N	NA	NA	NA	NA	NA	NA
IRON	31000	5500	N	NA	NA	NA	NA	NA	NA
LEAD	170	400	N	NA	NA	NA	NA	NA	NA
LEAD-CALC	170	400		NA	0 U	97.5	68.3	NA	0 U
MAGNESIUM	NC	NC		NA	NA	NA	NA	NA	NA
MANGANESE	1100	180	N	NA	NA	NA	NA	NA	NA
MERCURY	10	1	N	NA	NA	NA	NA	NA	NA
NICKEL	100	150	N	NA	NA	NA	NA	NA	NA
POTASSIUM	NC	NC		NA	NA	NA	NA	NA	NA
SELENIUM	68	39	N	NA	NA	NA	NA	NA	NA
SILVER	170	39	N	NA	NA	NA	NA	NA	NA
SODIUM	NC	NC		NA	NA	NA	NA	NA	NA
VANADIUM	240	39	N	NA	NA	NA	NA	NA	NA
ZINC	10000	2300	N	NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MEQ/100)									
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)									
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA	NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)									
pH	NC	NC		NA	NA	NA	NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)									
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	NA	NA	NA	NA
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	NA	NA	NA	NA
ACENAPHTHENE	110000	340000	N	NA	NA	NA	NA	NA	NA
ACENAPHTHYLENE	68000	340000	N	NA	NA	NA	NA	NA	NA
ANTHRACENE	430000	1700000	N	NA	NA	NA	NA	NA	NA
BENZO(A)ANTHRACENE	260	150	C	NA	NA	NA	NA	NA	NA
BENZO(A)PYRENE	26	15	C	NA	NA	NA	NA	NA	NA
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	NA	NA	NA	NA
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	NA	NA	NA	NA
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	NA	NA	NA	NA

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF-SS21-0312					
				SS21-0312	SS21-0003	SS22-0003	SS22-0312	SS23-0003	SS23-0312
				0.25 - 1 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs	0 - 0.25 ft bgs	0.25 - 1 ft bgs
				Jul-09	Dec-09	Jul-09	Jul-09	Jul-09	Jul-09
CHRYSENE	26000	15000	C	NA	NA	NA	NA	NA	NA
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	NA	NA	NA	NA
FLUORANTHENE	1000000	230000	N	NA	NA	NA	NA	NA	NA
FLUORENE	120000	230000	N	NA	NA	NA	NA	NA	NA
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	NA	NA	NA	NA
NAPHTHALENE	1700	3600	C	NA	NA	NA	NA	NA	NA
PHENANTHRENE	97000	170000	N	NA	NA	NA	NA	NA	NA
PYRENE	750000	170000	N	NA	NA	NA	NA	NA	NA
XRF (MG/KG)									
LEAD	170	400	N	377	16	35	31	157	16

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF		
				SS24-0003	SS25-0003	SS26-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Dec-09
EXPLOSIVES (MG/KG)						
2,4-DINITROTOLUENE	3.5	1.6	C	NA	NA	0.3 UJ
2,6-DINITROTOLUENE	1.6	6.1	N	NA	NA	0.3 UJ
2-AMINO-4,6-DINITROTOLUENE	NC	15	N	NA	NA	0.3 U
3-NITROTOLUENE	NC	0.61	N	NA	NA	0.3 U
4-AMINO-2,6-DINITROTOLUENE	NC	15	N	NA	NA	1.1 J
4-NITROTOLUENE	NC	30	C	NA	NA	0.3 U
METALS (MG/KG)						
ALUMINUM	69000	7700	N	NA	NA	2230
ANTIMONY	14	3.1	N	NA	NA	1.23 J
ARSENIC	9	0.39	C	NA	NA	*3.11*
BARIUM	6800	1500	N	NA	NA	43.7
BERYLLIUM	68	16	N	NA	NA	0.1 J
CADMIUM	2.1	7	N	NA	NA	0.195 J
CALCIUM	NC	NC		NA	NA	578
CHROMIUM	100	0.29	C	NA	NA	*3.47*
COBALT	15	2.3	N	NA	NA	0.6 J
COPPER	480	310	N	NA	NA	6.68
IRON	31000	5500	N	NA	NA	3840
LEAD	170	400	N	NA	NA	241 J
LEAD-CALC	170	400		0 U	0 U	NA
MAGNESIUM	NC	NC		NA	NA	174 J
MANGANESE	1100	180	N	NA	NA	33.9
MERCURY	10	1	N	NA	NA	0.0668
NICKEL	100	150	N	NA	NA	4.48
POTASSIUM	NC	NC		NA	NA	181 J
SELENIUM	68	39	N	NA	NA	0.553
SILVER	170	39	N	NA	NA	0.135 U
SODIUM	NC	NC		NA	NA	67.6 U
VANADIUM	240	39	N	NA	NA	15.1
ZINC	10000	2300	N	NA	NA	10.2
MISCELLANEOUS PARAMETERS (MEQ/100)						
CATION EXCHANGE CAPACITY	NC	NC		NA	NA	NA
MISCELLANEOUS PARAMETERS (MG/KG)						
TOTAL ORGANIC CARBON	NC	NC		NA	NA	NA
MISCELLANEOUS PARAMETERS (S.U.)						
pH	NC	NC		NA	NA	NA
POLYCYCLIC AROMATIC HYDROCARBONS (UG/KG)						
1-METHYLNAPHTHALENE	NC	22000	C	NA	NA	4.8 J
2-METHYLNAPHTHALENE	3600	31000	N	NA	NA	5.3 J
ACENAPHTHENE	110000	340000	N	NA	NA	12 J
ACENAPHTHYLENE	68000	340000	N	NA	NA	24 J
ANTHRACENE	430000	1700000	N	NA	NA	26 J
BENZO(A)ANTHRACENE	260	150	C	NA	NA	97 J
BENZO(A)PYRENE	26	15	C	NA	NA	*92*
BENZO(B)FLUORANTHENE	260	150	C	NA	NA	150
BENZO(G,H,I)PERYLENE	750000	170000	N	NA	NA	52 J
BENZO(K)FLUORANTHENE	2600	1500	C	NA	NA	68 J

TABLE A-1

DETECTED CONCENTRATIONS AND EXCEEDANCES IN SHALLOW SURFACE AND DEEP SURFACE SOIL
SKEET RANGE SITE INSPECTION
FORMER NAVAL AIR STATION BRUNSWICK
BRUNSWICK, MAINE

PARAMETER	MAINE RAGS (Appendix 3) (1)	USEPA RSL (2)		NASB-SKT-XRF		
				SS24-0003	SS25-0003	SS26-0003
				0 - 0.25 ft bgs	0 - 0.25 ft bgs	0 - 0.25 ft bgs
				Jul-09	Jul-09	Dec-09
CHRYSENE	26000	15000	C	NA	NA	150 J
DIBENZO(A,H)ANTHRACENE	26	15	C	NA	NA	18 UJ
FLUORANTHENE	1000000	230000	N	NA	NA	260 J
FLUORENE	120000	230000	N	NA	NA	10 J
INDENO(1,2,3-CD)PYRENE	260	150	C	NA	NA	90 U
NAPHTHALENE	1700	3600	C	NA	NA	90 U
PHENANTHRENE	97000	170000	N	NA	NA	140
PYRENE	750000	170000	N	NA	NA	220
XRF (MG/KG)						
LEAD	170	400	N	17	21	NA

MEQ/100 = Milliequivalent.
NC = No criterion.
J = Value is estimated.
S.U. = Standard Units.
U = Analyte not detected at the reported detection limilt.

Red Shading - concentration greater than Maine RAGs criterion.
Italics - concentration greater than RSL criterion.

Note: Chromium screening levels are for hexavalent chromium.

1 Maine RAGS, Appendix 3, (Jan, 2010).
2 USEPA residential Regional Screening Level (June, 2011). Non-carcinogen values are divided by 10.

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB01-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0003	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0003	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0003	M	ANTIMONY	0.301	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	M	LEAD	47.5	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	M	MAGNESIUM	2310	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	M	MANGANESE	179	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0003	M	MERCURY	0.0325	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	M	POTASSIUM	1220	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	M	SELENIUM	0.181	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB01-0003	M	SILVER	0.241	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB01-0003	M	SODIUM	87.4	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	1-METHYLNAPHTHALENE	14	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	2-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	ACENAPHTHENE	30	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	ACENAPHTHYLENE	65	UG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	ANTHRACENE	84	UG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	PAH	BENZO(G,H,I)PERYLENE	240	UG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	PAH	BENZO(K)FLUORANTHENE	230	UG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	PAH	FLUORENE	43	UG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0003	PAH	INDENO(1,2,3-CD)PYRENE	270	UG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0003	PAH	NAPHTHALENE	37	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0312	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0312	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0312	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0312	M	ANTIMONY	0.272	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0312	M	CADMIUM	0.199	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	M	LEAD	18.8	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0312	M	MAGNESIUM	2140	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0312	M	MANGANESE	174	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB01-0312	M	MERCURY	0.0284	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	M	POTASSIUM	1130	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB01-0312	M	SELENIUM	0.163	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB01-0312	M	SILVER	0.163	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB01-0312	M	SODIUM	111	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	1-METHYLNAPHTHALENE	2.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	2-METHYLNAPHTHALENE	3.5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	ACENAPHTHENE	11	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	ACENAPHTHYLENE	29	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	ANTHRACENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	FLUORENE	8.5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB01-0312	PAH	NAPHTHALENE	5.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003	M	ANTIMONY	0.529	MG/KG	J	DKP	MS/MSD Recovery Noncompliance, ICP Interference - includes ICS % R Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	M	BERYLLIUM	0.337	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB02-0003	M	CADMIUM	0.254	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	M	LEAD	166	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0003	M	MAGNESIUM	540	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0003	M	MANGANESE	117	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003	M	POTASSIUM	320	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	M	SELENIUM	0.642	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0003	M	SILVER	0.152	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0003	PAH	1-METHYLNAPHTHALENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	PAH	2-METHYLNAPHTHALENE	15	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	PAH	ACENAPHTHENE	59	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	PAH	ANTHRACENE	91	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003	PAH	DIBENZO(A,H)ANTHRACENE	170	UG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SB02-0003	PAH	FLUORENE	48	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	M	ANTIMONY	0.451	MG/KG	J	DKP	MS/MSD Recovery Noncompliance, ICP Interference - includes ICS % R Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	M	BERYLLIUM	0.344	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	M	CADMIUM	0.224	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	M	LEAD	152	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0003-D	M	MAGNESIUM	489	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0003-D	M	POTASSIUM	280	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	M	SELENIUM	0.495	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0003-D	M	SILVER	0.145	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0003-D	PAH	1-METHYLNAPHTHALENE	9.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	2-METHYLNAPHTHALENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	ACENAPHTHENE	61	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	ACENAPHTHYLENE	35	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	ANTHRACENE	95	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	BENZO(A)ANTHRACENE	930	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003-D	PAH	CHRYSENE	1200	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003-D	PAH	DIBENZO(A,H)ANTHRACENE	20	UG/KG	UJ	CG	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Field Duplicate Imprecision
NASB-SKT-SB02-0003-D	PAH	FLUORANTHENE	1400	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0003-D	PAH	FLUORENE	37	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0003-D	PAH	NAPHTHALENE	33	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0312	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0312	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0312	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0312	M	ANTIMONY	0.295	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0312	M	ARSENIC	1.93	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0312	M	COPPER	2.24	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0312	M	LEAD	11.2	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0312	M	MAGNESIUM	590	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB02-0312	M	MANGANESE	55.5	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB02-0312	M	NICKEL	3.79	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0312	M	POTASSIUM	277	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	M	SELENIUM	0.585	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0312	M	SILVER	0.177	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB02-0312	PAH	1-METHYLNAPHTHALENE	2.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	PAH	2-METHYLNAPHTHALENE	2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	PAH	ACENAPHTHENE	13	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	PAH	FLUORENE	5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB02-0312	PAH	NAPHTHALENE	7.5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB02-0312	PAH	PHENANTHRENE	57	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	M	ANTIMONY	0.317	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0003	M	CADMIUM	0.25	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	M	LEAD	68.7	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0003	M	MAGNESIUM	2160	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0003	M	POTASSIUM	1150	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0003	M	SELENIUM	0.952	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB03-0003	M	SILVER	0.0635	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB03-0003	M	SODIUM	104	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	1-METHYLNAPHTHALENE	3.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	2-METHYLNAPHTHALENE	4.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	ACENAPHTHENE	6.5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	ACENAPHTHYLENE	31	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	ANTHRACENE	27	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	BENZO(G,H,I)PERYLENE	82	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	BENZO(K)FLUORANTHENE	69	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	FLUORENE	11	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0003	PAH	NAPHTHALENE	8.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	M	ANTIMONY	0.275	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0312	M	CADMIUM	0.0965	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	M	LEAD	9.88	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0312	M	MAGNESIUM	2810	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0312	M	MANGANESE	168	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB03-0312	M	MERCURY	0.0219	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	M	POTASSIUM	1600	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB03-0312	M	SELENIUM	0.165	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB03-0312	M	SILVER	0.22	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB03-0312	M	SODIUM	134	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	2-METHYLNAPHTHALENE	1.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	ACENAPHTHENE	3.5	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	ACENAPHTHYLENE	34	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	ANTHRACENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	BENZO(G,H,I)PERYLENE	60	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	BENZO(K)FLUORANTHENE	52	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	FLUORENE	5.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	INDENO(1,2,3-CD)PYRENE	72	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB03-0312	PAH	PHENANTHRENE	45	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	M	ANTIMONY	0.369	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0003	M	BERYLLIUM	0.289	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	M	CADMIUM	0.183	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	M	LEAD	23	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0003	M	MAGNESIUM	1280	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0003	M	MANGANESE	94.3	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB04-0003	M	POTASSIUM	678	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0003	PAH	1-METHYLNAPHTHALENE	6.7	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	2-METHYLNAPHTHALENE	8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	ACENAPHTHENE	40	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	ACENAPHTHYLENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	ANTHRACENE	67	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	FLUORENE	35	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0003	PAH	NAPHTHALENE	17	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	M	ANTIMONY	0.294	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0312	M	CADMIUM	0.0736	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB04-0312	M	LEAD	18.4	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0312	M	MAGNESIUM	1670	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0312	M	MANGANESE	125	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB04-0312	M	MERCURY	0.0294	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	M	POTASSIUM	811	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB04-0312	M	SELENIUM	0.177	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB04-0312	M	SILVER	0.177	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB04-0312	PAH	2-METHYLNAPHTHALENE	1.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	ACENAPHTHENE	3.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	ACENAPHTHYLENE	7.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	ANTHRACENE	8.2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	BENZO(A)ANTHRACENE	46	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	BENZO(B)FLUORANTHENE	59	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	BENZO(G,H,I)PERYLENE	22	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	BENZO(K)FLUORANTHENE	23	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	CHRYSENE	60	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	DIBENZO(A,H)ANTHRACENE	5.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	FLUORENE	3.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	INDENO(1,2,3-CD)PYRENE	25	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB04-0312	PAH	PHENANTHRENE	38	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	M	ANTIMONY	0.283	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0003	M	CADMIUM	0.197	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	M	LEAD	39.3	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0003	M	MAGNESIUM	1490	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0003	M	MANGANESE	177	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB05-0003	M	POTASSIUM	638	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0003	M	SELENIUM	0.323	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB05-0003	M	SILVER	0.17	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB05-0003	M	SODIUM	69.7	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	1-METHYLNAPHTHALENE	5.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	2-METHYLNAPHTHALENE	5.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	ACENAPHTHENE	49	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	ACENAPHTHYLENE	27	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	FLUORENE	50	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0003	PAH	NAPHTHALENE	10	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	M	ANTIMONY	0.277	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0312	M	CADMIUM	0.118	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	M	LEAD	44	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0312	M	MAGNESIUM	960	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0312	M	MANGANESE	140	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SB05-0312	M	POTASSIUM	394	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB05-0312	M	SELENIUM	0.332	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB05-0312	M	SILVER	0.166	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB05-0312	PAH	1-METHYLNAPHTHALENE	4.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	PAH	2-METHYLNAPHTHALENE	5.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	PAH	ACENAPHTHENE	41	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	PAH	ACENAPHTHYLENE	13	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	PAH	FLUORENE	44	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB05-0312	PAH	NAPHTHALENE	11	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	M	ANTIMONY	1.7	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB06-0003	M	BERYLLIUM	0.114	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	M	CADMIUM	0.349	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	M	LEAD	774	MG/KG	J	D	MS/MSD Recovery Noncompliance

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB06-0003	M	MAGNESIUM	308	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	M	POTASSIUM	134	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	M	SELENIUM	0.411	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	1-METHYLNAPHTHALENE	4.7	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	2-METHYLNAPHTHALENE	6.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	ACENAPHTHENE	7.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	ACENAPHTHYLENE	15	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	ANTHRACENE	15	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	BENZO(A)ANTHRACENE	91	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	BENZO(G,H,I)PERYLENE	60	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	BENZO(K)FLUORANTHENE	60	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	DIBENZO(A,H)ANTHRACENE	17	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	INDENO(1,2,3-CD)PYRENE	80	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0003	PAH	NAPHTHALENE	19	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	M	ANTIMONY	0.378	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB06-0312	M	LEAD	17.6	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB06-0312	M	MAGNESIUM	591	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB06-0312	M	MERCURY	0.0305	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	M	POTASSIUM	176	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	M	SELENIUM	0.292	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	BENZO(A)ANTHRACENE	6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	BENZO(A)PYRENE	5.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	BENZO(B)FLUORANTHENE	9.7	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	BENZO(G,H,I)PERYLENE	3.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	BENZO(K)FLUORANTHENE	3.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	CHRYSENE	10	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	FLUORANTHENE	15	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	INDENO(1,2,3-CD)PYRENE	4.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	PHENANTHRENE	7.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB06-0312	PAH	PYRENE	13	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	M	ANTIMONY	0.283	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0003	M	CADMIUM	0.0632	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	M	CALCIUM	234	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	M	COPPER	3.97	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0003	M	LEAD	16.4	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0003	M	MAGNESIUM	1210	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0003	M	POTASSIUM	404	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0003	M	SELENIUM	0.35	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0003	M	SILVER	0.226	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0003	PAH	ACENAPHTHENE	2.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	ACENAPHTHYLENE	2.2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	ANTHRACENE	4.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	BENZO(A)ANTHRACENE	21	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	BENZO(B)FLUORANTHENE	28	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	BENZO(G,H,I)PERYLENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	BENZO(K)FLUORANTHENE	9.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	CHRYSENE	27	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	DIBENZO(A,H)ANTHRACENE	3.1	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	FLUORANTHENE	51	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	FLUORENE	2.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	INDENO(1,2,3-CD)PYRENE	13	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0003	PAH	PHENANTHRENE	28	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SB07-0003	PAH	PYRENE	44	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	M	ANTIMONY	0.282	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0312	M	CALCIUM	188	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	M	COPPER	3.79	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0312	M	LEAD	3.8	MG/KG	UJ	AD	Lab Blank Contamination, MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0312	M	MAGNESIUM	641	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB07-0312	M	NICKEL	3.75	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0312	M	POTASSIUM	199	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	M	SELENIUM	0.514	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0312	M	SILVER	0.169	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB07-0312	PAH	BENZO(A)ANTHRACENE	1.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	PAH	BENZO(B)FLUORANTHENE	2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	PAH	CHRYSENE	2.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	PAH	FLUORANTHENE	4.2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	PAH	PHENANTHRENE	2.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB07-0312	PAH	PYRENE	3.2	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	ANTIMONY	0.608	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	BERYLLIUM	0.166	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	CADMIUM	0.302	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	CALCIUM	307	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	COBALT	0.682	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	LEAD	443	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB08-0003	M	MAGNESIUM	236	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	M	POTASSIUM	144	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	1-METHYLNAPHTHALENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	2-METHYLNAPHTHALENE	16	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	ANTHRACENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	BENZO(A)ANTHRACENE	100	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	BENZO(K)FLUORANTHENE	59	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0003	PAH	INDENO(1,2,3-CD)PYRENE	80	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0312	M	ANTIMONY	0.308	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB08-0312	M	ARSENIC	2.09	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB08-0312	M	CALCIUM	185	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0312	M	COPPER	3	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB08-0312	M	LEAD	6.35	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB08-0312	M	MAGNESIUM	857	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SB08-0312	M	NICKEL	5.15	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB08-0312	M	POTASSIUM	243	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0312	M	SELENIUM	0.609	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB08-0312	M	SILVER	0.185	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SB08-0312	PAH	FLUORANTHENE	2.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0312	PAH	PHENANTHRENE	2.1	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SB08-0312	PAH	PYRENE	2.1	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003	EXP	2,6-DINITROTOLUENE	0.37	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003	EXP	2-AMINO-4,6-DINITROTOLUENE	0.37	MG/KG	J	U	% Difference between columns/detectors >25% for positive results determined via GC/HPLC
NASB-SKT-SS01-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	0.89	MG/KG	J	CGU	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Field Duplicate Imprecision, % Difference between columns/detectors >25% for positive results determined via GC/HPLC
NASB-SKT-SS01-0003	M	ANTIMONY	1.49	MG/KG	J	DG	MS/MSD Recovery Noncompliance, Field Duplicate Imprecision

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS01-0003	M	ARSENIC	3.5	MG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003	M	BERYLLIUM	0.167	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	M	CADMIUM	0.407	MG/KG	J	GP	Field Duplicate Imprecision, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	M	COBALT	1.08	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	M	LEAD	512	MG/KG	J	DG	MS/MSD Recovery Noncompliance, Field Duplicate Imprecision
NASB-SKT-SS01-0003	M	MAGNESIUM	369	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	M	POTASSIUM	407	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	M	SILVER	0.18	MG/KG	UJ	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003	PAH	1-METHYLNAPHTHALENE	16	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	PAH	2-METHYLNAPHTHALENE	20	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	PAH	ANTHRACENE	56	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003	PAH	BENZO(K)FLUORANTHENE	180	UG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	CG	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	M	ANTIMONY	1030	MG/KG	J	DG	MS/MSD Recovery Noncompliance, Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	M	ARSENIC	306	MG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	M	BERYLLIUM	0.159	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	M	CADMIUM	2.82	MG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	M	COBALT	1	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	M	LEAD	18400	MG/KG	J	DG	MS/MSD Recovery Noncompliance, Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	M	MAGNESIUM	329	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	M	POTASSIUM	384	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	M	SILVER	2.68	MG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	PAH	1-METHYLNAPHTHALENE	15	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	2-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	ACENAPHTHENE	36	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	ACENAPHTHYLENE	56	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	ANTHRACENE	75	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	BENZO(A)ANTHRACENE	370	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	PAH	BENZO(K)FLUORANTHENE	420	UG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS01-0003-D	PAH	CHRYSENE	560	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	PAH	DIBENZO(A,H)ANTHRACENE	23	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	PAH	FLUORANTHENE	940	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS01-0003-D	PAH	FLUORENE	31	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS01-0003-D	PAH	NAPHTHALENE	43	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS02-0003	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS02-0003	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS02-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS02-0003	M	ANTIMONY	0.315	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS02-0003	M	LEAD	50.9	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS02-0003	M	MAGNESIUM	2540	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS02-0003	M	MERCURY	0.0351	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	M	POTASSIUM	1430	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS02-0003	M	SELENIUM	0.189	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS02-0003	M	SILVER	0.252	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS02-0003	M	SODIUM	93.7	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	PAH	1-METHYLNAPHTHALENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS02-0003	PAH	2-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	PAH	ACENAPHTHYLENE	47	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	PAH	FLUORENE	69	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS02-0003	PAH	NAPHTHALENE	38	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS03-0003	M	ANTIMONY	0.373	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS03-0003	M	LEAD	134	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS03-0003	M	MAGNESIUM	3280	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS03-0003	M	POTASSIUM	1250	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS03-0003	M	SODIUM	135	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS03-0003	PAH	1-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS03-0003	PAH	2-METHYLNAPHTHALENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS03-0003	PAH	ACENAPHTHYLENE	98	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS03-0003	PAH	NAPHTHALENE	54	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	M	ANTIMONY	0.347	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS04-0003	M	BERYLLIUM	0.297	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	M	CADMIUM	0.285	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	M	LEAD	68.4	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS04-0003	M	MAGNESIUM	1210	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS04-0003	M	POTASSIUM	526	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS04-0003	M	SELENIUM	0.307	MG/KG	J	KP	ICP Interference - includes ICS % R Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	M	SILVER	0.277	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS04-0003	PAH	1-METHYLNAPHTHALENE	7.7	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	2-METHYLNAPHTHALENE	9.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	ACENAPHTHENE	52	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	ACENAPHTHYLENE	39	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	ANTHRACENE	89	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	BENZO(A)ANTHRACENE	660	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS04-0003	PAH	BENZO(K)FLUORANTHENE	270	UG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS04-0003	PAH	CHRYSENE	910	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS04-0003	PAH	DIBENZO(A,H)ANTHRACENE	19	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS04-0003	PAH	FLUORANTHENE	1200	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS04-0003	PAH	FLUORENE	50	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS04-0003	PAH	NAPHTHALENE	16	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS05-0003	M	ANTIMONY	0.302	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS05-0003	M	CADMIUM	0.246	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS05-0003	M	LEAD	17	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS05-0003	M	MAGNESIUM	1550	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS05-0003	M	POTASSIUM	845	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS05-0003	M	SELENIUM	0.306	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS05-0003	M	SILVER	0.181	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS05-0003	PAH	1-METHYLNAPHTHALENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS05-0003	PAH	2-METHYLNAPHTHALENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS05-0003	PAH	ACENAPHTHYLENE	36	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS05-0003	PAH	NAPHTHALENE	54	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	M	ANTIMONY	0.968	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	M	CADMIUM	0.535	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	M	LEAD	702	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003	M	MAGNESIUM	1060	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003	M	POTASSIUM	870	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003	MISC	CATION EXCHANGE CAPACITY	1.58	MEQ/100	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003	MISC	TOTAL ORGANIC CARBON	356000	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003	PAH	1-METHYLNAPHTHALENE	21	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS06-0003	PAH	2-METHYLNAPHTHALENE	30	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	PAH	ACENAPHTHENE	110	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	PAH	ANTHRACENE	160	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	PAH	BENZO(A)ANTHRACENE	1100	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003	PAH	BENZO(A)PYRENE	1200	UG/KG	J	G	Field Duplicate Imprecision
NASB-SKT-SS06-0003	PAH	CHRYSENE	1700	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003	PAH	DIBENZO(A,H)ANTHRACENE	38	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003	PAH	FLUORANTHENE	2400	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003	PAH	FLUORENE	74	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003	PAH	NAPHTHALENE	69	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	M	ANTIMONY	1.79	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	M	CADMIUM	0.501	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	M	COBALT	1.63	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	M	LEAD	781	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003-D	M	MAGNESIUM	901	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003-D	M	POTASSIUM	731	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS06-0003-D	PAH	1-METHYLNAPHTHALENE	23	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	PAH	2-METHYLNAPHTHALENE	30	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	PAH	ACENAPHTHENE	98	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	PAH	BENZO(A)ANTHRACENE	950	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003-D	PAH	BENZO(A)PYRENE	36	UG/KG	UJ	G	Field Duplicate Imprecision
NASB-SKT-SS06-0003-D	PAH	CHRYSENE	1300	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003-D	PAH	DIBENZO(A,H)ANTHRACENE	36	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003-D	PAH	FLUORANTHENE	2500	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS06-0003-D	PAH	FLUORENE	82	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS06-0003-D	PAH	NAPHTHALENE	60	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	ANTIMONY	3.3	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	BERYLLIUM	0.458	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	CADMIUM	0.585	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	LEAD	2340	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS07-0003	M	MAGNESIUM	1150	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	POTASSIUM	683	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	SODIUM	509	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	M	THALLIUM	0.73	MG/KG	UJ	Y	Percent solids <30%
NASB-SKT-SS07-0003	MISC	CATION EXCHANGE CAPACITY	1.02	MEQ/100	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS07-0003	MISC	TOTAL ORGANIC CARBON	197000	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS07-0003	PAH	1-METHYLNAPHTHALENE	37	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	2-METHYLNAPHTHALENE	42	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	ACENAPHTHENE	140	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	ACENAPHTHYLENE	140	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	ANTHRACENE	240	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	BENZO(A)ANTHRACENE	1700	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS07-0003	PAH	CHRYSENE	2800	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS07-0003	PAH	DIBENZO(A,H)ANTHRACENE	66	UG/KG	UJ	CY	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Percent solids <30%
NASB-SKT-SS07-0003	PAH	FLUORANTHENE	3800	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS07-0003	PAH	FLUORENE	110	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS07-0003	PAH	NAPHTHALENE	74	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	M	ANTIMONY	0.813	MG/KG	J	DKP	MS/MSD Recovery Noncompliance, ICP Interference - includes ICS % R Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	M	BERYLLIUM	0.192	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS08-0003	M	CADMIUM	0.13	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	M	LEAD	785	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS08-0003	M	MAGNESIUM	1080	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS08-0003	M	POTASSIUM	505	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS08-0003	M	SELENIUM	0.473	MG/KG	J	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS08-0003	M	SILVER	0.143	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS08-0003	MISC	CATION EXCHANGE CAPACITY	0.608	MEQ/100	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	MISC	TOTAL ORGANIC CARBON	73800	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS08-0003	PAH	1-METHYLNAPHTHALENE	14	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	PAH	2-METHYLNAPHTHALENE	17	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	PAH	ACENAPHTHENE	64	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	PAH	ACENAPHTHYLENE	68	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	PAH	BENZO(A)ANTHRACENE	600	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS08-0003	PAH	CHRYSENE	750	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS08-0003	PAH	DIBENZO(A,H)ANTHRACENE	19	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS08-0003	PAH	FLUORANTHENE	1200	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS08-0003	PAH	FLUORENE	44	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS08-0003	PAH	NAPHTHALENE	33	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	M	ANTIMONY	0.263	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS09-0003	M	LEAD	20.3	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS09-0003	M	MAGNESIUM	2060	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS09-0003	M	MERCURY	0.015	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	M	POTASSIUM	1000	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS09-0003	M	SELENIUM	0.158	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS09-0003	M	SILVER	0.21	MG/KG	UJ	K	ICP Interference - includes ICS % R Noncompliance
NASB-SKT-SS09-0003	PAH	ACENAPHTHENE	4.9	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	ACENAPHTHYLENE	2.6	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	ANTHRACENE	6.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	BENZO(A)ANTHRACENE	37	UG/KG	J	CP	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	CHRYSENE	36	UG/KG	J	CP	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	DIBENZO(A,H)ANTHRACENE	14	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS09-0003	PAH	FLUORANTHENE	75	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS09-0003	PAH	FLUORENE	3.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	INDENO(1,2,3-CD)PYRENE	22	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	PHENANTHRENE	43	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS09-0003	PAH	PYRENE	65	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	ANTIMONY	0.392	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	BERYLLIUM	0.116	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	CADMIUM	0.159	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	CALCIUM	265	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	COBALT	0.737	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	M	LEAD	294	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS10-0003	M	MAGNESIUM	371	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS10-0003	M	POTASSIUM	273	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	1-METHYLNAPHTHALENE	7.4	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	2-METHYLNAPHTHALENE	7.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	ACENAPHTHENE	24	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	ACENAPHTHYLENE	34	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	ANTHRACENE	48	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	BENZO(A)ANTHRACENE	230	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS10-0003	PAH	CHRYSENE	300	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS10-0003	PAH	DIBENZO(A,H)ANTHRACENE	18	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS10-0003	PAH	FLUORANTHENE	490	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS10-0003	PAH	FLUORENE	20	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS10-0003	PAH	NAPHTHALENE	17	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	ANTIMONY	0.392	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	BERYLLIUM	0.0959	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	CADMIUM	0.242	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	COBALT	0.575	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	LEAD	265	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS11-0003	M	MAGNESIUM	279	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	M	POTASSIUM	230	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	1-METHYLNAPHTHALENE	16	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	2-METHYLNAPHTHALENE	20	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	ACENAPHTHENE	25	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	ACENAPHTHYLENE	80	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	ANTHRACENE	66	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	BENZO(A)ANTHRACENE	320	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS11-0003	PAH	CHRYSENE	500	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS11-0003	PAH	DIBENZO(A,H)ANTHRACENE	21	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS11-0003	PAH	FLUORANTHENE	730	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS11-0003	PAH	FLUORENE	24	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS11-0003	PAH	NAPHTHALENE	51	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	ANTIMONY	0.488	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS12-0003	M	BERYLLIUM	0.148	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	CADMIUM	0.366	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	CALCIUM	310	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	COBALT	0.838	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	LEAD	66.7	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS12-0003	M	MAGNESIUM	222	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	M	POTASSIUM	314	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	1-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	2-METHYLNAPHTHALENE	24	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	ACENAPHTHENE	19	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	ACENAPHTHYLENE	73	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	ANTHRACENE	69	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	BENZO(A)ANTHRACENE	310	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS12-0003	PAH	BENZO(G,H,I)PERYLENE	120	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	CHRYSENE	490	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS12-0003	PAH	DIBENZO(A,H)ANTHRACENE	27	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS12-0003	PAH	FLUORANTHENE	740	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS12-0003	PAH	FLUORENE	27	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS12-0003	PAH	NAPHTHALENE	86	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	M	ANTIMONY	1790	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS17-0003	M	BERYLLIUM	0.124	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	M	LEAD	29300	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS17-0003	M	MAGNESIUM	552	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS17-0003	M	POTASSIUM	389	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	PAH	1-METHYLNAPHTHALENE	13	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS17-0003	PAH	2-METHYLNAPHTHALENE	14	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	PAH	ACENAPHTHENE	88	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	PAH	ACENAPHTHYLENE	51	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	PAH	BENZO(A)ANTHRACENE	840	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS17-0003	PAH	CHRYSENE	1000	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS17-0003	PAH	DIBENZO(A,H)ANTHRACENE	22	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS17-0003	PAH	FLUORANTHENE	1900	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS17-0003	PAH	FLUORENE	65	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS17-0003	PAH	NAPHTHALENE	28	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	EXP	2,4-DINITROTOLUENE	0.44	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	EXP	3-NITROTOLUENE	0.17	MG/KG	J	PU	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics), % Difference between columns/detectors >25% for positive results determined via GC/HPLC
NASB-SKT-SS19-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	0.18	MG/KG	J	CPU	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.), Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics), % Difference between columns/detectors >25% for positive results determined via GC/HPLC
NASB-SKT-SS19-0003	EXP	4-NITROTOLUENE	0.72	MG/KG	J	U	% Difference between columns/detectors >25% for positive results determined via GC/HPLC
NASB-SKT-SS19-0003	M	ANTIMONY	3.73	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS19-0003	M	BERYLLIUM	0.214	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	M	LEAD	513	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS19-0003	M	MAGNESIUM	343	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	M	POTASSIUM	352	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	MISC	CATION EXCHANGE CAPACITY	1.25	MEQ/100	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS19-0003	MISC	TOTAL ORGANIC CARBON	210000	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	PAH	1-METHYLNAPHTHALENE	33	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	PAH	2-METHYLNAPHTHALENE	44	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	PAH	ACENAPHTHENE	59	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	PAH	ACENAPHTHYLENE	87	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS19-0003	PAH	BENZO(A)ANTHRACENE	630	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	PAH	CHRYSENE	880	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	PAH	DIBENZO(A,H)ANTHRACENE	24	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	PAH	FLUORANTHENE	1500	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS19-0003	PAH	FLUORENE	58	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	M	ANTIMONY	0.446	MG/KG	UJ	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS21-0003	M	BERYLLIUM	0.131	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	M	COBALT	1.04	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	M	LEAD	101	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS21-0003	M	MAGNESIUM	318	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	M	POTASSIUM	251	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	1-METHYLNAPHTHALENE	14	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	2-METHYLNAPHTHALENE	18	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	ACENAPHTHENE	27	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	ACENAPHTHYLENE	68	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	ANTHRACENE	65	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	BENZO(A)ANTHRACENE	270	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS21-0003	PAH	BENZO(G,H,I)PERYLENE	100	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS21-0003	PAH	CHRYSENE	380	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS21-0003	PAH	DIBENZO(A,H)ANTHRACENE	24	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS21-0003	PAH	FLUORANTHENE	630	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS21-0003	PAH	FLUORENE	24	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

TABLE A-2

QUALIFIED DATA SUMMARY
SKEET RANGE SITE INSPECTION AND SITE 9 SAMPLE LOCATIONS WITHIN THE SKEET RANGE
NAS BRUNSWICK
BRUNSWICK, MAINE

SAMPLE	FRACTION	PARAMETER	RESULT	UNITS	QUALIFIER	QUALIFICATION CODE[1]	REASON FOR QUALIFICATION
NASB-SKT-SS21-0003	PAH	NAPHTHALENE	42	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	EXP	2,4,6-TRINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	EXP	2,4-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	EXP	2,6-DINITROTOLUENE	0.3	MG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	EXP	4-AMINO-2,6-DINITROTOLUENE	1.1	MG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	M	ANTIMONY	1.23	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS26-0003	M	BERYLLIUM	0.1	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	M	CADMIUM	0.195	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	M	COBALT	0.6	MG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	M	LEAD	241	MG/KG	J	D	MS/MSD Recovery Noncompliance
NASB-SKT-SS26-0003	M	MAGNESIUM	174	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	M	POTASSIUM	181	MG/KG	J	DP	MS/MSD Recovery Noncompliance, Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	1-METHYLNAPHTHALENE	4.8	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	2-METHYLNAPHTHALENE	5.3	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	ACENAPHTHENE	12	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	ACENAPHTHYLENE	24	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	ANTHRACENE	26	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	BENZO(A)ANTHRACENE	97	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	PAH	BENZO(G,H,I)PERYLENE	52	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	BENZO(K)FLUORANTHENE	68	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)
NASB-SKT-SS26-0003	PAH	CHRYSENE	150	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	PAH	DIBENZO(A,H)ANTHRACENE	18	UG/KG	UJ	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	PAH	FLUORANTHENE	260	UG/KG	J	C	Calibration Noncompliance (e.g. % RSDs, %Ds, ICVs, CCVs, RRFs, etc.)
NASB-SKT-SS26-0003	PAH	FLUORENE	10	UG/KG	J	P	Uncertainty near detection limit (< 2 x IDL for inorganics and <CRQL for organics)

Footnotes
1. Qualification Codes are listed on the page following this table.

Acronymns
CCVs = Continuing Calibration Verification
CRQL = Contract Required Quantitation Limit
EXP = Explosives
GC/HPLC = Gas Chromatography/High Performance Liquid Chromatography
ICP = Inductively Coupled Plasma
ICS %R = Internal Control Standard percent recovery
ICV = Initial Calibration Verification
IDL = Instrument Detection Limit
J = positive result is consider estimated
M = Metals
MG/KG = millgrams per kilogram
MISC = Micellaneous
MS/MSD = Matrix Spike/Matrix Spike Duplicate
PAH = Polycyclic Aromatic Hydrocarbons
OS = Semi-volatile Organic Compound
RRFs= Relative Response Factors
UG/KG = micrograms per kilogram
U = result considered non-detected due to laboratory blank contamination
UJ = non-detected result is considered estimated.
% Ds = percent difference
%RSDs = percent relative standard deviation

TABLE A-3

PROJECT SCREENING LEVEL SELECTION BACKGROUND TABLE
NAS BRUNSWICK
BRUNWICK, MAINE

Analyte	CAS Number	Human Health Screening Level[1]	Ecological Soil Screening Level[2]									
			Plant		Invertebrate		Avian		Mammal		Minimum	
		Residential Soil	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
Inorganics (mg/kg)												
Aluminum	7429-90-5	**7700 N**	NA[3]	EcoSSL	NA[3]	EcoSSL	NA[3]	EcoSSL	NA[3]	EcoSSL	NA[3]	EcoSSL
Antimony	7440-36-0	3.1 N	5	ORNL	78	EcoSSL	NA	NA	0.27	EcoSSL	**0.27**	**EcoSSL**
Arsenic	7440-38-2	**0.39 C**	18	EcoSSL	17.1	CCME	43	EcoSSL	46	EcoSSL	17.1	CCME
Barium	7440-39-3	1500 N	500	ORNL	330	EcoSSL	NA	NA	2000	EcoSSL	**330**	**EcoSSL**
Beryllium	7440-41-7	16 N	10	ORNL	40	EcoSSL	NA	NA	21	EcoSSL	**10**	**ORNL**
Cadmium	7440-43-9	7 N	32	EcoSSL	140	EcoSSL	0.77	EcoSSL	0.36	EcoSSL	**0.36**	**EcoSSL**
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	7440-47-3	**0.29 C[4]**	64	CCME	64	CCME	26	EcoSSL[5]	34	EcoSSL[5]	26	EcoSSL[5]
Cobalt	7440-48-4	**2.3 N**	13	EcoSSL	NA	NA	120	EcoSSL	230	EcoSSL	13	EcoSSL
Copper	7440-50-8	310 N	70	EcoSSL	80	EcoSSL	28	EcoSSL	49	EcoSSL	**28**	**EcoSSL**
Iron	7439-89-6	**5500 N**	NA[6]	EcoSSL	NA	NA	NA	NA	NA	NA	NA[6]	EcoSSL
Lead	7439-92-1	400	120	EcoSSL	1700	EcoSSL	11	EcoSSL	56	EcoSSL	**11**	**EcoSSL**
Mercury	7439-97-6	**2.3 N[7]**	12	CCME	12	CCME	NA	NA	NA	NA	**12**	**CCME**
Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	7439-96-5	180 N	220	EcoSSL	450	EcoSSL	4300	EcoSSL	4000	EcoSSL	**220**	**EcoSSL**
Nickel	7440-02-0	150 N	38	EcoSSL	280	EcoSSL	210	EcoSSL	130	EcoSSL	**38**	**EcoSSL**
Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	39 N	0.52	EcoSSL	4.1	EcoSSL	1.2	EcoSSL	0.63	EcoSSL	**0.52**	**EcoSSL**
Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	7440-62-2	39 N	130	CCME	130	CCME	7.8	EcoSSL	280	EcoSSL	**7.8**	**EcoSSL**
Zinc	7440-66-6	2300 N	160	EcoSSL	120	EcoSSL	46	EcoSSL	79	EcoSSL	**46**	**EcoSSL**
PAHs (mg/kg)												
1-Methylnaphthalene	90-12-0	**22 C**	NA	NA	29	EcoSSL[8]	NA	NA	100	EcoSSL[8]	29	EcoSSL[8]
2-Methylnaphthalene	91-57-6	31 N	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL	**29**	**EcoSSL**
Acenaphthene	83-32-9	340 N	20	ORNL	29	EcoSSL	NA	NA	100	EcoSSL	**20**	**ORNL**
Acenaphthylene	208-96-8	340 N[9]	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL	**29**	**EcoSSL**
Anthracene	120-12-7	1700 N	2.5	CCME	29	EcoSSL	NA	NA	100	EcoSSL	**2.5**	**CCME**
Benzo(a)anthracene	56-55-3	**0.15 C**	18	LANL	18	EcoSSL	NA	NA	1.1	EcoSSL	1.1	EcoSSL
Benzo(a)pyrene	50-32-8	**0.015 C**	20	CCME	18	EcoSSL	NA	NA	1.1	EcoSSL	1.1	EcoSSL
Benzo(b)fluoranthene	205-99-2	**0.15 C**	18	LANL	18	EcoSSL	NA	NA	1.1	EcoSSL	1.1	EcoSSL
Benzo(g,h,i)perylene	191-24-2	170 N[10]	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	**1.1**	**EcoSSL**
Benzo(k)fluoranthene	207-08-9	1.5 C	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	**1.1**	**EcoSSL**
Chrysene	218-01-9	15 C	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	**1.1**	**EcoSSL**
Dibenzo(a,h)anthracene	53-70-3	**0.015 C**	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	1.1	EcoSSL
Fluoranthene	206-44-0	230 N	50	CCME	29	EcoSSL	NA	NA	100	EcoSSL	**29**	**EcoSSL**
Fluorene	86-73-7	230 N	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL	**29**	**EcoSSL**
Indeno(1,2,3-cd)pyrene	193-39-5	**0.15 C**	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	1.1	EcoSSL
Naphthalene	91-20-3	3.6 C	1	LANL	29	EcoSSL	NA	NA	100	EcoSSL	**1**	**LANL**
Phenanthrene	85-01-8	170 N[10]	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL	**29**	**EcoSSL**
Pyrene	129-00-0	170 N	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL	**1.1**	**EcoSSL**

TABLE A-3

PROJECT SCREENING LEVEL SELECTION BACKGROUND TABLE
NAS BRUNSWICK
BRUNWICK, MAINE

Notes:
Minimum soil screening value for human health or ecological evaluation is shaded.

Footnotes:
1 - USEPA Regional Screening Level, June 2011. Carcinogenic values (denoted with a "C" flag) represent an incremental cancer risk of 1E-06. The noncarcinogenic values (denoted with a "N" flag) are the RSL divided by 10 to correspond to a Target Hazard Quotient of 0.1.
2 - Ecological Screening Level sources used in the order of preference:
EcoSSL - EPA Ecological Soil Screening Levels (USEPA, 2003, 2005, 2006, 2007, 2008)
CCME - Canadian Council of Ministers of the Environment (1999, 2001, 2010)
ORNL - Oak Ridge National Laboratory Toxicological Benchmarks for plants and invertebrates (Efroymson et al., 1997a and 1997b)
LANL - ECORISK Database (used for plants and invertebrates only) (LANL, 2009)
3 - Aluminum is considered a COPC only when the soil pH is less than 5.5.
4 - Value is for hexavalent chromium.
5 - Value is for trivalent chromium.
6 - Iron is not expected to be toxic to plants with a soil pH between 5 and 8.
7 - Value is for mercuric chloride (and other mercury salts).
8 - Used 2-methylnaphthalene screening level as a surrogate.
9 - Acenaphthene is used as a surrogate for acenaphthylene.
10 - Pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

APPENDIX B

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The following risk assessment work plan was prepared to support the Skeet Range Remedial Investigation at Naval Air Station (NAS) Brunswick, Brunswick, Maine. This work plan provides the human health risk assessment (HHRA) protocol that will be used to evaluate chemical concentrations in soil at the Skeet Range (SKT). The risk assessments will be performed to evaluate whether hazardous substances at the site pose potential human health to exposed receptors under current or hypothetical future land use. The risk assessment address a variety of chemicals in the soil matrix, exposure pathways, and receptors as a basis for characterizing the types and range of potential risks associated with site-related contamination.

1.0 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

The overall objective of the HHRA is to determine the potential for health risks in the absence of remedial action at the site and, if action is required, to focus the risk evaluation of remedial alternatives (RERA).

The following current risk assessment guidance documents were primarily used to develop the HHRA methodology:

- Conducting Human Health Risk Assessments Under the Environmental Restoration Program, Chief of Naval Operations (N45) 5090 Ser N453E/1U595168, Feb 12, 2001 (Navy, 2001)

- Navy Policy on the Use of Background Chemical Levels, Chief of Naval Operations 5090 Ser N45C/N4U732212, Jan 30, 2004. (Navy, 2004)

- Navy Human Health Risk Assessment Webpage: http://www-nehc.med.navy.mil/hhra/

- Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation Manual (Part A) (USEPA, 1989).

- Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Washington, D.C. Office of Solid Waste and Emergency Response (OSWER) Directive 9285.6-03 (USEPA, 1991).

- Distribution of Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington, D.C. (USEPA, 1993a).

- Guidance for Human Health Risk Assessments for Hazardous Substance Sites in Maine. State of Maine Department of Environmental Protection and Center for Disease Control. (MEDEP, 2009).

- Soil Screening Guidance: Technical Background Document. Office of Solid Waste and Emergency Response, Washington, D.C. EPA/540/R-95/128 (USEPA, 1996).

- Exposure Factors Handbook. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/P-95/002Fa (USEPA, 1997a).

- Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) (USEPA, 2001a).

- Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. Office of Emergency and Remedial Response, Washington, D.C. OSWER 9285.6-10 (USEPA, 2002a).

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. Office of Superfund Remediation and Technology Innovation, Washington, D.C. 20460 EPA/540/R/99/005, OSWER 9285.7-02EP; PB99-963312 (USEPA, 2004).

- Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum, Washington, DC. EPA/630/P-03/001B. (USEPA, March 2005).

- Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. Risk Assessment Forum, Washington, DC. EPA/630/R-03/003F (USEPA, March 2005).

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA, 2009a).

- Vapor Intrusion Evaluation Guidance. http://www.maine.gov/dep/rwm/publications/guidance (MEDEP, January 2010).

The HHRA is comprises following components:

- Data Evaluation Protocol
- Exposure Assessment
- Toxicity assessment
- Risk Characterization
- Uncertainty Analysis
- Derivation of Cleanup Goals

The HHRA will be structured and reported according to the guidelines of the Risk Assessment for Superfund (RAGS), Human Health Evaluation Manual, Part D: Standardized Planning, Reporting, and Review of Superfund Risk Assessments (RAGS Part D).

1.1 Data Evaluation

Data evaluation, the first component of a baseline HHRA, is a two-step, media-specific task involving the compilation and evaluation of analytical data. The first step involves the compilation of the analytical database and an evaluation of data usability for purposes of the HHRA. Soil data presented in the following report will be utilized for the SKT HHRA:

- Site Inspection Report for Munitions Response Program Sites - Machine Gun Bore Range Site – Skeet Range, Former Naval Air Station Brunswick, Brunswick, Maine, (Tetra Tech, 2011).

Additionally soil data collected during the SKT Remedial Investigation (RI) will be included in the HHRA.

The second step of the data evaluation is the selection of a medium-specific list of chemical of potential concern (COPCs), which will be used to quantitatively or qualitatively determine potential human health risks for site media. COPCs are selected based on a toxicity screen (a comparison of site contaminant concentrations to conservative toxicity screening values) and a background screen (a comparison of site concentrations to background concentrations). Risks will be calculated for non-site related chemicals (i.e., chemicals detected at concentrations less than background concentrations); however, non-site related risk will be evaluated separately from site related risk.

1.1.1 Toxicity Screen

COPCs for the site will be selected via the direct contact pathway (i.e., inhalation, dermal contact, and ingestion), groundwater protection soil screening levels (SSLs), and the indoor air (vapor intrusion) pathway.

Direct Contact Pathway Evaluation

USEPA Regional Screening Levels (RSLs) for residential soil will be used to select COPCs for the direct contact exposure pathway. The USEPA RSL concentrations are based on exposure pathways for which generally accepted methods, models, and assumptions have been developed (i.e., ingestion, dermal contact, and inhalation) for specific land-use conditions. The risk-based screening concentrations will correspond to a systemic hazard quotient (HQ) of 0.1 for noncarcinogens or an incremental lifetime cancer risk of 1 $x10^{-6}$ for carcinogens. The USEPA RSLs for noncarcinogens are based on a HQ of 1.0, whereas the screening concentrations will be based on an HQ of 0.1. The screening concentrations are based on an HQ of 0.1 to account for the potential cumulative effects of several chemicals affecting the same target organ or producing the same adverse non-carcinogenic effect.

Migration to Groundwater Pathway Evaluation

USEPA groundwater protection risk-based SSLs will be compared to maximum detected site concentrations for the selection of COPCs. The risk-based SSLs for groundwater protection are based on a dilution attenuation factor (DAF) of 1, which is the lowest DAF value possible and assumes that no reduction in concentration occurs as the contaminant moves from the source to groundwater, or in other words, that the concentrations at the source and in groundwater are the same (i.e., a receptor is exposed to the leachate concentration). If COPCs are selected for the migration to groundwater pathway, a qualitative evaluation will be used to further evaluate the COPCs. The qualitative evaluation will consider magnitudes of COPC concentrations, frequency of criteria exceedances, and whether COPC concentrations exceed groundwater protection SSLs based on a DAF of 20, which is generally assumed to be more accurate at most sites, or Maximum Contaminant Level (MCL-based) SSLs.

Vapor Intrusion Pathway Evaluation

Potential vapor intrusion (VI) sources in soil will be investigated in accordance with current USEPA Vapor Intrusion Guidance (USEPA, 2002b), Department of Defense Vapor Intrusion Handbook (DoD, 2009), and Maine Department of Environmental Protection (MEDEP) Vapor Intrusion Guidance (MEDEP, 2010).

The primary soil VI screening will be a qualitative evaluation to determine whether or not potential VI soil sources exist. Chemicals of sufficient volatility and toxicity to pose a VI concern will be screened for positive detections. Of the chemicals planned for analysis, naphthalene is considered both sufficiently volatile and sufficiently toxic to pose a VI concern. If positive detections of naphthalene exist, than the magnitude and frequency of those detections will be evaluated to qualitatively determine if a VI soil source may exist. Finally, if a qualitative evaluation of chemical data provides evidence that a VI source exists for naphthalene, than the concentrations of naphthalene will be plotted on a map of the site (e.g. tag map) to further evaluate whether or not a VI source may exist. The RI will provide recommendations for whether or not further investigation of potential VI soil sources is warranted.

1.1.2. Background Screen

Background concentrations are concentrations that would exist in the absence of influence from site operations. A background screening will be conducted for all chemicals included in the COPC screening process (i.e., chemicals yielding detections), as discussed herein. Site data will be compared to background using lines-of-evidence such as the pending MEDEP background PAH values which are expected to be added to Maine's Remedial Action Guidelines (RAGs) Appendix 1 and 2 tables.

The following Navy and USEPA guidance documents will be used to select the most appropriate statistical methods for determining if site concentrations differ from naturally occurring or anthropogenic background concentrations:

- *Guidance for Environmental Background Analysis Volume 1: Soil, Naval Facilities Engineering Command (NFESC) User's Guide*, UG-2049-ENV, prepared by Battelle Memorial Institute, Earth Tech, Inc, NewFields, Inc. Washington D.C., April 2002. (Navy, 2002)

- *Guidance for Characterizing Background Chemicals in Soil at Superfund Sites*. USEPA OSWER. Office of Emergency Response and Remedial Response (OERR) and OSWER 9285.7-41, EPA 540-R-01-003. (USEPA, 2001b)

- *PROUCL Version 4.1.00 User Guide*, EPA/600/R-07/041. (USEPA, 2010a)

To the extent possible, data set to data set comparisons will be used to determine whether site concentrations exceed background concentrations using statistical tests such as the Wilcoxon Rank Sum test. However, data set to data set comparisons often specify a minimum number of data values in both the site data set and background data set and a minimum number of sample results to provide meaningful information. Also, such statistical tests are often of limited value when a large percentage of a

dataset are censored values (e.g., non-detect results). Consequently, visual inspection of the data (e.g., a review of probability plots) and professional judgment may be used to determine if a contaminant exceeds background in some cases. Statistical comparisons will be conducted at the 5 percent significance level. The Background Comparison Flow Chart (Attachment A) provides an overview of the statistical methodology that will be used to conduct the background screen. Total risks (including background) will be quantitatively evaluated separately from site-related risks (excluding background).

1.1.3 Selection of COCPs

The COPC selection process is as follows:

Step 1: The maximum detected concentration of an analyte is compared with the toxicity screening values previously defined. If the maximum detected concentration is less than the screening value, the parameter is not retained for quantitative risk assessment. Additionally, essential nutrients (i.e., calcium, magnesium, potassium, and sodium) are not selected as COPCs.

Step 2: A constituent detected at concentrations less than background, as determined using the Background Comparison Flow Chart in Attachment A, will not be identified as a COPC and will not be included in risk estimates calculated in the primary risk summary tables.

Because of the lack of toxicity criteria, risk-based COPC screening levels are not available for some chemicals (i.e., acenaphthylene, benzo(g,h,i)perylene, and phenanthrene). For these constituents, surrogate chemicals (which have toxicity criteria) will be used for screening purposes. Acenaphthene will be used as a surrogate for acenaphthylene, and pyrene will be used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

The results of the COPC selection will be summarized in tables prepared according to RAGS Part D guidance (RAGS Part D Table 2.1). The rationale for the inclusion or exclusion of chemicals as COPCs will be clearly presented.

1.2 Exposure Assessment Protocol

The exposure assessment component of a baseline HHRA defines and provides a means to evaluate, quantitatively or qualitatively, the type and magnitude of human exposure to chemicals present at or migrating from a site. A foundation of the exposure assessment is the conceptual site model (CSM), which identifies site characteristics including potential contaminant sources, contaminant release mechanisms, transport routes, receptors, and other appropriate information. The CSM must consider

both current and future land use scenarios and integrates information regarding the physical characteristics of the site, exposed populations, sources of contamination, and contaminant mobility (fate and transport) to identify potential exposure routes and receptors evaluated in the risk assessment. A well-defined CSM allows for a better understanding of the risks at a site and aids risk managers in the identification of the potential need for remediation. The following sections summarize the SKT soil CSM:

1.2.1 Conceptual Site Model

Sources of Contamination

Based on the environmental investigations and actions to date; the potential source of soil contamination at the SKT is lead and polycyclic aromatic hydrocarbons (PAHs) associated with lead shot and clay targets, respectively, from former SKT activities.

Potential Contaminant Migration Mechanisms

Potential contaminant migration methods of lead and PAHs in soil include dissolution and migration from soil to groundwater, erosion and overland runoff, and VI.

Previous chemical data collected at the SKT seem to indicate that dissolution of contaminants associated with SKT activities (PAHs and metals) in infiltrating precipitation with subsequent lateral migration is not a significant migration pathway. PAHs and metals generally tend to adsorb to soil rather than dissolve in water. Regardless, potential migration via dissolution from precipitation and subsequent lateral migration will be evaluated using SSLs as described in Section 1.1.1

Erosion and overland runoff are potential migration mechanisms if contaminants are exposed. Fine-grained soils such as clays tend to accumulate a greater mass of PAHs and metals than large-grained soils, such as sand, and tend to be transported via overland runoff to lower elevations during rain events. If contaminated matrices (soils) are uncovered, contaminant transport of dissolved and suspended particulates in overland runoff would occur at the rate of overland flow. Overland flow particles could eventually settle into stream or pond sediments if this potential transport mechanism occurred.

Potential VI sources in soil will be investigated as described in Section 1.1.1.

Land Uses and Potential Exposure

Prior to 1950, the SKT was in a highly developed part of the base and included several buildings. After 1950, the SKT was undeveloped except for the northernmost portion, which contains a baseball field and is intersected by Neptune Drive. In the future, most of the SKT will be slated for business and technology industry use, while the eastern portion will be used for outdoor recreation. Potential current human

exposure pathways are ingestion, dermal contact, inhalation of shallow surface soil, and inhalation of indoor air (as a result of VI).

1.2.2 Human Health Receptors

Following is a discussion of the potential human health receptors. Potential human receptors are residents, business and technology industry workers, construction workers, and recreational users. Expanded residential use of the site is not currently planned; however, hypothetical future residential use is evaluated as a risk scenario that could occur if the sites were developed for residential use. Additionally, residential use is evaluated because residential land use already exists on the northern portion of the range and is an allowable land use scenario in the Community Mixed Use Zones.

The baseline soil risk assessment prepared for the site will consider receptor exposure under current and hypothetical land use where surface soil will be evaluated at the depth intervals of 0 to 3 inches bgs and 3 to 12 inches bgs for undisturbed areas and 0 to 12 inch bgs depth interval for disturbed areas, and subsurface soil (samples collected deeper than 1 foot bgs) will be evaluated for the following receptors:

Current and Future Industry Worker/Facility Personnel – an onsite receptor under current and future land use who may spend time outdoors and/or indoors and be exposed to site contaminants in soil and indoor air (as a result of VI). The direct contact scenario could occur if soil was uncovered at the site. This receptor could be exposed to surface soil (0 to 1 foot bgs) via incidental ingestion, dermal contact, and inhalation. This receptor is expected to be exposed to soils on a more frequent basis (but less intensely) than the construction worker. Industry workers may also be exposed to contaminants in soil indirectly via indoor air as a result of VI.

Current and Future Construction Workers – an onsite receptor under current or future land use. Construction workers could be exposed to contamination surface soil (0 to 1 foot bgs) via incidental ingestion, dermal contact, and air (inhalation). A construction worker could be exposed to subsurface soil and groundwater; however, according to the CSM, site-related contamination is only expected to be found in the top foot of soil.

Current and Future Recreational Users (Children and Adults) – an onsite receptor under current and future land use who may spend time outdoors recreating (e.g., walking, playing sports). A recreational user may be exposed to surface soil (0 to 1 foot bgs) via incidental ingestion, dermal contact, and inhalation. Receptor exposure to subsurface soil would only occur if subsurface soils were excavated and deposited on existing surface soils; however, according to the CSM, site-related contamination is only expected to be found in the top foot of soil.

Hypothetical Future Residents (Children and Adults) – Future child and adult residents, assuming the land use is changed to residential. The hypothetical future resident is expected to be exposed to surface soil (0 to 1 foot bgs) by incidental ingestion, dermal contact, and inhalation assuming that soil is uncovered (no grass or asphalt) and indoor air. Receptor exposure to subsurface soil would only occur if subsurface soils were excavated and deposited on existing surface soils; however, according to the CSM, site-related contamination is only expected to be found in the top foot of soil.

1.2.3 Calculation of Exposure Point Concentrations

The exposure point concentration (EPC), which is calculated for COPCs only, is an estimate of the chemical concentrations within an exposure unit likely to be contacted over time by a receptor and is used to estimate exposure intakes. The following paragraphs discuss the relationship between the terms "site" and EU in reference to calculating the EPC, the EUs that are typically evaluated, and the guidelines for calculating the EPC.

An "exposure unit" (EU) is the area over which receptor activity is expected to occur. The two most important considerations in defining an EU are the anticipated receptor activity and the spatial distribution of contaminant concentrations. SKT is currently undeveloped, except for the northernmost portion, which contains a baseball field. Future anticipated uses are slated for business and technology industries, except for the eastern portion which will be used for outdoor recreation. Exposure units will be determined by project stakeholders after evaluating the data collected for this investigation.

The available data sets for the site will be evaluated to assure that the data are adequate and acceptable for risk assessment (i.e., there are no data gaps) prior to the calculation of EPCs. If the data sets are found to be inadequate, the project stakeholders (Navy, USEPA, MEDEP) will discuss and agree how to proceed. Sample and duplicate analytical results will be averaged for statistical use before the EPC is calculated. Non-detected values will be evaluated in accordance with the USEPA's ProUCL guidance.

Soil EPCs will be calculated for each EUs. Chemical-specific upper confidence limits (UCLs) for each data set will be calculated using USEPA's ProUCL Version 4.1.00 software. If the UCL for a data set is greater than the maximum detected concentration for that medium, the maximum detected concentration will represent the EPC for the data set. The mean lead concentration for each data set will represent the EPC for lead.

EUs depths for disturbed areas will be the 0 to 12 inch depth interval. EU surface soil depths for undisturbed areas will be the 0 to 3 inch bgs and 3 to 12 inch bgs depth intervals and 0 to 12 inches in

disturbed areas, The subsurface soil EU (samples collected at a depth greater than 1 foot bgs) will also be evaluated for disturbed areas .

1.2.4 Chemical and Intake Estimation

Estimates of exposure are based on the contaminant concentrations at the exposure points and on scenario-specific assumptions and intake parameters. The most recent USEPA and MEDEP guidance (e.g., the Exposure Factors Handbook [USEPA, 2011], Supplement Guidance for Dermal Risk Assessment, [USEPA, 2004], and Maine's Guidance for Human Health Risk Assessments for Hazardous Substance Sites in Maine [MEDEP, 2009]) will be used to estimate intakes. In general, standard default parameters, which combine mid-range and upper-end exposure factors, will be used to assess exposures. The equations and exposure parameters obtained from USEPA and MEDEP guidance documents that will be used to quantify intakes and intake parameters are summarized in the RAGS Part D Table 4s, provided in Attachment B.

Traditionally, exposures evaluated in the HHRA have been based on the concept of reasonable maximum exposure (RME), defined as "the maximum exposure that is reasonably expected to occur at a site" (USEPA, 1989a). However, more recent risk assessment guidance (USEPA, 1992), recommends addressing an average case, or Central Tendency Exposure (CTE). The available guidance concerning the evaluation of CTE (USEPA, 1993a) is limited; however, the CTE will be evaluated for each receptor to provide a greater perspective about site risks for risk managers than just the RME scenario alone.

USEPA's Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens (2005b) recommends adjusting the toxicity of carcinogenic chemicals that act via the mutagenic mode of action when evaluating early-life exposures to contaminants. The guidance recommends using age-dependent adjustment factors (ADAFs) in concert with age-specific exposure estimates when assessing cancer risks. Absent chemical-specific data, the supplemental guidance recommends the following default adjustments, which reflect that cancer risks are generally higher from early-life exposures than from similar exposures later in life:

- For exposures before two years of age (i.e., spanning a two-year interval from the first day of birth until a child's second birthday), a 10-fold adjustment.

- For exposures between two and less than 16 years of age (i.e., spanning a 14-year time interval from a child's second birthday until a child's sixteenth birthday), a three-fold adjustment.

- For exposures after reaching 16 years of age, no adjustment.

These adjustments are applied using the same method as that used by USEPA to develop the RSLs. Children will be evaluated in two age groups, ages 0–2 and 2–6 years old. Adults will be evaluated as two age groups (6-16 and 16–30 years old). Using this approach, the intakes for child and adult recreational users and residents were calculated for the RME scenario as follows:

$$\text{Intake}_{\text{Child}} = \text{Intake}_{(\text{ages 0 to 2 years})} \times 10 + \text{Intake}_{(\text{ages 2 to 6 years})} \times 3$$
$$\text{Intake}_{\text{Adult}} = \text{Intake}_{(\text{age 6 to 16 years})} \times 3 + \text{Intake}_{(\text{ages 16 to 30 years})} \times 1$$

This approach will be used only for the chemicals planned for analysis that are identified as mutagenic in the USEPA RSL table (i.e., benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene). Sample calculations showing how this approach was applied will be included in an appendix to the HHRA. In addition, risks to lifelong recreational users and lifelong resident receptors will be evaluated. Risks to these receptors are sums of the cancer risks calculated for individual children and adult receptors. Therefore, lifelong cancer risks from chemicals that act via the mutagenic pathway are assessed through the lifelong recreational user and lifelong resident receptor scenarios.

Lead (if selected as a COPC) will be evaluated using the USEPA Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in children Windows Version 1.1, Build 11 (USEPA, 2010b). Exposure of adults (workers and recreational users) to lead will be evaluated by the adult exposure model presented in the following USEPA document: Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soils (USEPA, January 2003a). The following paragraphs provide a brief overview of these models.

The IEUBK model is recommended by USEPA for the evaluation of childhood lead exposures assuming a residential land use scenario. The IEUBK is designed to estimate blood-lead levels in children (under 7 years of age) based on either default or site-specific input values for air, drinking water, diet, dust, and soil exposure. Studies indicate that infants and young children are extremely susceptible to adverse effects from exposure to lead. Considerable behavioral and developmental impairments have been noted in children with elevated blood-lead levels. The results of the IEUBK modeling are given in terms of the probability that exposed children will exceed a 10 ug/dL blood-lead level. This probability is typically compared to the USEPA goal of limiting the childhood risk of exceeding a 10 ug/dL blood-lead concentration to 5 percent. The 400 mg/kg USEPA RSL for lead for residential land use is based on the IEUBK model.

The USEPA Technical Review Workgroup (TRW) Adult Lead Model (ALM) focuses on assessing risks associated with non-residential adult exposures to lead in soils. The model was originally published to provide guidance on the calculation of soil clean-up levels based on protecting adults (specifically, women of childbearing age) using a conservative approach that relates the lead level in the environment with the blood-lead level of a developing fetus. The output of the model is the risk (i.e., the probability) that elevated fetal blood-lead concentrations (i.e., concentrations greater than 10 ug/dL) will result due to exposures to women of childbearing age.

If the IEUBK model is run for lead, the input parameters other than the site arithmetic mean soil lead concentration will be USEPA default values. The IEUBK model output files, which include the default input parameters, will be included in an appendix to the HHRA. If the ALM is run for lead, the non-default input parameters to the ALM are the arithmetic mean soil lead concentration and receptor-specific ingestion rates and exposure frequencies, which are based on Central Tendency Exposure (CTE) exposure assumptions (included in the RAGS Part D Table 4s). The receptors evaluated by the ALM are non-residents. In this HHRA, the ALM would be used to evaluate lead exposures for construction workers, industrial workers, and adult recreational users. The receptor-specific input parameters will be in the model output files, which will be included in an appendix to the HHRA, and the receptor-specific input parameters will also be discussed in the text.

1.3 Toxicity Assessment

The objective of the toxicity assessment is to identify the potential adverse health effects in exposed populations. Quantitative estimates of the relationship between the magnitude and type of exposures and the severity or probability of human health effects are defined for the identified constituents of concern. Quantitative toxicity values determined during this component of the risk assessment are integrated with outputs of the exposure assessment to characterize the potential for the occurrence of adverse health effects for each receptor group.

The reference dose (RfD) is the toxicity value used to evaluate non-carcinogenic health effects for ingestion and dermal exposures. The reference concentration (RfC) is used to evaluate non-carcinogenic health effects for inhalation exposures. The RfD and RfC estimate the daily exposure level for the human population that is likely to be without appreciable risk during a portion or all of a lifetime. Those are based on a review of available animal and/or human toxicity data, with adjustments for various uncertainties associated with the data. Carcinogenic effects are quantified using the cancer slope factor (CSF) for ingestion and dermal exposures, and using inhalation unit risks (IURs) for inhalation exposure that are plausible upper-bound estimates of the probability of development of cancer per unit intake of chemical

over a lifetime. The probability is based on available dose-response data from human and/or animal studies.

1.3.1 Toxicity Criteria for Oral and Inhalation Exposures

Oral RfDs and CSFs and inhalation RfCs and IURs to be used in the site-specific risk assessments will be obtained from the following primary USEPA literature sources (USEPA, 2003b):

- Tier 1 - Integrated Risk Information System (IRIS).
- Tier 2 - USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs) – The Office of Research and Development/National Center for Environmental Assessment (NCEA) Superfund Health Risk Technical Support Center develops PPRTVs on a chemical specific basis when requested by USEPA's Superfund program.
- Tier 3 - Other Toxicity Values – These sources include but are not limited to California Environmental Protection Agency (Cal EPA) toxicity values, the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs), and the Annual Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b).

Although RfDs and CSFs can be found in several toxicological sources, USEPA's IRIS online database is the preferred source of toxicity values. This database is frequently updated, and presented values have been verified by USEPA.

1.3.2 Toxicity Criteria for Dermal Exposure

RfDs and CSFs found in literature are typically expressed as administered (not absorbed) doses. Therefore, these values are considered to be inappropriate for estimating the risks associated with the dermal route of exposure. Oral dose-response parameters based on administered doses must be adjusted to absorbed doses before the comparison to estimated dermal exposure intakes is made.

The adjustment to an absorbed dose will be made using chemical-specific gastrointestinal absorption efficiencies published in USEPA dermal guidance (USEPA, 2004) using the following equations:

$$RfD_{dermal} = (RfD_{oral})(ABS_{GI})$$

$$CSF_{dermal} = (CSF_{oral}) \ / \ (ABS_{GI})$$

where: ABS_{GI} = absorption efficiency in the gastrointestinal tract

RfD_{dermal}= reference dose for the dermal route of exposure

RfD_{oral} = reference dose for the oral route of exposure

CSF_{dermal}= cancer slope factor for the dermal route of exposure

CSF_{oral} = cancer slope factor for the oral route of exposure

As noted above, the preceding adjustment of the oral toxicity criteria is necessary so that the dermal route of exposure may be quantitatively evaluated in the baseline risk assessment. Explanations and the need for this procedure are presented in Appendix A of USEPA RAGS Part A (USEPA, 1989). The sources or rationale for ABS_{GI} values used in risk calculations will be documented in the HHRA if any COPCs lack published ABS_{GI} values in RAGS Part E.

1.4 Risk Characterization Protocol

Potential risks (non-carcinogenic and carcinogenic) for human receptors resulting from the potential exposures outlined in the exposure assessment are quantitatively determined during the risk characterization component of the HHRA. The quantitative estimates of risk are calculated in accordance with the risk assessment methods outlined in USEPA guidance (USEPA, 1989).

1.4.1 Quantitative Analysis of Chemicals

Quantitative estimates of risk for chemicals will be calculated according to risk assessment methods outlined in USEPA and MEDEP guidance (USEPA, 1989 and MEDEP, 2009). Lifetime cancer risks will be expressed in the form of dimensionless probabilities, referred to as incremental lifetime cancer risks (ILCRs), based on CSFs. Non-carcinogenic risk estimates will be presented in the form of hazard quotients (HQs) that are determined through a comparison of intakes with published RfDs.

ILCR estimates for ingestion and dermal exposures are generated for each COPC using estimated exposure intakes and published CSFs, as follows:

$$ILCR = (\text{Estimated Exposure Intake})(CSF)$$

Where:

ILCR = Incremental Lifetime Cancer Risk for a COPC (unitless)

Estimated Exposure Intake = oral or dermal chemical intake for a receptor [milligram per kilogram per day (mg/kg/day)]

CSF = oral or dermal cancer slope factor for a COPC $(mg/kg/day)^{-1}$

If the above equation results in an ILCR greater than 0.01, the following equation will be used:

$$ILCR = 1-[exp(-Estimated\ Exposure\ Intake)(CSF)]$$

ILCR estimates for inhalation exposures were generated for each COPC using estimated exposure concentrations and published IURs, as follows:

$$ILCR = [IUR][Exposure\ Concentration][1000\ micrograms\ per\ milligram(\mu g/mg)]$$

Where:

IUR = inhalation unit risk for a COPC $((\mu g/m^3)^{-1}$; where m^3 = meters cubed
Exposure Concentration = inhalation chemical intake for a receptor (mg/m^3)

An ILCR of 1×10^{-6} indicates that the exposed receptor has a one-in-one-million chance of developing cancer under the defined exposure scenario. Alternatively, such a risk may be interpreted as representing one additional case of cancer in an exposed population of one million persons.

As mentioned previously, non-carcinogenic risks will be assessed using the concept of HQs and hazard indices (His). The HQ for a COPC is the ratio of the estimated intake to the RfD, as follows for ingestion and dermal exposures:

$$HQ = (Estimated\ Exposure\ Intake)/(RfD)$$

Where:

HQ = Hazard Quotient for a COPC (unitless)
Estimated Exposure Intake = oral or dermal chemical intake for a receptor (mg/kg/day)
RfD = inhalation reference dose for a COPC (mg/kg/day)

For inhalation exposures, HQ is calculated as follows:

$$HQ = (Exposure\ Concentration)/(RfC)$$

Where:

Exposure concentration = inhalation chemical intake for a receptor (mg/m^3)
RfC = inhalation reference concentration for a COPC (mg/m^3)

An HI will be generated by summing the individual HQs for all COPCs. The HI is not a mathematical prediction of the severity of toxic effects and is not a true "risk"; it is simply a numerical indicator of the possibility of the occurrence of non-carcinogenic (threshold) effects.

1.4.2 Interpretation of Risk Assessment Results

To interpret the quantitative risk estimates and to aid risk managers in determining the need for remediation, quantitative risk estimates will be compared to typical USEPA and MEDEP risk benchmarks. Calculated ILCRs will be interpreted using the USEPA target range (1×10^{-6} to 1×10^{-4}) and State of Maine's risk benchmark (1×10^{-5}), and HIs will be evaluated using a value of 1.0. Current USEPA policy regarding lead exposures is to limit the childhood risk of exceeding a 10 microgram per decilitler (µg/dL) blood-lead level to 5 percent.

USEPA has defined the range of 1×10^{-6} to 1×10^{-4} as the ILCR target range for hazardous waste facilities addressed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). Individual or cumulative ILCRs greater than 1×10^{-4} are generally considered to be "unacceptable" by the USEPA. Risk management decisions are necessary when the ILCR is within 1×10^{-4} to 1×10^{-6}. Remediation is typically not required by the USEPA when the cumulative ILCR does not exceed 1×10^{-6}. Similarly, cumulative ILCRs greater than 1×10^{-5} are generally considered to be "unacceptable" by the State of Maine.

An HI exceeding unity (1.0) indicates that there may be non-carcinogenic health risks associated with exposure. If an HI exceeds unity, target organ effects associated with exposure to COPCs are considered. Only those HQs for chemicals that affect the same target organ(s) or exhibit similar critical effect(s) are regarded as truly additive. Consequently, it may be possible for a cumulative HI to exceed 1.0, but no adverse health effects are anticipated if the COPCs do not affect the same target organ or exhibit the same critical effect.

Lead is evaluated separately from other chemicals. The results of the IEUBK model and ALM model will be compared to the USEPA limit of 5 percent of children having a blood-lead concentration exceeding µg/dL. If a model output indicates that more than 5 percent of children are expected to have blood-lead concentrations exceeding 10 µg/dL, the risk is typically considered unacceptable.

1.5 Human Health Risk Uncertainty Analysis

The baseline risk assessment will include an uncertainty analysis that qualitatively addresses major sources of uncertainty in the data evaluation, exposure assessment, toxicity assessment, and risk characterization. Probabilistic risk assessment techniques may be recommended to provide risk managers with a more comprehensive understanding of the uncertainty associated with the quantitative risk assessment results. The following subsections present an overview of uncertainties that may be addressed in a site-specific risk assessment uncertainty section.

1.5.1 Uncertainty in Data Evaluation

This section may discuss uncertainties in the risk assessment associated with the analytical data and data quality. This may also involve a discussion of uncertainty in the COPC selection process, the inclusion or exclusion of COPCs in the risk assessment on the basis of background concentrations, the uncertainty in COPC screening levels, uncertainty associated with non-detected results that exceed the screening criteria, and the omission of constituents for which health criteria are not available.

1.5.2 Uncertainty in the Exposure Assessment

This section will include a discussion of the following: assumptions related to current and future land use; the uncertainty in EPCs (e.g., the use of maximum concentrations to estimate risks); uncertainty in the selection of potential receptors and exposure scenarios; and uncertainty in the selection of exposure parameters (RME vs. CTE). If predictive models are used in the risk estimation, the uncertainty associated with the model and modeling parameters will be evaluated.

1.5.3 Uncertainty in the Toxicity Assessment

The uncertainties inherent in RfDs and CSFs and use of available criteria will be discussed. A discussion of the uncertainty in hazard assessment, which deals with characterizing the nature and strength of the evidence of causation, or the likelihood that a chemical that induces adverse effects in animals will also induce adverse effects in humans, will be provided. This section will also discuss uncertainty in the dose-response evaluations for the COPCs, which relates to the determination of a CSF for the carcinogenic assessment and derivation of an RfD for the non-carcinogenic assessment.

1.5.4 Uncertainty in the Risk Characterization

This section will discuss the uncertainty in risk characterization which results primarily from assumptions made regarding additivity/synergism of effects from exposure to multiple COPCs affecting different target organs across various exposure routes. The risk assessment will discuss the uncertainty inherent in summing risks for several substances across different exposure pathways. It should be noted that probabilistic risk assessment techniques may also be recommended to further define the uncertainty attached to the risk characterization results. However, the exposure assumptions (e.g., probability distributions) used to prepare the probabilistic risk assessment will be reviewed with the regulatory reviewers before they are incorporated into the uncertainty section of the baseline risk assessment.

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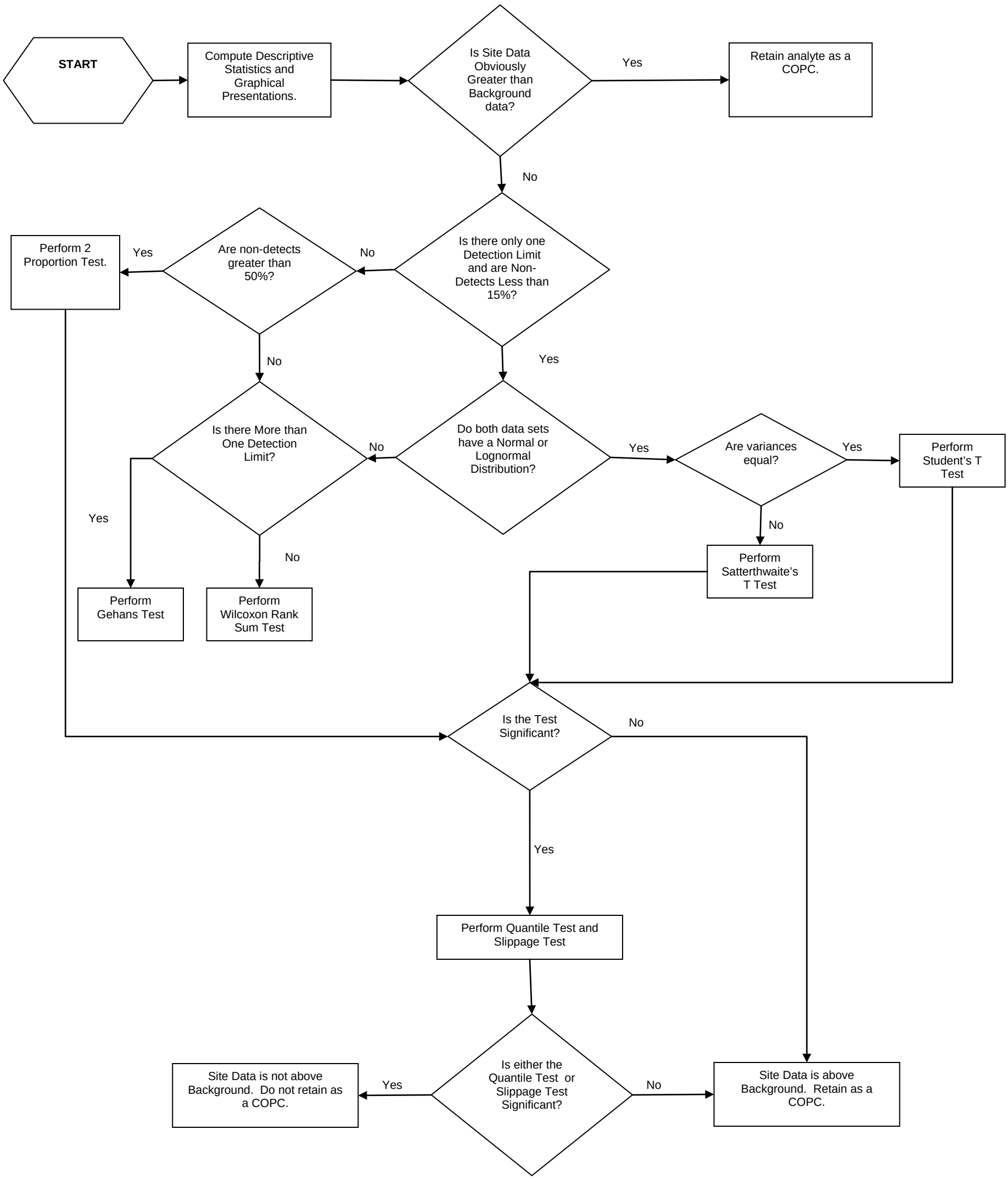
Attachment A

Background Comparison Flow Chart

BACKGROUND COMPARISON FLOW CHART



Attachment B

Exposure Assumptions

VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE - CONSTRUCTION WORKERS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Construction Workers	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	330	mg/day	USEPA, 2002b	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
Dermal	Construction Workers	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	3300	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.3	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	MEDEP, 2009	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Sources:

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Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 4.61E-08 Cancer Dermal Intake = 1.38E-07

Noncancer Ingestion Intake = 3.23E-06 Noncancer Dermal Intake = 9.69E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - CONSTRUCTION WORKERS - SOILS

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Construction Workers	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	165	mg/day	USEPA, 2002b	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
Dermal	Construction Workers	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	3300	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.1	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	USEPA, 2002b	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPAb, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 2.31E-08 Cancer Dermal Intake = 4.61E-08

Noncancer Ingestion Intake = 1.61E-06 Noncancer Dermal Intake = 3.23E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - CONSTRUCTION WORKERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Construction Workers	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	8	hours/day	MEDEP, 2009	CA x ET x EF x ED
				CF	Conversion Factor	24	hours/day	--	AT x CF
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
				PEF	Particulate Emission Factor	1.43E+06	m3/kg	USEPA, 2002a (1)	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

Unit Intake Calculations

Inhalation Intake = (ET x EF x ED)/(AT x CF)

Cancer Inhalation Intake = 3.26E-03 Noncancer Inhalation Intake = 2.28E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - CONSTRUCTION WORKERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Construction Workers	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	8	hours/day	MEDEP, 2009	CA x ET x EF x ED
				CF	Conversion Factor	24	hours/day	--	AT x CF
				EF	Exposure Frequency	250	days/year	MEDEP, 2009	
				ED	Exposure Duration	1	years	USEPA, 2002b	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	365	days	USEPA, 1989	
				PEF	Particulate Emission Factor	1.43E+06	m3/kg	USEPA, 2002a (1)	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

Unit Intake Calculations

Inhalation Intake = (ET x EF x ED)/(AT x CF)

Cancer Inhalation Intake = 3.26E-03 Noncancer Inhalation Intake = 2.28E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

Footnote:

1 Site specific value for construction worker; assumes 140 days of precipitation > 0.01 inches (USEPA, 2002a).

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - OCCUPATIONAL WORKERS - SOIL

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Occupational Worker	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	100	mg/day	USEPA, 1993	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	--	--	BW x AT
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	
				ED	Exposure Duration	25	years	USEPA, 1997	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
Dermal	Occupational Worker	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	3300	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	
				ED	Exposure Duration	25	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPAa, 2002a: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPAb, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 2.10E-07 Cancer Dermal Intake = 1.38E-06

Noncancer Ingestion Intake = 5.87E-07 Noncancer Dermal Intake = 3.87E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES - OCCUPATIONAL WORKERS - SOIL
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Occupational Worker	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	50	mg/day	USEPA, 1993	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	
				ED	Exposure Duration	9	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
Dermal	Occupational Worker	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	3300	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.02	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	
				ED	Exposure Duration	9	years	USEPA, 1993	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. OERR. EPA/540/1-89/002.

USEPA, 1993. Distribution of Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington, D.C. May.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPAa, 2002a: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPAb, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 3.77E-08 Cancer Dermal Intake = 4.98E-08

Noncancer Ingestion Intake = 2.94E-07 Noncancer Dermal Intake = 3.87E-07

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - OCCUPATIONAL WORKERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Industrial Workers	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	8	hours/day	USEPA, 1991	CA x ET x EF x ED
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	AT x 24 hours/day
				ED	Exposure Duration	25	years	USEPA, 1991	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2010	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 1991: Human Health Evaluation Manual, Supplemental guidance: Standard Default Exposure Factors, March 1991.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Cancer Inhalation Intake = 4.89E-02 Noncancer Inhalation Intake = 1.37E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - OCCUPATIONAL WORKERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Industrial Workers	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	8	hours/day	MEDEP, 2009	CA x ET x EF x ED
				EF	Exposure Frequency	150	days/year	MEDEP, 2009	AT x 24 hours/day
				ED	Exposure Duration	9	years	USEPA, 1993	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 1993: Superfund Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Cancer Inhalation Intake = 1.76E-02 Noncancer Inhalation Intake = 1.37E-01

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - CHILD RECREATIONAL USERS - SOILS

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational User	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	200	mg/day	USEPA, 1997	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	USEPA, 1989	
Dermal	Recreational User	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	2,800	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	USEPA, 1989	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Age 0 - 6) = 2.82E-07 Cancer Dermal Intake (Age 0 - 6) = 7.89E-07

Mutagenic Chemicals

Cancer Ingestion Intake (Age 0 - 2) = 9.39E-08 Cancer Dermal Intake (Age 0 - 2) = 2.63E-07

Cancer Ingestion Intake (Age 2 - 6) = 1.88E-07 Cancer Dermal Intake (Age 2 - 6) = 5.26E-07

Noncarcinogenic Chemicals

Noncancer Ingestion Intake = 3.29E-06 Noncancer Dermal Intake = 9.21E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - CHILD RECREATIONAL USERS - SOILS

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface Soil/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational User	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	100	mg/day	USEPA, 1997	
				CF3	Conversion Factor 3	0.000001	kg/mg	--	CSs x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
Dermal	Recreational User	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	0.000001	kg/mg	--	
				SA	Skin Surface Available for Contact	2,800	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.04	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1993: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake = 4.70E-08 Cancer Dermal Intake = 5.26E-08

Mutagenic Chemicals

Cancer Ingestion Intake (Age 0 - 2) = 2.35E-08 Cancer Dermal Intake (Age 0 - 2) = 2.63E-08

Cancer Ingestion Intake (Age 2 - 6) = 2.35E-08 Cancer Dermal Intake (Age 2 - 6) = 2.63E-08

Noncarcinogenic Chemicals

Noncancer Ingestion Intake = 1.64E-06 Noncancer Dermal Intake = 1.84E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - CHILD RECREATIONAL USERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational User	Child	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	2	hours/day	MEDEP, 2009	CA x ET x EF x ED
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	AT x 24 hours/day
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	CA = (1/PEF + 1/VF) x Cs
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 6) = 1.76E-03

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 2.05E-02

Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 2) = 5.87E-04

Cancer Inhalation Intake (Age 2 - 6) = 1.17E-03

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - CHILD RECREATIONAL USERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational User	Child	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	2	hours/day	MEDEP, 2009	CA x ET x EF x ED
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	AT x 24 hours/day
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake = 5.87E-04

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 2.05E-02

Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 2) = 2.94E-04

Cancer Inhalation Intake (Age 2 - 6) = 2.94E-04

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - ADULT RECREATIONAL USERS - SOILS

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational User	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	100	mg/day	(1)	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1)(2)	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1)(2)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
Dermal	Recreational User	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	5,700	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.07	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1)(2)	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1)(2)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

Notes:

1 - Same as adult resident exposures.

2 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Age 6 - 30) = 1.21E-07 Cancer Dermal Intake (Age 6 - 30) = 4.82E-07

Mutagenic Chemicals

Cancer Ingestion Intake (Age 6 - 16) = 5.03E-08 Cancer Dermal Intake (Age 6 - 16) = 2.01E-07

Cancer Ingestion Intake Age 16 - 30) = 7.05E-08 Cancer Dermal Intake (Age 16 - 30) = 2.81E-07

Noncarcinogenic Chemicals

Noncancer Ingestion Intake = 3.52E-07 Noncancer Dermal Intake = 1.41E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES - ADULT RECREATIONAL USERS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Recreational User	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	50	mg/day	(1)	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1)(2)	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1)(2)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
Dermal	Recreational User	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	5,700	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.01	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1)(2)	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1)(2)	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	

1 - Same as adult resident exposures.

2 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 2002:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 5.03E-09 Cancer Dermal Intake = 5.74E-09

Noncancer Ingestion Intake = 5.03E-08 Noncancer Dermal Intake = 5.74E-08

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - ADULT RECREATIONAL USERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational User	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	2	hours/day	MEDEP, 2009	CA x ET x EF x ED
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	AT x 24 hours/day
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1), USEPA, 1989, 2005	CA = (1/PEF + 1/VF) x Cs
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8760	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake (Age 6 - 30) = 7.05E-03

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 2.05E-02

Mutagenic Chemicals

Cancer Inhalation Intake (Age 6 - 16) = 2.94E-03

Cancer Inhalation Intake (Age 16 - 30) = 4.11E-03

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - ADULT RECREATIONAL USERS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Current/Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Recreational User	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	2	hours/day	MEDEP, 2009	CA x ET x EF x ED
				EF	Exposure Frequency	90	days/year	MEDEP, 2009	AT x 24 hours/day
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1), USEPA, 1989, 2005	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	2555	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, recreational adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

MEDEP, 2009. Guidance for Human Health Risk Assessment for Hazardous Substance Sites in Maine. DEP-BRWM 2B 2009, July.

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake = 2.05E-03

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 2.05E-02

Mutagenic Chemicals

Cancer Inhalation Intake (Age 6 - 16) = 5.87E-04

Cancer Inhalation Intake (Age 16 - 30) = 1.47E-03

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE - ADULT RESIDENTS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	100	mg/day	USEPA, 2002b	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	350	days/year	USEPA, 2002b	
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
Dermal	Residents	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	5,700	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.07	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	350	days/year	USEPA, 2002b	
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

Notes:

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002a:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Age 6 - 30) = 4.70E-07 Cancer Dermal Intake (Age 6 - 30) = 1.87E-06

Mutagenic Chemicals

Cancer Ingestion Intake (Age 6 - 16) = 1.96E-07 Cancer Dermal Intake (Age 6 - 16) = 7.81E-07

Cancer Ingestion Intake (Age 16 - 30) = 2.74E-07 Cancer Dermal Intake (Age 16 - 30) = 1.09E-06

Noncarcinogenic Chemicals

Noncancer Ingestion Intake = 1.37E-06 Noncancer Dermal Intake = 5.47E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES - ADULT RESIDENTS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	50	mg/day	USEPA, 1993	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	--	BW x AT
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
Dermal	Residents	Adult	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	5,700	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.01	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	70	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A.

USEPA, 1993. Distribution of Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington, D.C. May.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002a:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 1.31E-08 Cancer Dermal Intake = 1.49E-08

Noncancer Ingestion Intake = 1.31E-07 Noncancer Dermal Intake = 1.49E-07

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - ADULT RESIDENTS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	24	hours/day	USEPA, 2002a	$\frac{CA \times ET \times EF \times ED}{AT \times 24 \text{ hours/day}}$
				EF	Exposure Frequency	350	days/year	USEPA, 2002a	
				ED1	Exposure Duration (Age 6 - 16)	10	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	14	years	(1), USEPA, 1989, 2005	CA = (1/PEF + 1/VF) x Cs
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8760	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	$PEF = \frac{Q / C \times 3600}{0.036 \times (1 - V) \times (U_m / U_t)^3 \times F(x)}$
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	$F(x) = 0.18 * (8x^3 + 12x) * \exp(-x^2)$
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	x = 0.886 * Ut / Um
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals		Noncarcinogenic Chemicals	
Cancer Inhalation Intake (Age 6 - 30) =	3.29E-01	Noncancer Inhalation Intake =	9.59E-01
Mutagenic Chemicals			
Cancer Inhalation Intake (Age 6 - 16) =	1.37E-01		
Cancer Inhalation Intake (Age 16 - 30) =	1.92E-01		

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - ADULT RESIDENTS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	24	hours/day	USEPA, 2002a	CA x ET x EF x ED / AT x 24 hours/day
				EF	Exposure Frequency	234	days/year	USEPA, 2002b	
				ED1	Exposure Duration (Age 6 - 16)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 16 - 30)	5	years	(1), USEPA, 1989, 2005	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	2555	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	$PEF = \frac{Q / C \times 3600}{0.036 \times (1 - V) \times (U_m / U_t)^3 \times F(x)}$
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	x = 0.886 * Ut / Um
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Adults were evaluated as one age group (7 - 30 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential adults were evaluated as two age groups, 7 - 16 years and 16 - 30 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake = 6.41E-02

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 6.41E-01

Mutagenic Chemicals

Cancer Inhalation Intake (Age 6 - 16) = 1.83E-02

Cancer Inhalation Intake (Age 16 - 30) = 4.58E-02

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE - CHILD RESIDENTS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	200	mg/day	USEPA, 2002b	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	Assumed	BW x AT
				EF	Exposure Frequency	350	days/year	USEPA, 2002b	
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
Dermal	Residents	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	2,800	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.2	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	350	days/year	USEPA, 2002b	
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002a:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Non-Mutagenic Chemicals

Cancer Ingestion Intake (Age 0 - 6) = 1.10E-06 Cancer Dermal Intake (Age 0 - 6) = 3.07E-06

Mutagenic Chemicals

Cancer Ingestion Intake (Age 0 - 2) = 3.65E-07 Cancer Dermal Intake (Age 0 - 2) = 1.02E-06

Cancer Ingestion Intake (Age 2 - 6) = 7.31E-07 Cancer Dermal Intake (Age 2 - 6) = 2.05E-06

Noncarcinogenic Chemicals

Noncancer Ingestion Intake = 1.28E-05 Noncancer Dermal Intake = 3.58E-05

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURES - CHILD RESIDENTS - SOILS
NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Surface/Subsurface Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Residents	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002a	Intake (mg/kg/day) =
				IR-S	Ingestion Rate	100	mg/day	USEPA, 1993	
				CF3	Conversion Factor 3	1.0E-06	kg/mg	--	CS x IRS x CF3 x FI x EF x ED
				FI	Fraction Ingested	1	unitless	Assumed	BW x AT
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
Dermal	Residents	Child	Skeet Range	CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002	Dermally Absorbed Dose (mg/kg/day) =
				CF3	Conversion Factor 3	1E-06	kg/mg	--	
				SA	Skin Surface Available for Contact	2,800	cm2	USEPA, 2004	CS x CF3 x SA x SSAF x DABS x EV x EF x ED
				SSAF	Soil to Skin Adherence Factor	0.04	mg/cm2/event	USEPA, 2004	BW x AT
				DABS	Absorption Factor	Chemical Specific	unitless	USEPA, 2004	
				EV	Events Frequency	1	events/day	USEPA, 2004	
				EF	Exposure Frequency	234	days/year	USEPA, 1993	
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				BW	Body Weight	15	kg	USEPA, 1997	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1993. Distribution of Preliminary Review Draft: Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Office of Solid Waste and Emergency Response, Washington, D.C. May.

USEPA, 1997: Exposure Factors Handbook. USEPA/600/8-95/002FA.

USEPA, 2002:Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

Unit Intake Calculations

Incidental Ingestion Intake = (IR-S x CF3 x FI x EF x ED)/(BW x AT)

Dermal Intake = (CF3 x SA x SSAF x EF x ED)/(BW x AT)

Cancer Ingestion Intake = 6.11E-08 Cancer Dermal Intake = 6.84E-08

Noncancer Ingestion Intake = 2.14E-06 Noncancer Dermal Intake = 2.39E-06

Cancer risk from ingestion = Soil concentration x Cancer Ingestion Intake x Oral Cancer Slope Factor

Cancer risk from dermal contact = Soil concentration x Cancer Dermal Intake x Absorption Factor x Dermal Cancer Slope Factor

Hazard Index from ingestion = Soil concentration x Noncancer Ingestion Intake / Oral Reference Dose

Hazard Index from dermal contact = Soil concentration x Noncancer Dermal Intake x Absorption Factor / Dermal Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE - CHILD RESIDENTS SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Child	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	24	hours/day	USEPA, 2002a	CA x ET x EF x ED
				EF	Exposure Frequency	350	days/year	USEPA, 2002a	AT x 24 hours/day
				ED1	Exposure Duration (Age 0 - 2)	2	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	4	years	(1), USEPA, 1989, 2005	CA = (1/PEF + 1/VF) x Cs
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 6) = 8.22E-02

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 9.59E-01

Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 2) = 2.74E-02

Cancer Inhalation Intake (Age 2 - 6) = 5.48E-02

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY EXPOSURES - CHILD RESIDENTS - SOILS TO AIR

NAS BRUNSWICK, BRUNSWICK, MAINE

Scenario Timeframe: Future
Medium: Surface/Subsurface Soil
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Child	Skeet Range	CA	Chemical concentration in air	Calculated	mg/m3	USEPA, 2002a	Exposure Concentration (mg/m^3) =
				CS	Chemical concentration in soil	Max or 95% UCL	mg/kg	USEPA, 2002b	
				ET	Exposure Time	24	hours/day	USEPA, 2002a	CA x ET x EF x ED
				EF	Exposure Frequency	234	days/year	USEPA, 2002a	AT x 24 hours/day
				ED1	Exposure Duration (Age 0 - 2)	1	years	(1), USEPA, 1989, 2005	
				ED2	Exposure Duration (Age 2 - 6)	1	years	(1), USEPA, 1989, 2005	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	CA = (1/PEF + 1/VF) x Cs
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
				PEF	Particulate Emission Factor	9.37E+09	m3/kg	USEPA, 2010	
				VF	Volatilization Factor	Chemical-specific	m3/kg	USEPA, 2002a	
				Q/C	Inverse of mean concentration at center of source	74.3185	g/m2-s per kg/m3	USEPA 2010	
				Ut	Equivalent threshold of wind velocity at 7m.	11.32	m/sec	USEPA 2010	
				Um	Mean annual wind speed	3.89	m/sec	USEPA 2010	
				V	Fraction of vegetative cover	0.5	unitless	USEPA 2010	
				F(x)	Function dependent of Um/Ut	0.0391	unitless	USEPA 2010	

Notes:

1 - Children were evaluated as one age group (0 - 6 years) for non-mutagenic chemicals. For chemicals that act via the mutagenic mode of action, residential children were evaluated as two age groups, 0 - 2 years and 2 - 6 years in accordance with USEPA's Supplemental Guidance of Assessing Susceptibility from Early-Life Exposure to Carcinogens (USEPA, 2005).

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. USEPA/540/1-86/060.

USEPA, 2002a: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2002b: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10, December.

USEPA, 2010: Soil Screening Guidance calculation Internet site at http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi. Site-specific values for Portland, Maine.

Unit Intake Calculations

Unit Exposure Concentration = (ET x EF x ED)/(AT x 24 hours/day)

Non-Mutagenic Chemicals

Cancer Inhalation Intake = 1.83E-02

Noncarcinogenic Chemicals

Noncancer Inhalation Intake = 6.41E-01

Mutagenic Chemicals

Cancer Inhalation Intake (Age 0 - 2) = 9.16E-03

Cancer Inhalation Intake (Age 2 - 6) = 9.16E-03

Cancer risk from ingestion = Air concentration x Cancer Inhalation Intake x Inhalation Cancer Slope Factor

Hazard Index from ingestion = Air concentration x Noncancer Inhalation Intake / Inhalation Reference Dose

APPENDIX C

ECOLOGICAL RISK ASSESSMENT METHODOLOGY

ECOLOGICAL RISK ASSESSMENT METHODOLOGY

The goal of the ecological risk assessment (ERA) for the Skeet Range will be to evaluate the potential for adverse ecological impacts of site-related contamination and to determine the need for further investigation and/or remedial action at the site. The ERA will contain information to enable scientists and managers to conclude either that ecological risks at the site are most likely negligible or that further information is necessary to evaluate potential ecological risks at the site.

The ERA will be conducted in accordance with the following guidance documents:

- Navy Policy for Conducting Ecological Risk Assessment, Navy, 1999.
- Navy Guidance for Conducting Ecological Risk Assessments (http://web.ead.anl.gov/ecorisk/index.cfm)
- Final Guidelines for Ecological Risk Assessment, United States Environmental Protection Agency (USEPA), 1998.
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, USEPA, 1997.

The ERA will consist of Steps 1, 2, and 3a of the eight step ERA process. The first two screening steps comprise the screening-level ecological risk assessment (SERA), and correspond with Tier 1 of the Navy Policy (Navy, 1999), 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 Tier 1 assumptions following Steps 1 and 2 to further focus the ERA process on the chemicals of greatest concern at a site. Step 3a corresponds with the first part of Tier 2 of the Navy Policy (Navy, 1999). The remaining steps of the ERA process require revision to the Work Plan and Field Sampling Plan prior to initiation, and will not be included in the ERA. Sediment and surface water will not be included in this ERA; they will be evaluated under separate cover.

1.0 Tier 1, Step 1: Screening-Level Problem Formulation and Ecological Effects Evaluation

Problem formulation is the first step of an ERA. The problem formulation process enables the risk assessor to identify the ecological resources to be protected (known as assessment endpoints); the measurements that will be used to evaluate risks to those resources (known as measurement endpoints); and the chemicals, geographic areas, and environmental media relevant to the risk assessment.

1.1 Environmental Setting

The site consists of an open field to the east, two impoundment ponds within a forested area south of Neptune Road, and several buildings and a baseball field to the north. The SKT encompasses an area of approximately 30 acres, not including paved surfaces and water bodies. The impoundment ponds receive runoff from surrounding areas, including a runway. The impoundment ponds discharge to a stream located to the southeast. The former range was located adjacent to Range Road, just northeast of the taxiway intersection. Potential ecological receptors at the site likely include plants, soil invertebrates, sediment invertebrates, aquatic organisms, and small mammals and birds.

1.2 Potential Sources of Contamination

The site is a former skeet range used in the 1950s. Contaminants such as metals, propellants, and polycyclic aromatic hydrocarbons (PAHs) may have impacted soil, sediment, and surface water. The surface water in the impoundment ponds has other significant sources of potential PAH contamination including stormwater runoff and runway runoff.

1.3 Potential Exposure Pathways

Terrestrial ecological receptors, such as plants, soil invertebrates, mammals, and birds, can be exposed to contaminated surface soil through direct contact as they search for food and burrow into the soil. Benthic invertebrates and other aquatic organisms can be exposed to chemicals in surface water and sediment. Mammals and birds can also ingest contaminated surface soil, sediment, surface water, and food items in which contaminants have accumulated.

1.4 Assessment and Measurement Endpoints

Assessment endpoints are explicit expressions of the environmental value that is to be protected (USEPA, 1997). The selection of these endpoints is based on the habitats present, the migration pathways of chemicals, and the routes that chemicals may take to enter receptors. Measurement endpoints are estimates of biological impacts (e.g., mortality, growth, reproduction) used to evaluate the assessment endpoints. The assessment and measurement endpoints that will be used to evaluate site data are presented in Table 1. The potential receptors at the site for soil exposure include terrestrial plants, soil invertebrates, and herbivorous and insectivorous mammals and birds.

For vertebrate receptors, selection of a particular species is required so that intake through eating can be estimated. The following surrogate species will be used for the food chain modeling:

- Herbivorous mammal: meadow vole
- Herbivorous bird: bobwhite quail
- Insectivorous mammal: short-tailed shrew
- Insectivorous bird: American robin

USEPA guidance (USEPA, 1997) states that "it is not practical or possible to directly evaluate risks to all of the individual components of the ecosystem at a site. Instead, assessment endpoints focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals from the site." Therefore, this ERA focuses on the endpoints tending to yield the highest risks, which should account for endpoints that have lower risks.

Large carnivorous birds and mammals were not selected as assessment endpoints because their home range (hundreds of acres) is larger than the site (approximately 30 acres, not including paved surfaces and impoundment ponds), so they would only consume a portion of food from this area. Therefore, risks would be greater to small mammals and birds that obtain all or most of their food from the site. Although some limited reptiles (e.g., snakes) may be present at the site, they were not selected as assessment endpoints because of the lack of toxicity information and the lack of methods to evaluate their exposure to chemicals.

1.5 Conceptual Site Model

A conceptual site model (CSM) in ERA problem formulation is a written description of predicted relationships between ecological entities and the stressors to which they may be exposed (USEPA, 1998). The CSM consists of two primary components: predicted relationships among stressor, exposure, and assessment endpoint response, and a diagram that illustrates the relationships (USEPA, 1998). At the site, the sources of the chemicals include metals, explosives, and PAHs associated with the former SKT. The exposure media includes surface soil, sediment, and surface water. Surface water runoff carrying contaminated soil from the site or off-site areas may have led to contamination of surface water and sediment at the site. Because the site consists of different habitats such as vegetated areas and impoundment ponds, a variety of terrestrial and aquatic receptors may be present at the site. For this ERA, surface soil will be defined as 0 to 1 foot. If this ERA identifies potentially unacceptable risk to ecological receptors from exposure to 0 to 1 foot surface soil, separate ERAs will be performed to evaluate risks from shallow surface soil from 0 to 3 inches and deep surface soil from 3 to 12 inches.

Sediment and surface water will not be included in this ERA because they will be evaluated under separate cover.

2.0 Tier 1, Step 2: Screening-Level Exposure Estimate and Risk Quotients

2.1 Ecological Effects Evaluation

The preliminary ecological effects evaluation is an investigation of the relationship between exposure to a chemical and the potential for adverse effects resulting from exposure. In this step, conservative screening levels for evaluating the toxicity to ecological receptors from the detected levels of chemicals at the sites are compiled.

Terrestrial plants and soil invertebrates

Risks to terrestrial plants and soil invertebrates resulting from direct exposure to chemicals will be evaluated by comparing the chemical concentrations in the surface soil to screening levels. In order of preference, the first source selected for the screening levels is the USEPA Ecological Soil Screening Levels (Eco SSLs) (http://www.epa.gov/ecotox/ecossl/). If an Eco SSL is not available for a particular chemical or receptor, then Canadian Soil Quality Guidelines (CCME) (http://ceqg-rcqe.ccme.ca/), followed by Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for invertebrates (Efroymson et al., 1997a) and plants (Efroymson et al., 1997b), Ecotoxicology of Explosives (Sunahara et al., 2009), and ECORISK Database (Release 2.4) (LANL, 2009) will be used. Eco SSLs will be used first because they are the most current soil screening levels. The screening levels are presented in Table 2.

Mammals and birds

Potential risks to mammals and birds resulting from exposure to chemicals in the surface soil will be evaluated by comparing chemical concentrations to ecological screening levels (Table 2). If a chemical concentration exceeds its screening level or a screening level is not available, the chemical will be evaluated using food chain models for risks to mammals and birds.

Risks to mammals and birds from exposures to chemicals in the surface soil will be determined by estimating the Chronic Daily Intake (CDI) and comparing the CDI to toxicity reference values (TRVs) representing acceptable daily doses in mg/kg-day. The TRVs, including no observed adverse effects levels (NOAELs), and lowest observed adverse effect levels (LOAELs) were obtained from wildlife studies presented in the USEPA Eco SSLs (http://www.epa.gov/ecotox/ecossl/) and ORNL Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996) and are supplemented with other toxicity

information when necessary. Table 3 presents the TRVs for each chemical and Table 4 presents the sources (i.e., NOAELs and LOAELs) of the TRVs. If a subchronic study was used to develop the TRV, the final value was multiplied by a factor of 0.1 to account for uncertainty between subchronic and chronic effects. Also, the LOAEL was multiplied by a factor of 0.1 to estimate a NOAEL TRV if only a LOAEL study was available. The chemical-specific Eco SSL documents provide both NOAELs and LOAELS for various studies, but TRVs are generally calculated only for NOAELs. The geometric mean of the chemical-specific growth and reproduction LOAELs from the chemical-specific Eco SSL documents were used as the LOAEL TRVs for several metals. This approach was used because the survival LOAELs tend to be greater than growth or reproductive LOAELs and the selected LOAELs were generally much lower than many NOAELs for growth, reproduction, and survival.

2.2 Exposure Characterization

Terrestrial soil invertebrates and plants are exposed to chemicals in the surface soil through direct contact and/or ingestion. Maximum chemical concentrations in soil will be used in the screening step to select chemicals of potential concern (COPCs).

Doses in mg/kg-day will be estimated for terrestrial wildlife (mammals and birds) using exposure equations. The following equation will be used to calculate the exposure dose for terrestrial wildlife from exposure to chemicals in soil and associated food items (e.g., plants and invertebrates):

$$CDI = \frac{(C_f * I_f) + (C_s * I_s) * H}{BW}$$

Where:

CDI	=	chronic daily intake (mg/kg-day)
C_f	=	chemical concentration in food (mg/kg) (see discussion below)
C_s	=	chemical concentration in surface soil (mg/kg)
I_f	=	food ingestion rate (kg/day)
I_s	=	incidental surface soil ingestion rate (kg/day)
H	=	portion of food intake from the contaminated area (unitless)
BW	=	body weight (kg)

The exposure assumptions (i.e., ingestion rate, body weight) will be obtained primarily from the Wildlife Exposure Factors Handbook (USEPA, 1993) with other sources used as necessary. Food ingestion rates will be presented on a dry weight basis and chemical concentrations in the food items will be estimated in

dry weight concentrations. This will be done to be consistent with chemical concentrations in soil, which are reported on a dry weight basis. The exposure assumptions are presented in Table 5.

Chemical concentrations in food items for soil insectivorous and herbivorous receptors will be calculated using soil-to-invertebrate or soil-to-plant bioaccumulation factors (BAFs) or regression equations. The following equation will be used to calculate chemical concentrations in plants or invertebrates when BAFs are used:

$$C_f = C_s * BAF$$

Where:

C_f = Chemical concentration in food (mg/kg)
C_s = Chemical concentration in surface soil (mg/kg)
BAF = Biota-soil bioaccumulation factor (unitless) (soil to plant or soil to earthworm)

The following sources of plants/earthworm BAFs will be used to calculate the chemical concentrations in plants and earthworms:

- Plant and invertebrate BAFs: Guidance for Developing Ecological Soil Screening Level (USEPA, 2007a).
- Plant BAFs: ORNL Risk Assessment Information System (http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem_spef) (ORNL, 2011).
- BAFs for Explosives: Los Alamos National Laboratory (LANL) ECORISK Database (LANL, 2009)

A default value of 1.0 will be used for the BAF when chemical-specific data are not available.

The food chain model scenarios will be calculated using various exposure assumptions to present a range of potential risks. For selection of chemicals as COPCs, the following set of conservative exposure assumptions will be used:

- Maximum soil concentrations
- Conservative receptor body weight and ingestion rates
- Receptors spend 100 percent of their time at the Site

2.3 Risk Characterization

An Ecological Effects Quotient (EEQ) approach will be used to characterize the risk to ecological receptors. This approach characterizes the potential effects by comparing exposure concentrations with the effects data. When EEQs exceed 1.0, it is an indication that ecological receptors are potentially at risk, although additional evaluation or data may be necessary to confirm with greater certainty whether ecological receptors are actually at risk, especially because most benchmarks are developed using conservative exposure assumptions and/or studies. An EEQ should not be construed as being probabilistic; rather, it is a numerical indicator of the extent to which an EPC exceeds or is less than a benchmark.

The EEQs for surface soil receptors will be calculated as follows:

$$EEQ = \frac{Css}{SSSL}$$

where:

EEQ	=	Ecological Effects Quotient (unitless)
Css	=	Chemical concentration in surface soil (µg/kg or mg/kg)
SSSL	=	Surface soil screening level (µg/kg or mg/kg)

The EEQs for mammals and birds will be calculated as follows:

$$EEQ = \frac{CDI}{TRV}$$

where:

EEQ	=	Ecological effects quotient (unitless)
CDI	=	Chronic daily intake dose (mg/kg-day)
TRV	=	Toxicity reference value (NOAEL or LOAEL) (mg/kg-day)

2.4 Selection of Chemicals of Potential Concern

The final part of the screening evaluation includes the initial selection of ecological COPCs. Chemicals that are not retained as COPCs are assumed to only cause negligible risk to ecological receptors and will not be evaluated further in the ERA. Chemicals that are initially selected as COPCs will be further

evaluated in Step 3a to determine if they will be retained as final COPCs. The initial ecological COPCs will be selected by the following procedures:

- For plants and soil invertebrates, chemicals with EEQs greater than 1.0 (using screening values) will be selected as COPCs because they have a potential to cause risk to ecological receptors.

- For birds and mammals, chemicals with EEQs greater than 1.0 based on the food chain model using NOAELs will be selected as COPCs because they have the potential to cause risks to higher trophic level mammals and birds.

- Chemicals without screening values will be selected as COPCs, but only evaluated qualitatively.

- Calcium, magnesium, potassium, and sodium will not be selected as COPCs, because they are essential nutrients that can be tolerated by living systems even at high concentrations. No evidence indicates that these chemicals are related to site operations, and they are not considered hazardous chemicals.

3.0 Tier 2, Step 3a: COPC Refinement

The purposes of Step 3a are to re-evaluate the COPCs that are retained from Tier 1 for further evaluation in a Tier 2 BERA and to identify and eliminate from further consideration those chemicals that are only selected as COPCs because of the use of very conservative exposure scenarios. Using less conservative (but more realistic) assumptions, the Tier 1 risk estimates will be recalculated and the new estimates will be used to refine the list of COPCs identified by the Tier 1 screening risk assessment in order to focus any additional efforts on chemicals that are of primary ecological concern.

For chemicals that are evaluated further in Step 3a, the following factors will be evaluated, as appropriate, to determine if the risks are great enough to warrant additional evaluations. Note that all of these factors might not be applicable for each chemical and/or receptor group.

- Magnitude of criterion exceedance: Although the magnitude of the risks may not relate directly to the magnitude of a criterion exceedance, the magnitude of the criterion exceedance may be one item used in a lines-of-evidence approach to determine the need for further site evaluation. The greater the criterion exceedance, the greater the probability and concern that an unacceptable risk exists.

- Frequency of chemical detection and spatial distribution: A chemical detected at a low frequency typically is of less concern than a chemical detected at higher frequency if toxicity values, concentrations, and spatial areas represented by the data are similar. All else being equal, chemicals

detected frequently will be given greater consideration than those detected relatively infrequently. In addition, the spatial distribution of a chemical may be evaluated to determine the area that a sample, or samples, represents.

- Background: Concentrations of chemicals in surface soil will be compared to background concentration data if available. If the concentration of a detected chemical is not greater than the background concentration, the chemical will be considered as not site-related and eliminated as a COPC.

- Contaminant bioavailability: Many contaminants (especially inorganics) are present in the environment in forms that are typically not bioavailable, and the limited bioavailability will be considered when evaluating the exposures of receptors to site contaminants. Contaminants with generally less bioavailability will be considered to be less toxic than the more bioavailable contaminants, all other factors being equal.

- Additional Benchmarks: Alternative benchmarks will be used to further evaluate risks to specific groups of ecological receptors (e.g., plants and invertebrates).

- Food Chain Modeling: Exposure via the food chain is a major pathway of concern for chemicals known to significantly bioaccumulate and/or biomagnify. Thus, potential risk to upper level receptors is evaluated using food chain models. The Tier 1 exposure doses calculated for terrestrial wildlife will be re-calculated using the following Tier 2, Step 3A exposure assumptions and chemical concentrations:
  - 95th percentile UCL soil concentrations
  - Average receptor body weights and ingestion rates

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TABLE 1

ASSESSMENT ENDPOINTS AND MEASUREMENT ENDPOINTS
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNWICK, MAINE

Assessment Endpoint	Measurement Endpoint
Adverse effects on the survival, reproduction, and/or growth of soil invertebrates	Survival, growth, and/or reproduction of soil invertebrates will be evaluated by comparing the measured concentrations of chemicals in the surface soil to invertebrate soil screening levels.
Adverse effects on the survival, reproduction, and/or growth of terrestrial plants	Survival, growth, and/or reproduction of terrestrial plants will be evaluated by comparing the measured concentrations of chemicals in the surface soil to plant soil screening levels.
Adverse effects on the survival, reproduction, and/or increase in development effects of insectivorous birds	Survival, reproduction, and/or increase in development effects of birds will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and earthworms to No Observed Adverse Effects Levels (NOAELs) and Lowest Observed Adverse Effects Levels (LOAELs) for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of insectivorous mammals	Survival, reproduction, and/or increase in development effects of mammals will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and earthworms to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of herbivorous birds	Survival, reproduction, and/or increase in development effects of birds will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and plants to NOAELs and LOAELs for surrogate wildlife species.
Adverse effects on the survival, reproduction, and/or increase in development effects of herbivorous mammals	Survival, reproduction, and/or increase in development effects of mammals will be evaluated by comparing the estimated ingested dose of contaminants in the surface soil and plants to NOAELs and LOAELs for surrogate wildlife species.

TABLE 2

SURFACE SOIL SCREENING VALUES
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNWICK, MAINE

Analyte	CAS Number	Plant		Invertebrate		Avian		Mammal	
		Value	Source	Value	Source	Value	Source	Value	Source
Inorganics (mg/kg)									
Aluminum	7429-90-5	NA[1]	EcoSSL	NA[1]	EcoSSL	NA[1]	EcoSSL	NA[1]	EcoSSL
Antimony	7440-36-0	5	ORNL	78	EcoSSL	NA	NA	0.27	EcoSSL
Arsenic	7440-38-2	18	EcoSSL	17.1	CCME	43	EcoSSL	46	EcoSSL
Barium	7440-39-3	500	ORNL	330	EcoSSL	NA	NA	2000	EcoSSL
Beryllium	7440-41-7	10	ORNL	40	EcoSSL	NA	NA	21	EcoSSL
Cadmium	7440-43-9	32	EcoSSL	140	EcoSSL	0.77	EcoSSL	0.36	EcoSSL
Calcium	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	7440-47-3	64	CCME	64	CCME	26	EcoSSL	34	EcoSSL
Cobalt	7440-48-4	13	EcoSSL	NA	NA	120	EcoSSL	230	EcoSSL
Copper	7440-50-8	70	EcoSSL	80	EcoSSL	28	EcoSSL	49	EcoSSL
Iron	7439-89-6	NA[2]	EcoSSL	NA	NA	NA	NA	NA	NA
Lead	7439-92-1	120	EcoSSL	1700	EcoSSL	11	EcoSSL	56	EcoSSL
Mercury	7439-97-6	12	CCME	12	CCME	NA	NA	NA	NA
Magnesium	7439-95-4	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	7439-96-5	220	EcoSSL	450	EcoSSL	4300	EcoSSL	4000	EcoSSL
Nickel	7440-02-0	38	EcoSSL	280	EcoSSL	210	EcoSSL	130	EcoSSL
Potassium	7440-09-7	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	0.52	EcoSSL	4.1	EcoSSL	1.2	EcoSSL	0.63	EcoSSL
Silver	7440-22-4	560	EcoSSL	NA	NA	4.2	EcoSSL	14	EcoSSL
Sodium	7440-23-5	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	1.4	CCME	1.4	CCME	NA	NA	NA	NA
Vanadium	7440-62-2	130	CCME	130	CCME	7.8	EcoSSL	280	EcoSSL
Zinc	7440-66-6	160	EcoSSL	120	EcoSSL	46	EcoSSL	79	EcoSSL
PAHs (mg/kg)									
1-Methylnaphthalene[3]	90-12-0	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL
2-Methylnaphthalene	91-57-6	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL
Acenaphthene	83-32-9	20	ORNL	29	EcoSSL	NA	NA	100	EcoSSL
Acenaphthylene	208-96-8	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL
Anthracene	120-12-7	2.5	CCME	29	EcoSSL	NA	NA	100	EcoSSL
Benzo(a)anthracene	56-55-3	18	LANL	18	EcoSSL	NA	NA	1.1	EcoSSL
Benzo(a)pyrene	50-32-8	20	CCME	18	EcoSSL	NA	NA	1.1	EcoSSL
Benzo(b)fluoranthene	205-99-2	18	LANL	18	EcoSSL	NA	NA	1.1	EcoSSL
Benzo(g,h,i)perylene	191-24-2	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Benzo(k)fluoranthene	207-08-9	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Chrysene	218-01-9	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Dibenzo(a,h)anthracene	53-70-3	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Fluoranthene	206-44-0	50	CCME	29	EcoSSL	NA	NA	100	EcoSSL
Fluorene	86-73-7	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL
Indeno(1,2,3-cd)pyrene	193-39-5	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Naphthalene	91-20-3	1	LANL	29	EcoSSL	NA	NA	100	EcoSSL
Phenanthrene	85-01-8	NA	NA	29	EcoSSL	NA	NA	100	EcoSSL
Pyrene	129-00-0	NA	NA	18	EcoSSL	NA	NA	1.1	EcoSSL
Explosives (mg/kg)									
2,4-Dinitrotoluene	121-14-2	6	Sunahara	20	Sunahara	NA	NA	NA	NA
2,6-Dinitrotoluene	606-20-2	5	Sunahara	7	Sunahara	NA	NA	NA	NA
2,4,6-Trinitrotoluene	118-96-7	6	Sunahara	12	Sunahara	6.4	NA	NA	NA
2-Amino-4,6-Dinitrotoluene	35572-78-2	80	LANL	NA	NA	NA	NA	NA	NA
2-Nitrotoluene	88-72-2	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitrotoluene	99-08-1	NA	NA	NA	NA	NA	NA	NA	NA
4-Amino-2,6-Dinitrotoluene	19406-51-0	80	LANL	NA	NA	NA	NA	NA	NA
4-Nitrotoluene	99-99-0	NA	NA	NA	NA	NA	NA	NA	NA
Nitroglycerin	55-63-0	NA	NA	NA	NA	NA	NA	NA	NA

Screening Level Sources in the Order of Preference:
EcoSSL - EPA Ecological Soil Screening Levels (USEPA, 2003, 2005, 2006, 2007, 2008)
CCME - Canadian Council of Ministers of the Environment (1999, 2001, 2010)
ORNL - Oak Ridge National Laboratory Toxicological Benchmarks for plants and invertebrates (Efroymson et al., 1997a and 1997b)
Sunahara - Ecotoxicity of Explosives (Sunahara et al., 2009)
LANL - ECORISK Database (used for plants and invertebrates only) (LANL, 2009)

1 - Aluminum is considered a COPC only when the soil pH is less than 5.5.
2 - Iron is not expected to be toxic to plants with a soil pH between 5 and 8.
3 - Used 2-methylnaphthalene screening level as a surrogate.

TABLE 3
TOXICITY REFERENCE VALUES
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNWICK, MAINE

ANALYTE	Mammal		Bird	
	NOAEL	LOAEL	NOAEL	LOAEL
SEMIVOLATILES				
1-Methylnaphthalene	65.6	356	2	20
2-Methylnaphthalene	65.6	356	2	20
Acenaphthene	65.6	356	2	20
Acenaphthylene	65.6	356	2	20
Anthracene	65.6	356	2	20
Benzo(a)anthracene	0.615	38.4	2	20
Benzo(a)pyrene	0.615	38.4	2	20
Benzo(b)fluoranthene	0.615	38.4	2	20
Benzo(g,h,i)perylene	0.615	38.4	2	20
Benzo(k)fluoranthene	0.615	38.4	2	20
Chrysene	0.615	38.4	2	20
Dibenzo(a,h)anthracene	0.615	38.4	2	20
Fluoranthene	65.6	356	2	20
Fluorene	65.6	356	2	20
Indeno(1,2,3-cd)pyrene	0.615	38.4	2	20
Naphthalene	65.6	356	2	20
Phenanthrene	65.6	356	2	20
Pyrene	0.615	38.4	2	20
INORGANICS				
Aluminum	1.93	19.3	109.7	1097
Antimony	0.059	2.76	NV	NV
Arsenic	1.04	4.55	2.24	4.51
Barium	51.8	82.7	20.8	41.7
Beryllium	0.532	0.673	NV	NV
Cadmium	0.77	6.9	1.47	6.35
Calcium	NV	NV	NV	NV
Chromium	2.40	58.17	2.66	15.63
Cobalt	7.33	18.90	7.61	18.34
Copper	5.6	82.7	4.05	34.87
Iron	50	500	100	1000
Lead	4.7	186.4	1.63	44.63
Magnesium	NV	NV	NV	NV
Manganese	51.5	145.67	179	376.6
Mercury	0.032	0.16	0.0064	0.064
Nickel	1.70	14.77	6.71	18.57
Potassium	NV	NV	NV	NV
Selenium	0.143	0.661	0.29	0.819
Silver	6.02	118.6	2.02	60.47
Sodium	NV	NV	NV	NV
Thallium	0.0074	0.074	NV	NV
Vanadium	4.16	9.44	0.34	1.69
Zinc	75.4	297.58	66.1	171.44
EXPLOSIVES				
2,4-Dinitrotoluene	0.67	1.4	0.01	1.3
2,6-Dinitrotoluene	0.7	7	NV	NV
2,4,6-Trinitrotoluene	0.2	0.3	0.07	1.8
2-Amino-4,6-Dinitrotoluene	9	48	NV	NV
2-Nitrotoluene	20	200	NV	NV
3-Nitrotoluene	20	200	NV	NV
4-Amino-2,6-Dinitrotoluene	9	48	NV	NV
4-Nitrotoluene	20	200	NV	NV
Nitroglycerin	3	32	NV	NV

NV - No value available.

Notes:
The sources of these NOAELS and LOAELS are presented in the table titled "Sources and Endpoints for NOAELS and LOAELS for Terrestrial Wildlife" .

TABLE 4
SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNSWICK, MAINE

Parameters	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Semivolatiles Organics							
7,12-Dimethylbenz(a)anthracene	20	LOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
7,12-Dimethylbenz(a)anthracene	2	NOAEL	systemic	chronic	nestling/starlings	Trust et al., 1994	
High Molecular Weight PAHs	38.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
High Molecular Weight PAHs	0.615	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Low Molecular Weight PAHs	356	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Low Molecular Weight PAHs	65.6	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Explosives							
2-Amino-4,6-Dinitrotoluene	9	NOAEL	mortality	acute*	rat	Ellis et al., 1980	USACHPPM, 2005
2-Amino-4,6-Dinitrotoluene	48	LOAEL	mortality	acute*	rat	Ellis et al., 1980	USACHPPM, 2005
4-Amino-2,6-Dinitrotoluene	9	NOAEL	mortality	acute*	rat	Ellis et al., 1980	USACHPPM, 2005
4-Amino-2,6-Dinitrotoluene	48	LOAEL	mortality	acute*	rat	Ellis et al., 1980	USACHPPM, 2005
2,4,6-Trinitrotoluene	0.3	ED_{10}	growth	chronic	dog	Levine et al., 1990	USACHPPM, 2001
2,4,6-Trinitrotoluene	0.2	LED_{10}	growth	chronic	dog	Levine et al., 1990	USACHPPM, 2001
2,4,6-Trinitrotoluene	1.8	LOAEL	systemic	subchronic*	bobwhite quail	Gogal et al., (*in draft*)	USACHPPM, 2001
2,4,6-Trinitrotoluene	0.07	NOAEL	systemic	subchronic*	bobwhite quail	Gogal et al., (*in draft*)	USACHPPM, 2001
2,4-Dinitrotoluene	1.4	ED_{10}	neurotoxicity	chronic	dog	Ellis et al., 1979	USACHPPM. 2006
2,4-Dinitrotoluene	0.67	LED_{10}	neurotoxicity	chronic	dog	Ellis et al., 1979	USACHPPM. 2006
2,4-Dinitrotoluene	0.01	NOAEL	mortality	subchronic*	bobwhite quail	Johnson et al, 2005	USACHPPM, 2006
2,4-Dinitrotoluene	1.3	LOAEL	mortality	subchronic*	bobwhite quail	Johnson et al, 2005	USACHPPM, 2006
2,6-Dinitrotoluene	7	LOAEL	growth	chronic	rat	Leonard et al., 1987	USACHPPM. 2006
2, 3, and 4-Nitrotoluene	200	LOAEL	systemic	chronic	rat	Ciss et al., 1980	HEAST, 1997
Nitroglycerin	32	LOAEL	growth	chronic	rat	USACHPPM, 2007	Ellis et al., 1978
Nitroglycerin	3	NOAEL	growth	chronic	rat	USACHPPM, 2007	Ellis et al., 1978
Inorganics							
Aluminum	19.3	LOAEL	reproductive	chronic	mouse	Ondreicka et al., 1966	Sample et.al., 1996
Aluminum	109.7	NOAEL	reproductive	chronic	ringed dove	Carriere et al., 1986	Sample et.al., 1996
Antimony	2.76	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Antimony	0.059	NOAEL	reproduction & growth	chronic	rat	USEPA, 2005	
Arsenic	4.51	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Arsenic	4.55	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Arsenic	2.24	NOAEL	reproduction & growth	chronic	chicken	USEPA, 2005	
Arsenic	1.04	NOAEL	reproduction & growth	chronic	dog	USEPA, 2005	
Barium	82.7	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Barium	416.53	LOAEL	Survival	subchronic	chicks	Johnson et al., 1960	Sample et.al., 1996
Barium	51.8	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Barium	208.26	NOAEL	Survival	subchronic	chicks	Johnson et al., 1960	Sample et.al., 1996
Beryllium	0.673	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Beryllium	0.532	NOAEL	Survival	chronic	rat	USEPA, 2005	
Cadmium	6.35	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	6.9	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Cadmium	1.47	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cadmium	0.77	NOAEL	reproduction & growth	chronic	rat	USEPA, 2005	
Chromium(III)	15.63	LOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	58.17	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Chromium(III)	2.66	NOAEL	reproduction & growth	chronic	birds	USEPA, 2008	
Chromium(III)	2.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2008	
Cobalt	18.34	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Cobalt	18.9	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Cobalt	7.61	NOAEL	reproduction & growth	chronic	birds	USEPA, 2005	

TABLE 4
SOURCES AND ENDPOINTS FOR NOAELS AND LOAELS FOR TERRESTRIAL WILDLIFE
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNSWICK, MAINE

Parameters	Concentration (mg/kg-day)	Endpoint	Effect	Chronic/ Subchronic	Species	Primary Reference	Source of Reference
Cobalt	7.33	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Copper	34.87	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Copper	82.7	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Copper	4.05	NOAEL	reproduction & growth	chronic	chicken	USEPA, 2007	
Copper	5.6	NOAEL	reproduction & growth	chronic	pig	USEPA, 2007	
Iron	500	LOAEL	unknown	chronic	rabbit	NAS, 1980	
Iron	1000	LOAEL	unknown	chronic	poultry	NAS, 1980	
Lead	44.6	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Lead	186.4	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Lead	1.63	NOAEL	reproduction & growth	chronic	chicken	USEPA, 2005	
Lead	4.7	NOAEL	reproduction & growth	chronic	rat	USEPA, 2005	
Manganese	376.6	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Manganese	145.67	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Manganese	179	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Manganese	51.5	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Mercury	0.064	LOAEL	reproductive	chronic	mallard duck	Heinz, 1979	Sample et.al., 1996
Mercury	0.16	LOAEL	reproductive	chronic	rat	Verschuuren et al., 1976	Sample et.al., 1996
Mercury	0.032	NOAEL	reproductive	chronic	rat	Verschuuren et al., 1976	Sample et.al., 1996
Nickel	18.57	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Nickel	14.77	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Nickel	6.71	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Nickel	1.7	NOAEL	reproduction & growth	chronic	mouse	USEPA, 2007	
Selenium	0.819	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Selenium	0.661	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Selenium	0.29	NOAEL	reproduction & growth	chronic	chicken	USEPA, 2007	
Selenium	0.143	NOAEL	reproduction & growth	chronic	pig	USEPA, 2007	
Silver	60.47	LOAEL	reproduction & growth	chronic	birds	USEPA, 2006	
Silver	118.62	LOAEL	reproduction & growth	subchronic*	mammals	USEPA, 2006	
Silver	2.02	NOAEL	reproduction & growth	subchronic*	turkey	USEPA, 2006	
Silver	6.02	NOAEL	reproduction & growth	chronic	pig	USEPA, 2006	
Thallium	0.74	LOAEL	reproductive	subchronic	rat	Formigli et al., 1986	Sample et.al., 1996
Vanadium	1.686	LOAEL	reproduction & growth	chronic	birds	USEPA, 2005	
Vanadium	9.436	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2005	
Vanadium	0.344	NOAEL	reproduction & growth	chronic	chicken	USEPA, 2005	
Vanadium	4.16	NOAEL	reproduction & growth	chronic	mouse	USEPA, 2005	
Zinc	297.58	LOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	171.44	LOAEL	reproduction & growth	chronic	birds	USEPA, 2007	
Zinc	75.4	NOAEL	reproduction & growth	chronic	mammals	USEPA, 2007	
Zinc	66.1	NOAEL	reproduction & growth	chronic	birds	USEPA, 2007	

Notes:
NOAEL = No Observed Adverse Effects Level
LOAEL = Lowest Observed Adverse Effects Level
The NOAELS and LOAELS for the following PAHs are based on the Low Molecular Weight PAH values: acenapthylene, acenaphthene, anthracene, fluoranthene, fluorene, phenanthrene, 2-methylnaphthalene, 1-methylnaphthalene, and naphthalene.
The NOAELS and LOAELS for the following PAHs are based on the High Molecular Weight PAH values: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, dibenzofuran, indeno(1,2,3-c,d)pyrene, and pyrene.
The NOAELS and LOAELS for the PAHs for birds were based on 7,12-dimethylbenz(a)anthracene.
The LOAELs used for several metals were calculated as the geometric mean of growth and reproduction data from the Ecological Soil Screening Levels (USEPA, 2005, 2006, 2007, 2008).
References for the NOAELS and LOAELs are presented in this Attachment and Titled "TRV Source and Endpoint References".
* Value has been adjusted for chronic effects, no further adjustment of values is necessary on Table C-5.

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TABLE 5

EXPOSURE PARAMETERS FOR THE TERRESTRIAL WILDLIFE MODEL
ECOLOGICAL RISK ASSESSMENT METHODOLOGY
NAS BRUNSWICK
BRUNSWICK, MAINE

	Conservative Inputs		Average Inputs	
Species/Exposure Inputs	**Values**	**Units**	**Values**	**Units**
Meadow Vole				
Body Weight = BW	1.700E-02	kg	3.580E-02	kg
Food Ingestion Rate = If	1.878E-03	kg/day	1.744E-03	kg/day
Water Ingestion Rate = Iw	7.513E-03	L/day	6.261E-03	L/day
Soil Ingestion Rate = Is	6.010E-05	kg/day	2.093E-05	kg/day
Home Range = HR	Assume 100% on site		6.590E-02	acres
Bobwhite Quail				
Body Weight = BW	1.540E-01	kg	1.751E-01	kg
Food Ingestion Rate = If	2.440E-03	kg/day	2.040E-03	kg/day
Water Ingestion Rate = Iw	2.276E-02	L/day	1.926E-02	L/day
Soil Ingestion Rate = Is	3.392E-04	kg/day	1.244E-04	kg/day
Home Range = HR	Assume 100% on site		1.880E+01	acres
Short-Tailed Shrew				
Body Weight = BW	1.500E-02	kg	1.610E-02	kg
Food Ingestion Rate = If	1.600E-03	kg/day	1.433E-03	kg/day
Water Ingestion Rate = Iw	4.280E-03	L/day	3.600E-03	L/day
Soil Ingestion Rate - Is	4.801E-05	kg/day	1.289E-05	kg/day
Home Range = HR	Assume 100% on site		9.699E-01	acres
American Robin				
Body Weight = BW	7.73E-02	kg	8.04E-02	kg
Food Ingestion Rate = If	1.25E-02	kg/day	1.19E-02	kg/day
Water Ingestion Rate = Iw	1.21E-02	L/day	1.13E-02	L/day
Soil Ingestion Rate - Is	2.05E-03	kg/day	7.60E-04	kg/day
Home Range = HR	Assume 100% on site		6.10E-01	acres

Notes:

The soil ingestion rates were calculated by multiplying the food ingestion rates by the following incidental soil ingestion rates:

	Conservative	Average	Source
Meadow Vole	3.2%	1.2%	1
Bobwhite quail	13.9%	6.1%	1, 2
Short-tailed Shrew	3%	0.90%	1
American Robin	16.40%	6.40%	1, 3

1 - USEPA, 2007. Ecological Soil Screening Level Guidance, Office of Emergency and Remedial Response. February.
2 - Based on the mourning dove.
3 - Based on the American woodcock.

APPENDIX D

TETRA TECH STANDARD OPERATING PROCEDURES

TETRA TECH NUS, INC.	STANDARD OPERATING PROCEDURES	Number CT-05	Page 1 of 7
		Effective Date 01/29/01	Revision 2
		Applicability Tetra Tech NUS, Inc.	
		Prepared Management Information Systems Department	
Subject DATABASE RECORDS AND QUALITY ASSURANCE		Approved D. Senovich	

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1.0 PURPOSE

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

2.0 SCOPE

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

3.0 GLOSSARY

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

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

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

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

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

4.0 RESPONSIBILITIES

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

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

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

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

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

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

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

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

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

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

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

5.0 PROCEDURES

5.1 Introduction

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

5.2 File Establishment

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

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

5.3 Electronic Deliverables

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

5.4 Sample Tracking Forms

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

5.5 Chain-of-Custody Forms

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

5.6 Data Validation Letters

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

5.7 Historical Data

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

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

6.0 RECORDS

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

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

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

ATTACHMENT A

MIS REQUEST FORM

Tetra Tech NUS, Inc.

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

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

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

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

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

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

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

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1.0 PURPOSE

The purpose of this document is to establish standard procedures and technical guidance on borehole and sample logging.

2.0 SCOPE

These procedures provide descriptions of the standard techniques for borehole and sample logging. These techniques shall be used for each boring logged to provide consistent descriptions of subsurface lithology. While experience is the only method to develop confidence and accuracy in the description of soil and rock, the field geologist/engineer can do a good job of classification by careful, thoughtful observation and by being consistent throughout the classification procedure.

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES

Site Geologist. Responsible for supervising all boring activities and assuring that each borehole is completely logged. If more than one rig is being used on site, the Site Geologist must make sure that each field geologist is properly trained in logging procedures. A brief review or training session may be necessary prior to the start up of the field program and/or upon completion of the first boring.

5.0 PROCEDURES

The classification of soil and rocks is one of the most important jobs of the field geologist/engineer. To maintain a consistent flow of information, it is imperative that the field geologist/engineer understand and accurately use the field classification system described in this SOP. This identification is based on visual examination and manual tests.

5.1 Materials Needed

When logging soil and rock samples, the geologist or engineer may be equipped with the following:

- Rock hammer
- Knife
- Camera
- Dilute hydrochloric acid (HCl)
- Ruler (marked in tenths and hundredths of feet)
- Hand Lens

5.2 Classification of Soils

All data shall be written directly on the boring log (Figure 1) or in a field notebook if more space is needed. Details on filling out the boring log are discussed in Section 5.5.

FIGURE 1

BORING LOG (EXAMPLE)

BORING LOG

Page ___ of ___

PROJECT NAME: _____ BORING NUMBER: _____
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: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**

* When rock coring, enter rock brokeness.

** Include monitor reading in 5 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): _____

Remarks: _____

Converted to Well: Yes _____ No _____ Well I.D. #: _____

FIGURE 1 (CONTINUED)

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE-GRAINED SOILS More Than Half of Material is LARGER Than No. 200 Sieve Size					FINE-GRAINED SOILS More Than Half of Material is SMALLER Than No. 200 Sieve Size					
FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)			GROUP SYMBOL	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (Excluding Particles Larger Than 3 Inches and Basing Fractions on Estimated Weights)				GROUP SYMBOL	TYPICAL NAMES
					Identification Procedures on Fraction Smaller Than No. 40 Sieve Size					
						DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
GRAVELS (More Than Half of Coarse Fraction Is Larger Than No. 4 Sieve Size)	CLEAN GRAVELS (Little or No Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	SILTS AND CLAYS (Liquid Limit Less Than 50)	None to Slight	Quick to Slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.		Medium to High	None to Very Slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	GRAVELS WITH FINES (Appreciable Amount of Fines)	Nonplastic fines (for identification procedures, see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.		Slight to Medium	Slow	Slight	OL	Organic silts and organic silty clays of low plasticity.
		Plastic fines (for identification procedures, see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.	SILTS AND CLAYS (Liquid Limit Greater Than 50)	Slight to Medium	Slow to None	Slight to Medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
SANDS (More Than Half of Coarse Fraction Is Smaller Than No. 4 Sieve Size)	CLEAN SANDS (Little or No Fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	SW	Well-graded sands, gravelly sands, little or no fines.		Slight to Very High	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.		Medium to High	None to Very Slow	Slight to Medium	OH	Organic clays of medium to high plasticity.
	SANDS WITH FINES (Appreciable Amount of Fines)	Nonplastic fines (for identification procedures, see ML)	SM	Silty sands, poorly graded sand-silt mixtures.	HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils
		Plastic fines (for identification procedures, see CL)	SC	Clayey sands, poorly graded sand-clay mixtures.						

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.
All sieve sizes on this chart are U.S. Standard.

DENSITY OF GRANULAR SOILS

DESIGNATION	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT
Very Loose	0-4
Loose	5-9
Medium Dense	10-29
Dense	30-49
Very Dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS/SQ. FT.)	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT	FIELD IDENTIFICATION METHOD
Very Soft	Less Than 0.25	0 to 2	Easily penetrated several inches by fist
Soft	0.25 to 0.5	2 to 4	Easily penetrated several inches by thumb.
Medium Stiff	0.5 to 1.0	4 to 8	Can be penetrated several inches by thumb.
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb.
Very Stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail.
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail.

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)			ROCK BROKENNESS		
Descriptive Terms	Scratches or Knife Blade	Hammer Blows	Descriptive Terms	Abbreviations	Spacing
Soft	Easily Gouged	Crushes when pressed with hammer	Very Broken	(V.Br.)	< 1"
Medium Soft	Can be Gouged	Breaks (one blow) crumbly edges	Broken	(Br.)	1"-3"
Medium Hard	Can be scratched	Breaks (more than one blow), sharp edges	Blocky	(Bl.)	3"-9"
Hard	Cannot be scratched	Breaks only by powerful blows, sharp edges	Massive	(M.)	9"-3'

LEGEND :

SOIL SAMPLER - TYPES	ROCK SAMPLER - TYPES	CAVE IN LEVELS
1-3" Split Spoon Sample	3-NQ (Commercial) Core (1-1/8" O.D.)	S/G
2.5" O.D. Undisturbed Sample	4-HQ (Commercial) Core (1.5/8" O.D.)	2.3.C Still Level which is Depth
0 - Other Samples, Specify in Remarks	2 - Other Core Sizes, Specify in Remarks	S/G
		2.3.C Stabilized Level which is Depth

5.2.1 USCS Classification

Soils are to be classified according to the Unified Soil Classification System (USCS). This method of classification is detailed in Figure 1 (Continued).
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 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 shall be divided into rock fragments, sand, or gravel. The terms sand and gravel 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 shall be used to indicate angular granular materials resulting from the breakup of rock. The sharp edges 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 shall be followed by a size designation such as "(1/4 inchΦ-1/2 inchΦ)" 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.

5.2.2 Color

Soil colors shall 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." Since 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 shall 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" shall be used to indicate soils irregularly marked with spots of different colors. Mottling in soils usually indicates poor aeration and lack of good drainage.

Soil Color Charts shall not be used unless specified by the project manager.

5.2.3 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 noncohesive (particles do not adhere well when compressed). Finer-grained soils (silts and clays) are cohesive (particles will adhere together when compressed).

The density of noncohesive, granular soils is classified according to standard penetration resistances obtained from split-barrel sampling performed according to the methods detailed in Standard Operating Procedures GH-1.3 and SA-1.3. Those designations are:

Designation	Standard Penetration Resistance (Blows per Foot)
Very loose	0 to 4
Loose	5 to 10
Medium dense	11 to 30
Dense	31 to 50
Very dense	Over 50

Standard penetration resistance is the number of blows required to drive a split-barrel sampler with a 2-inch outside diameter 12 inches into the material using a 140-pound hammer falling freely through 30 inches. The sampler is driven through an 18-inch sample interval, and the number of blows is recorded for each 6-inch increment. The density designation of granular soils is obtained by adding the number of blows required to penetrate the last 12 inches of each sample interval. It is important to note that if gravel or rock fragments are broken by the sampler or if rock fragments are lodged in the tip, the resulting blow count will be erroneously high, reflecting a higher density than actually exists. This shall be noted on the log and referenced to the sample number. 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 Figure 2.

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

The consistency of cohesive soils is determined either by blow counts, a pocket penetrometer (values listed in the table as Unconfined Compressive Strength), or by hand by determining the resistance to penetration by the thumb. The pocket penetrometer and thumb determination methods are conducted on a selected sample of the soil, preferably the lowest 0.5 foot of the sample in the split-barrel sampler. The sample shall be broken in half and the thumb or penetrometer 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. Consistency shall not be determined solely by blow counts. One of the other methods shall be used in conjunction with it. The designations used to describe the consistency of cohesive soils are shown in Figure 2.

5.2.4 Weight Percentages

In nature, soils are comprised 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

FIGURE 2

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

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.

5.2.5 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 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 drilling job.

Laboratory tests for water content shall be performed if the natural water content is important.

5.2.6 Stratification

Stratification can only be determined after the sample barrel is opened. The stratification or bedding thickness for soil and rock is depending on grain size and composition. The classification to be used for stratification description is shown in Figure 3.

5.2.7 Texture/Fabric/Bedding

The texture/fabric/bedding of the soil shall be described. Texture is described as the relative angularity of the particles: rounded, subrounded, subangular, and angular. Fabric shall be noted as to whether the particles are flat or bulky and whether there is a particular relation between particles (i.e., all the flat particles are parallel or there is some cementation). The bedding or structure shall also be noted (e.g., stratified, lensed, nonstratified, heterogeneous varved).

5.2.8 Summary of Soil Classification

In summary, soils shall 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
- Stratification
- Texture, fabric, bedding
- Other distinguishing features

FIGURE 3

BEDDING THICKNESS CLASSIFICATION

Thickness (metric)	Thickness (Approximate English Equivalent)	Classification
> 1.0 meter	> 3.3'	Massive
30 cm - 1 meter	1.0' - 3.3'	Thick Bedded
10 cm - 30 cm	4" - 1.0'	Medium Bedded
3 cm - 10 cm	1" - 4"	Thin Bedded
1 cm - 3 cm	2/5" - 1"	Very Thin Bedded
3 mm - 1 cm	1/8" - 2/5"	Laminated
1 mm - 3 mm	1/32" - 1/8"	Thinly Laminated
< 1 mm	<1/32"	Micro Laminated

(Weir, 1973 and Ingram, 1954)

5.3 Classification of Rocks

Rocks are grouped into three main divisions: sedimentary, igneous and metamorphic. Sedimentary rocks are by far the predominant type exposed at the earth's surface. The following basic names are applied to the types of rocks found in sedimentary sequences:

- Sandstone - Made up predominantly of granular materials ranging between 1/16 to 2 mm in diameter.
- Siltstone - Made up of granular materials less than 1/16 to 1/256 mm in diameter. Fractures irregularly. Medium thick to thick bedded.
- Claystone - Very fine-grained rock made up of clay and silt-size materials. Fractures irregularly. Very smooth to touch. Generally has irregularly spaced pitting on surface of drilled cores.
- Shale - A fissile very fine-grained rock. Fractures along bedding planes.
- Limestone - Rock made up predominantly of calcite ($CaCO_3$). Effervesces strongly upon the application of dilute hydrochloric acid.
- Coal - Rock consisting mainly of organic remains.
- Others - Numerous other sedimentary rock types are present in lesser amounts in the stratigraphic record. The local abundance of any of these rock types is dependent upon the depositional history of the area. Conglomerate, halite, gypsum, dolomite, anhydrite, lignite, etc. are some of the rock types found in lesser amounts.

In classifying a sedimentary rock the following hierarchy shall be noted:

- Rock type
- Color
- Bedding thickness
- Hardness
- Fracturing
- Weathering
- Other characteristics

5.3.1 Rock Type

As described above, there are numerous types of sedimentary rocks. In most cases, a rock will be a combination of several grain types, therefore, a modifier such as a sandy siltstone, or a silty sandstone can be used. The modifier indicates that a significant portion of the rock type is composed of the modifier. Other modifiers can include carbonaceous, calcareous, siliceous, etc.

Grain size is the basis for the classification of clastic sedimentary rocks. Figure 4 is the Udden-Wentworth classification that will be assigned to sedimentary rocks. The individual boundaries are slightly different than the USCS subdivision for soil classification. For field determination of grain sizes, a scale can be used for the coarse grained rocks. For example, the division between siltstone and claystone may not be measurable in the field. The boundary shall be determined by use of a hand lens. If the grains cannot be seen with the naked eye but are distinguishable with a hand lens, the rock is a siltstone. If the grains are not distinguishable with a hand lens, the rock is a claystone.

FIGURE 4

GRAIN SIZE CLASSIFICATION FOR ROCKS

Particle Name	Grain Size Diameter
Cobbles	> 64 mm
Pebbles	4 - 64 mm
Granules	2 - 4 mm
Very Coarse Sand	1 - 2 mm
Coarse Sand	0.5 - 1 mm
Medium Sand	0.25 - 0.5 mm
Fine Sand	0.125 - 0.25 mm
Very Fine Sand	0.0625 - 0.125 mm
Silt	0.0039 - 0.0625 mm

After Wentworth, 1922

5.3.2 Color

The color of a rock can be determined in a similar manner as for soil samples. Rock core samples shall be classified while wet, when possible, and air cored samples shall be scraped clean of cuttings prior to color classifications.

Rock color charts shall not be used unless specified by the Project Manager.

5.3.3 Bedding Thickness

The bedding thickness designations applied to soil classification (see Figure 3) will also be used for rock classification.

5.3.4 Hardness

The hardness of a rock is a function of the compaction, cementation, and mineralogical composition of the rock. A relative scale for sedimentary rock hardness is as follows:

- Soft - Weathered, considerable erosion of core, easily gouged by screwdriver, scratched by fingernail. Soft rock crushes or deforms under pressure of a pressed hammer. This term is always used for the hardness of the saprolite (decomposed rock which occupies the zone between the lowest soil horizon and firm bedrock).
- Medium soft - Slight erosion of core, slightly gouged by screwdriver, or breaks with crumbly edges from single hammer blow.
- Medium hard - No core erosion, easily scratched by screwdriver, or breaks with sharp edges from single hammer blow.
- Hard - Requires several hammer blows to break and has sharp conchoidal breaks. Cannot be scratched with screwdriver.

Note the difference in usage here of the works "scratch" and "gouge." A scratch shall be considered a slight depression in the rock (do not mistake the scraping off of rock flour from drilling with a scratch in the rock itself), while a gouge is much deeper.

5.3.5 Fracturing

The degree of fracturing or brokenness of a rock is described by measuring the fractures or joint spacing. After eliminating drilling breaks, the average spacing is calculated and the fracturing is described by the following terms:

- Very broken (V. BR.) - Less than 2-inch spacing between fractures
- Broken (BR.) - 2-inch to 1-foot spacing between fractures
- Blocky (BL.) - 1- to 3-foot spacing between fractures
- Massive (M.) - 3 to 10-foot spacing between fractures

The structural integrity of the rock can be approximated by calculating the Rock Quality Designation (RQD) of cores recovered. The RQD is determined by adding the total lengths of all pieces exceeding 4 inches and dividing by the total length of the coring run, to obtain a percentage.

Method of Calculating RQD
(After Deere, 1964)

$$RQD\ \% = r/l \times 100$$

r = Total length of all pieces of the lithologic unit being measured, which are greater than 4 inches length, and have resulted from natural breaks. Natural breaks include slickensides, joints, compaction slicks, bedding plane partings (not caused by drilling), friable zones, etc.

l = Total length of the coring run.

5.3.6 Weathering

The degree of weathering is a significant parameter that is important in determining weathering profiles and is also useful in engineering designs. The following terms can be applied to distinguish the degree of weathering:

- Fresh - Rock shows little or no weathering effect. Fractures or joints have little or no staining and rock has a bright appearance.
- Slight - Rock has some staining which may penetrate several centimeters into the rock. Clay filling of joints may occur. Feldspar grains may show some alteration.
- Moderate - Most of the rock, with exception of quartz grains, is stained. Rock is weakened due to weathering and can be easily broken with hammer.
- Severe - All rock including quartz grains is stained. Some of the rock is weathered to the extent of becoming a soil. Rock is very weak.

5.3.7 Other Characteristics

The following items shall be included in the rock description:

- Description of contact between two rock units. These can be sharp or gradational.
- Stratification (parallel, cross stratified).
- Description of any filled cavities or vugs.
- Cementation (calcareous, siliceous, hematitic).
- Description of any joints or open fractures.
- Observation of the presence of fossils.
- Notation of joints with depth, approximate angle to horizontal, any mineral filling or coating, and degree of weathering.

All information shown on the boring logs shall be neat to the point where it can be reproduced on a copy machine for report presentation. The data shall be kept current to provide control of the drilling program and to indicate various areas requiring special consideration and sampling.

5.3.8 Additional Terms Used in the Description of Rock

The following terms are used to further identify rocks:

- Seam - Thin (12 inches or less), probably continuous layer.
- Some - Indicates significant (15 to 40 percent) amounts of the accessory material. For example, rock composed of seams of sandstone (70 percent) and shale (30 percent) would be "sandstone -- some shale seams."
- Few - Indicates insignificant (0 to 15 percent) amounts of the accessory material. For example, rock composed of seam of sandstone (90 percent) and shale (10 percent) would be "sandstone -- few shale seams."
- Interbedded - Used to indicate thin or very thin alternating seams of material occurring in approximately equal amounts. For example, rock composed of thin alternating seams of sandstone (50 percent) and shale (50 percent) would be "interbedded sandstone and shale."
- Interlayered - Used to indicate thick alternating seams of material occurring in approximately equal amounts.

The preceding sections describe the classification of sedimentary rocks. The following are some basic names that are applied to igneous rocks:

- Basalt - A fine-grained extrusive rock composed primarily of calcic plagioclase and pyroxene.
- Rhyolite - A fine-grained volcanic rock containing abundant quartz and orthoclase. The fine-grained equivalent of a granite.
- Granite - A coarse-grained plutonic rock consisting essentially of alkali feldspar and quartz.
- Diorite - A coarse-grained plutonic rock consisting essentially of sodic plagioclase and hornblende.
- Gabbro - A coarse-grained plutonic rock consisting of calcic plagioclase and clinopyroxene. Loosely used for any coarse-grained dark igneous rock.

The following are some basic names that are applied to metamorphic rocks:

- Slate - A very fine-grained foliated rock possessing a well developed slaty cleavage. Contains predominantly chlorite, mica, quartz, and sericite.
- Phyllite - A fine-grained foliated rock that splits into thin flaky sheets with a silky sheen on cleavage surface.
- Schist - A medium to coarse-grained foliated rock with subparallel arrangement of the micaceous minerals which dominate its composition.
- Gneiss - A coarse-grained foliated rock with bands rich in granular and platy minerals.
- Quartzite - A fine- to coarse-grained nonfoliated rock breaking across grains, consisting essentially of quartz sand with silica cement.

5.4 Abbreviations

Abbreviations may be used in the description of a rock or soil. However, they shall be kept at a minimum. Following are some of the abbreviations that may be used:

C - Coarse	Lt - Light	Yl - Yellow
Med - Medium	BR - Broken	Or - Orange
F - Fine	BL - Blocky	SS - Sandstone
V - Very	M - Massive	Sh - Shale
Sl - Slight	Br - Brown	LS - Limestone
Occ - Occasional	Bl - Black	Fgr - Fine-grained
Tr - Trace		

5.5 Boring Logs and Documentation

This section describes in more detail the procedures to be used in completing boring logs in the field. Information obtained from the preceding sections shall be used to complete the logs. A sample boring log has been provided as Figure 5.

The field geologist/engineer shall use this example as a guide in completing each boring log. Each boring log shall be fully described by the geologist/engineer as the boring is being drilled. Every sheet contains space for 25 feet of log. Information regarding classification details is provided either on the back of the boring log or on a separate sheet, for field use.

5.5.1 Soil Classification

- Identify site name, boring number, job number, etc. Elevations and water level data to be entered when surveyed data is available.

- Enter sample number (from SPT) under appropriate column. Enter depth sample was taken from (1 block = 1 foot). Fractional footages, i.e., change of lithology at 13.7 feet, shall be lined off at the proportional location between the 13- and 14-foot marks. Enter blow counts (Standard Penetration Resistance) diagonally (as shown). Standard penetration resistance is covered in Section 5.2.3.

- Determine sample recovery/sample length as shown. Measure the total length of sample recovered from the split-spoon sampler, including material in the drive shoe. Do not include cuttings or wash material that may be in the upper portion of the sample tube.

- Indicate any change in lithology by drawing a line at the appropriate depth. For example, if clayey silt was encountered from 0 to 5.5 feet and shale from 5.5 to 6.0 feet, a line shall be drawn at this increment. This information is helpful in the construction of cross-sections. As an alternative, symbols may be used to identify each change in lithology.

- The density of granular soils is obtained by adding the number of blows for the last two increments. Refer to Density of Granular Soils Chart on back of log sheet. For consistency of cohesive soils refer also to the back of log sheet - Consistency of Cohesive Soils. Enter this information under the appropriate column. Refer to Section 5.2.3.

FIGURE 5
COMPLETED BORING LOG (EXAMPLE)

BORING LOG

Page 1 of 1

PROJECT NAME: NSB- SITE
PROJECT NUMBER: 9594
DRILLING COMPANY: SOILTEST CO.
DRILLING RIG: CME-55
BORING NUMBER: SB/MW 1
DATE: 3/8/96
GEOLOGIST: SJ CONTI
DRILLER: R. ROCK

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	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 @ 0800	0.0	7/6	1.5/2.0		M DENSE	BRN TO BLK	SILTY SAND - SOME	SM	MOIST SL. ORG. ODOR	5	0	0	0
	2.0	9/10					ROCK FR.; TR BRICKS (FILL)		FILL TO 4'±				
	4.0			4.0									
S-2 @ 0810	6.0	5/7 9/8	2.0/2.0		M DENSE	BRN	SILTY SAND - TR FINE GRAVEL	SM	MOIST - W ODOR NAT. MATL. TOOK SAMPLE SB01-0406 FOR ANALYSIS	10	0	-	-
				7' ▽									
	8.0			8.0									
S-3 @ 0820	10.0	6/8 17/16	1.9/2.0		DENSE	TAN BRN	FINE TO COARSE SAND TR F. GRAVEL	SW	WET HIT WATER: 7'±	0	0	0	0
	12.0			12.0									
S-4 @ 0830	14.0	7/6 5/8	1.6/2.0		STIFF	GRAY	SILTY CLAY	CL	MOIST → WET	0	.5	-	-
	15.0			15.0					AUGER REF @ 15'				
				11 FINE 16	M HARD	BRN	SILTSTONE	WR	WEATHERED LO ∡ JNTS @ 15.5				
9/5	①		4.0/5.0						WATER STAINS @ 16.5, 17.1, 17.5	0	0	0	0
				19'					LOSING SOME				
	20.0		①		HARD	GRAY	SANDSTONE - SOME SILTSTONE	BR	DRILL H2O @ 17'± SET TEMP 6" CAS TO 15.5				
4.8/5.0	②		5.0/5.0						SET 2" ID PVC SCREEN 16-25	0	0	0	0
									SAND 14-28				
	25.0			25					PELLETS 12-14				

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

● 1-20Z
1-80Z

Drilling Area Background (ppm): 0

Remarks: CME-55 R16, 4 1/4" ID HSA - 9" OD ±
2" SPLIT SPOONS - 140 LB HAMMER - 30" DROP
NX CORE IN BEDROCK RUN ① = 25 min. RUN ② = 15 min

Converted to Well: Yes ✓ No _____ Well I.D. #: MW-1

- Enter color of the material in the appropriate column.
- Describe material using the USCS. Limit this column for sample description only. The predominant material is described last. If the primary soil is silt but has fines (clay) - use clayey silt. Limit soil descriptors to the following:
  - Trace: 0 - 10 percent
  - Some: 11 - 30 percent
  - And/Or: 31 - 50 percent
- Also indicate under Material Classification if the material is fill or natural soils. Indicate roots, organic material, etc.
- Enter USCS symbol - use chart on back of boring log as a guide. If the soils fall into one of two basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example ML/CL or SM/SP.
- The following information shall be entered under the "Remarks" column and shall include, but is not limited by, the following:
  - Moisture - estimate moisture content using the following terms - dry, moist, wet and saturated. These terms are determined by the individual. Whatever method is used to determine moisture, be consistent throughout the log.
  - Angularity - describe angularity of coarse grained particles using the terms angular, subangular, subrounded, or rounded. Refer to ASTM D 2488 or Earth Manual for criteria for these terms.
  - Particle shape - flat, elongated, or flat and elongated.
  - Maximum particle size or dimension.
  - Water level observations.
  - Reaction with HCl - none, weak, or strong.
- Additional comments:
  - Indicate presence of mica, caving of hole, when water was encountered, difficulty in drilling, loss or gain of water.
  - Indicate odor and Photoionization Detector (PID) or Flame Ionization Detector (FID) reading if applicable.
  - Indicate any change in lithology by drawing a line through the lithology change column and indicate the depth. This will help when cross-sections are subsequently constructed.
  - At the bottom of the page indicate type of rig, drilling method, hammer size and drop, and any other useful information (i.e., borehole size, casing set, changes in drilling method).

- Vertical lines shall be drawn (as shown in Figure 5) in columns 6 to 8 from the bottom of each sample to the top of the next sample to indicate consistency of material from sample to sample, if the material is consistent. Horizontal lines shall be drawn if there is a change in lithology, then vertical lines drawn to that point.

- Indicate screened interval of well, as needed, in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

5.5.2 Rock Classification

- Indicate depth at which coring began by drawing a line at the appropriate depth. Indicate core run depths by drawing coring run lines (as shown) under the first and fourth columns on the log sheet. Indicate RQD, core run number, RQD percent, and core recovery under the appropriate columns.

- Indicate lithology change by drawing a line at the appropriate depth as explained in Section 5.5.1.

- Rock hardness is entered under designated column using terms as described on the back of the log or as explained earlier in this section.

- Enter color as determined while the core sample is wet; if the sample is cored by air, the core shall be scraped clean prior to describing color.

- Enter rock type based on sedimentary, igneous or metamorphic. For sedimentary rocks use terms as described in Section 5.3. Again, be consistent in classification. Use modifiers and additional terms as needed. For igneous and metamorphic rock types use terms as described in Sections 5.3.8.

- Enter brokenness of rock or degree of fracturing under the appropriate column using symbols VBR, BR, BL, or M as explained in Section 5.3.5 and as noted on the back of the Boring Log.

- The following information shall be entered under the remarks column. Items shall include but are not limited to the following:

  - Indicate depths of joints, fractures and breaks and also approximate to horizontal angle (such as high, low), i.e., 70° angle from horizontal, high angle.
  - Indicate calcareous zones, description of any cavities or vugs.
  - Indicate any loss or gain of drill water.
  - Indicate drop of drill tools or change in color of drill water.

- Remarks at the bottom of Boring Log shall include:

  - Type and size of core obtained.
  - Depth casing was set.
  - Type of rig used.

- As a final check the boring log shall include the following:

  - Vertical lines shall be drawn as explained for soil classification to indicate consistency of bedrock material.

  - If applicable, indicate screened interval in the lithology column. Show top and bottom of screen. Other details of well construction are provided on the well construction forms.

5.5.3 Classification of Soil and Rock from Drill Cuttings

The previous sections describe procedures for classifying soil and rock samples when cores are obtained. However, some drilling methods (air/mud rotary) may require classification and borehole logging based on identifying drill cuttings removed from the borehole. Such cuttings provide only general information on subsurface lithology. Some procedures that shall be followed when logging cuttings are:

- Obtain cutting samples at approximately 5-foot intervals, sieve the cuttings (if mud rotary drilling) to obtain a cleaner sample, place the sample into a small sample bottle or "zip lock" bag for future reference, and label the jar or bag (i.e. hole number, depth, date, etc.). Cuttings shall be closely examined to determine general lithology.
- Note any change in color of drilling fluid or cuttings, to estimate changes in lithology.
- Note drop or chattering of drilling tools or a change in the rate of drilling, to determine fracture locations or lithologic changes.
- Observe loss or gain of drilling fluids or air (if air rotary methods are used), to identify potential fracture zones.
- Record this and any other useful information onto the boring log as provided in Figure 1.

This logging provides a general description of subsurface lithology and adequate information can be obtained through careful observation of the drilling process. It is recommended that split-barrel and rock core sampling methods be used at selected boring locations during the field investigation to provide detailed information to supplement the less detailed data generated through borings drilled using air/mud rotary methods.

5.6 Review

Upon completion of the borings logs, copies shall be made and reviewed. Items to be reviewed include:

- Checking for consistency of all logs.
- Checking for conformance to the guideline.
- Checking to see that all information is entered in their respective columns and spaces.

6.0 REFERENCES

Unified Soil Classification System (USCS).

ASTM D2488, 1985.

Earth Manual, U.S. Department of the Interior, 1974.

7.0 RECORDS

Originals of the boring logs shall be retained in the project files.

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		Effective Date 04/072008	Revision 9
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject SOIL SAMPLING		Approved Tom Johnston T E Johnston	

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1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures to be used to collect surface, near-surface, and subsurface soil samples. Additionally, it describes the methods for sampling of test pits and trenches to determine subsurface soil and rock conditions and for recovery of small-volume or bulk samples from pits.

2.0 SCOPE

This document applies to the collection of surface, near-surface, and subsurface soil samples exposed through hand digging, hand augering, drilling, or machine excavating at hazardous substance sites for laboratory testing, onsite visual examination, and onsite testing.

3.0 GLOSSARY

Composite Sample - A composite sample is a combination of more than one grab sample from various locations and/or depths and times that is homogenized and treated as one sample. This type of sample is usually collected when determination of an average waste concentration for a specific area is required. Composite samples shall not be collected for volatile organics analysis.

Confined Space - As stipulated in 29 Code of Federal Regulations (CFR) 1910.146, a confined space means a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, pits, and excavations); and (3) is not designed for continuous employee occupancy. TtNUS considers all confined space as permit-required confined spaces.

Grab Sample - One sample collected at one location and at one specific time.

Hand Auger - A sampling device used to extract soil from the ground.

Representativeness – A qualitative description of the degree to which an individual sample accurately reflects population characteristics or parameter variations at a sampling point. It is therefore an important characteristic not only of assessment and quantification of environmental threats posed by the site, but also for providing information for engineering design and construction. Proper sample location selection and proper sample collection methods are important to ensure that a truly representative sample has been collected.

Sample for Non-Volatile Analyses - Includes all chemical parameters other than volatile organics (e.g., semivolatiles, pesticides/PCBs, metals, etc.) and those engineering parameters that do not require undisturbed soil for their analysis.

~~Split-Barrel Sampler - A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. Also called a split-spoon sampler, this device can be driven into resistant materials using a drive weight mounted in the drilling string. A standard split-barrel sampler is typically available in two common lengths, providing either 20-inch or 26-inch longitudinal clearance for obtaining 18-inch or 24-inch-long samples, respectively. These split-barrel samplers commonly range in size from 2 to 3.5 inches OD. The larger sizes are commonly used when a larger volume of sample material is required (see Attachment B).~~

~~Test Pit and Trench - Open, shallow excavations, typically rectangular (if a test pit) or longitudinal (if a trench), excavated to determine shallow subsurface conditions for engineering, geological, and soil chemistry exploration and/or sampling purposes. These pits are excavated manually or by machine (e.g., backhoe, clamshell, trencher, excavator, or bulldozer).~~

Thin-Walled Tube Sampler - A thin-walled metal tube (also called a Shelby tube) used to recover relatively undisturbed soil samples. These tubes are available in various sizes, ranging from 2 to 5 inches outside diameter (OD) and from 18 to 54 inches in length.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

Project Manager - The Project Manager is responsible for determining the sampling objectives, selecting proposed sampling locations, and selecting field procedures used in the collection of soil samples. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the Project Manager establishes the need for test pits or trenches and determines their approximate locations and dimensions.

Site Safety Officer (SSO) - The SSO (or a qualified designee) is responsible for providing the technical support necessary to implement the project Health and Safety Plan. This will include (but not be limited to) performing air quality monitoring during sampling, boring, and excavation activities and to ensure that workers and offsite (downwind) individuals are not exposed to hazardous levels of airborne contaminants. The SSO/designee may also be required to advise the FOL on other safety-related matters regarding boring, excavation, and sampling, such as mitigative measures to address potential hazards from unstable trench walls, puncturing of drums or other hazardous objects, etc.

Field Operations Leader (FOL) - This individual is primarily responsible for the execution of the planning document containing the Sampling and Analysis Plan (SAP). This is accomplished through management of a field sampling team for the proper acquisition of samples. He or she is responsible for the supervision of onsite analyses; ensuring proper instrument calibration, care, and maintenance; sample collection and handling; the completion and accuracy of all field documentation; and making sure that custody of all samples obtained is maintained according to proper procedures. When appropriate and as directed by the FOL, such responsibilities may be performed by other qualified personnel (e.g., field technicians) where credentials and time permit. The FOL is responsible for finalizing the locations for collection of surface, near-surface, and subsurface (hand and machine borings, test pits/trenches) soil samples. He/she is ultimately responsible for the sampling and backfilling of boreholes, test pits, and trenches and for adherence to Occupational Safety and Health Administration (OSHA) regulations during these operations through self acquisition or through the management of a field team of samplers.

Project Geologist/Sampler - The project geologist/sampler is responsible for the proper acquisition of samples in accordance with this SOP and/or other project-specific documents. In addition, this individual is responsible for the completion of all required paperwork (e.g., sample log sheets, field notebook, boring logs, test pit logs, container labels, custody seals, and chain-of-custody forms) associated with the collection of those samples.

Competent Person - A Competent Person, as defined in 29 CFR 1929.650 of Subpart P - Excavations, means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

General personnel qualifications for groundwater sample collection and onsite water quality testing include the following:

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

- ~~Familiarity with appropriate procedures for sample documentation, handling, packaging, and shipping.~~

5.0 HEALTH AND SAFETY

Health and safety precautions are identified for individual sample collection procedures throughout this SOP. In addition to those precautions, the following general hazards may be incurred during sampling activities:

- Knee injuries from kneeling on hard or uneven surfaces
- Slips, trips, and falls
- Cuts and lacerations
- Traffic hazards associated with sampling in parking areas, along roadways and highways.

Methods of avoiding these hazards are provided below.

Knee injuries – If kneeling is required during soil sampling, this could result in knee injuries from stones/foreign objects and general damage due to stress on the joints. To minimize this hazard:

- Clear any foreign objects from the work area.
- Wear hard-sided knee pads.
- Stretch ligaments, tendons and muscles before, during and after. Take breaks as frequently as necessary.
- Report pre-existing conditions to the SSO if you feel this activity will aggravate an existing condition.

Slips, Trips, and Falls – These hazards exist while traversing varying terrains carrying equipment to sample locations. To minimize these hazards:

- Pre-survey sampling locations. Eliminate, barricade, or otherwise mark physical hazards leading to the locations.
- Carry small loads that do not restrict the field of vision.
- Travel the safest and clearest route (not necessarily the shortest).

Cuts and Lacerations - To prevent cuts and lacerations associated with soil sampling, the following provisions are required:

- Always cut away from yourself and others when cutting tubing or rope. This will prevent injury to yourself and others if the knife slips.
- Do not place items to be cut in your hand or on your knee.
- Change blades as necessary to maintain a sharp cutting edge. Many accidents result from struggling with dull cutting attachments.

- Whenever practical, wear cut-resistant gloves (e.g., leather or heavy cotton work gloves) at least on the hand not using the knife.
- Keep cutting surfaces clean and smooth.
- Secure items to be cut – do not hold them against the opposing hand, a leg, or other body part.
- When transporting glassware, keep it in a hard-sided container such as a cooler so that if there is a fall, you will be less likely to get cut by broken glass.
- DO NOT throw broken sample jars or glass ampoules into garbage bags. Place broken glass and glass ampoules in hard-sided containers such as a cardboard box or directly into a dumpster. DO NOT reach into garbage bags to retrieve any item accidentally thrown away. Empty the contents onto a flat surface to avoid punctures and lacerations from reaching where you cannot see.

Vehicular and Foot Traffic Hazards – When sampling along the roadway or near traffic patterns, follow the following precautions:

- Motorists may be distracted by onsite activities – ASSUME THEY DO NOT SEE YOU OR MEMBERS OF YOUR FIELD CREW.
- DO NOT place obstructions (such as vehicles) along the sides of the road that may cause site personnel to move into the flow of traffic to avoid your activities or equipment or that will create a blind spot.
- **Provide a required free space of travel**. Maintain at least 6 feet of space between you and moving traffic. Where this is not possible, use flaggers and/or signs to warn oncoming traffic of activities near or within the travel lanes.
- Face Traffic. Whenever feasible, if you must move within the 6 feet of the required free space or into traffic, attempt to face moving traffic at all times. Always leave yourself an escape route.
- Wear high-visibility vests to increase visual recognition by motorists.
- Do not rely on the vehicle operator's visibility, judgment, or ability. Make eye contact with the driver. Carefully and deliberately use hand signals so they will not startle or confuse motorists or be mistaken for a flagger's direction before moving into traffic.
- Your movements may startle a motorist and cause an accident, so move deliberately. Do not make sudden movements that might confuse a motorist.

6.0 PROCEDURES

The following procedures address surface and subsurface sampling.

CAUTION

Each situation must be evaluated individually to determine the applicability and necessity for obtaining a utility clearance ticket/dig permit. Common sense dictates, prior to digging or boring with power equipment, no matter what the depth, or digging by hand in a manner that could damage unprotected underground utilities, that a dig permit is required. See SOP HS-1.0, Utility Locating and Excavation Clearance, for additional clarification. If you do not know or are unsure as to whether a ticket is necessary – **Get the Ticket**.

6.1 Overview

Soil sampling is an important adjunct to groundwater monitoring. Sampling of the soil horizons above the groundwater table can detect contaminants before they migrate to the water table, and can establish the amount of contamination absorbed or adsorbed on aquifer solids that have the potential of contributing to groundwater contamination.

Soil types can vary considerably on a hazardous waste site. These variations, along with vegetation, can affect the rate of contaminant migration through the soil. It is important, therefore, that a detailed record be maintained during sampling operations, particularly noting sampling locations, depths, and such characteristics as grain size, color, and odor. Subsurface conditions are often stable on a daily basis and may demonstrate only slight seasonal variation especially with respect to temperature, available oxygen and light penetration. Changes in any of these conditions can radically alter the rate of chemical reactions or the associated microbiological community, thus further altering specific site conditions. Certain vegetation species can create degradation products that can alter contaminant concentrations in soil. This is why vegetation types and extent of degradation of this foliage must be recorded. To prevent degradation, samples must be kept at their at-depth temperature or lower, protected from direct light, sealed tightly in approved glass containers, and be analyzed as soon as possible after collection. In addition, to the extent possible, vegetation should be removed from the sample.

The physical properties of the soil, its grain size, cohesiveness, associated moisture, and such factors as depth to bedrock and water table, will limit the depth from which samples can be collected and the method required to collect them. It is the intent of this document to present the most commonly employed soil sampling methods used at hazardous waste sites.

6.2 Soil Sample Collection

6.2.1 Procedure for Preserving and Collecting Soil Samples for Volatile Organic Compound Analysis

Samples collected using traditional methods such as collection in a jar with no preservation have been known to yield non-representative samples due to loss of volatile organic compounds (VOCs). To prevent such losses, preservation of samples with methanol or sodium bisulfate may be used to minimize volatilization and biodegradation. This preservation may be performed either in the field or laboratory, depending on the sampling methodology employed. Because of the large number of sampling methods and associated equipment required, careful coordination between field and laboratory personnel is needed.

Soil samples to be preserved by the laboratory are currently being collected using Method SW-846, 5035. For samples preserved in the field, laboratories are currently performing low-level analyses (sodium bisulfate preservation) and high- to medium-level analyses (methanol preservation) depending on the needs of the end user.

The following procedures outline the necessary steps for collecting soil samples to be preserved at the laboratory, and for collecting soil samples to be preserved in the field with methanol or sodium bisulfate.

6.2.1.1 Soil Samples to be Preserved at the Laboratory

Soil samples collected for volatile organic analysis that are to be preserved at the laboratory shall be obtained using a hermetically sealed sample vial such as an EnCore™ sampler. Each sample shall be

obtained using a reusable sampling handle (T-handle) that can be provided with the EnCore™ sampler when requested and purchased. Collect the sample in the following manner for each EnCore™ sampler:

1. Scene Safety - Evaluate the area where sampling will occur. Ensure that the area is safe from physical, chemical, and natural hazards. Clear or barricade those hazards that have been identified.

2. Wear the appropriate personal protective equipment (PPE). This will include, at a minimum, safety glasses and nitrile surgeon's gloves. If you must kneel on the ground or place equipment on the surface being sampled, cover the ground surface with plastic to minimize surface contamination of your equipment and clothing. Wear knee pads to protect your knees from kneeling on hard or uneven surfaces.

3. Load the Encore™ sampler into the T-handle with the plunger fully depressed.

4. Expose the area to be sampled using a hand trowel or similar device to remove surface debris.

5. Press the T-handle against the freshly exposed soil surface, forcing soil into the sampler. The plunger will be forced upward as the cavity fills with soil.

6. When the sampler is full, rotate the plunger and lock it into place. If the plunger does not lock, the sampler is not full. This method ensures there is no headspace. Soft soil may require several plunges or forcing soil against a hard surface such as a sample trowel to ensure that headspace is eliminated.

7. Use a paper towel to remove soil from the side of the sampler so a tight seal can be made between the sample cap and the rubber O-ring.

8. With soil slightly piled above the rim of the sampler, force the cap on until the catches hook the side of the sampler.

9. Remove any surface soil from the outside of the sampler and place in the foil bag provided with the sampler. Good work hygiene practices and diligent decontamination procedures prevents the spread of contamination even on the outside of the containers.

10. Label the bag with appropriate information in accordance with SOP SA-6.3.

11. Place the full sampler inside a lined cooler with ice and cool to 4°C ± 2 °C. Make sure any required trip blanks and temperature blanks are also in the cooler. Secure custody of the cooler in accordance with SOP SA-6.3.

12. Typically, collect three Encore™ samplers at each location. Consult the SAP or laboratory to determine the required number of Encore™ samplers to be collected.

13. The T-handle shall be decontaminated before moving to the next interval or location using a soap and water wash and rinse, and where applicable, the selected solvent as defined in the project planning documents.

Using this type of sampling device eliminates the need for field preservation and the shipping restrictions associated with preservatives. A complete set of instructions is included with each Encore™ sampler.

After the Encore™samples are collected, they should be placed on ice immediately and delivered to the laboratory within 48 hours (following the chain-of-custody and documentation procedures outlined in SOP SA-6.1). Samples must be preserved by the laboratory within 48 hours of sample collection.

6.2.1.2 Soil Samples to be Preserved in the Field

Soil samples preserved in the field may be prepared for analyses using both the low-level (sodium bisulfate preservation) and high- to medium-level (methanol preservation) methods.

Safety Reminder

When using chemicals in the field to preserve samples, the FOL and/or SSO must ensure that Materials Safety Data Sheets (MSDSs) have been provided with the chemicals to be used. They also must ensure that these chemicals have been added to the Chemical Inventory List contained within Section 5.0, Hazard Communication, of your Health and Safety Guidance Manual (HSGM). Lastly, but most importantly, the FOL and/or SSO must review the hazards with personnel using these chemicals and ensure that provisions are available for recommended PPE and emergency measures (e.g., eyewash, etc.).

Methanol Preservation (High to Medium Level):

Bottles may be pre-spiked with methanol in the laboratory or prepared in the field. Soil samples to be preserved in the field with methanol shall utilize 40 to 60 mL glass vials with septum-lined lids. Each sample bottle shall be filled with 25 mL of demonstrated analyte-free purge-and-trap grade methanol. The preferred method for adding methanol to the sample bottle is by removing the lid and using a pipette or scaled syringe to add the methanol directly to the bottle.

CAUTION

NEVER attempt to pipette by mouth

In situations where personnel are required to spike the septum using a hypodermic needle, the following provisions for handling sharps must be in place:

- Training of personnel regarding methods for handling of sharps
- Hard-sided containers for the disposal of sharps
- Provisions for treatment in cases where persons have received a puncture wound

Soil shall be collected with the use of a decontaminated (or disposable), small-diameter coring device such as a disposable tube/plunger-type syringe with the tip cut off. The outside diameter of the coring device must be smaller than the inside diameter of the sample bottle neck.

A small electronic balance or manual scale will be necessary for measuring the volume of soil to be added to the methanol-preserved sample bottle. Calibration of the scale shall be performed prior to use and intermittently throughout the day according to the manufacturer's requirements.

The sample should be collected as follows:

1. Weigh the unused syringe and plunger to the nearest 0.01 gram.
2. Pull the plunger back and insert the syringe into the soil to be sampled.
3. Collect 8 to 12 grams of soil by pushing the syringe barrel into the soil.
4. Weigh the sample and adjust until obtaining the required amount of sample.

5. Record the sample weight to the nearest 0.01 gram in the field logbook and/or on the sample log sheet.

6. Extrude the weighed soil sample into the methanol-preserved sample bottle taking care not to contact the sample container with the syringe.

7. If dirty, wipe soil particles from the threads of the bottle and cap. Cap the bottle tightly.

8. After capping the bottle, swirl the sample (do not shake) in the methanol and break up the soil such that all of the soil is covered with methanol.

9. Place the sample on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

Sodium Bisulfate Preservation (Low Level):

> ***CAUTION***
> Care should be taken when adding the soil to the sodium bisulfate solution. A chemical reaction of soil containing carbonates (limestone) may cause the sample to effervesce or the vial to possibly explode. To avoid this hazard or hazards of this type, a small sample aliquot should be subjected to the sample preservative. If it effervesces in an open air environment, utilize an alternative method such as Encore™ or 2-ounce jar.

Bottles may be prepared in the laboratory or in the field with sodium bisulfate solution. Samples to be preserved in the field using the sodium bisulfate method are to be prepared and collected as follows:

1. Add 1 gram of sodium bisulfate to 5 mL of laboratory-grade deionized water in a 40 to 60 mL glass vial with septum-lined lid.

2. Collect the soil sample and record the sample weight to the nearest 0.01 gram in the field logbook or on the sample log sheet as described for methanol preservation

3. Add the weighed sample to the sample vial.

4. Collect duplicate samples using the methanol preservation method on a one-for-one sample basis because it is necessary for the laboratory to perform both low-level and medium-level analyses.

5. Place the samples on ice immediately and prepare for shipment to the laboratory as described in SOP SA-6.1.

> ***NOTE***
> If lower detection limits are necessary, an option to field preserving with sodium bisulfate may be to collect EnCore™ samplers at a given sample location. Consult the planning documents to determine whether this is required. If it is, collect samples in accordance with the Encore™ sampling procedure above and then send all samplers to the laboratory to perform the required preservation and analyses.

6.2.2 Procedure for Collecting Soil Samples for Non-Volatile Analyses

Samples collected for non-volatile analyses may be collected as either grab or composite samples as follows:

1. With a stainless steel trowel or other approved tool, transfer a portion of soil to be sampled to a stainless steel bowl or disposable inert plastic tray.

2. Remove roots, vegetation, sticks, and stones larger than the size of a green pea.

3. Thoroughly mix the soil in the bowl or tray to obtain as uniform a texture and color as practicable. The soil type, moisture content, amount of vegetation, and other factors may affect the amount of time required to obtain a properly mixed sample. In some cases, it may be impossible to obtain a uniform sample appearance. Use the field logbook to describe any significant difficulties encountered in obtaining a uniform mixture.

4. Transfer the mixed soil to the appropriate sample containers and close the containers.

5. Label the sample containers in accordance with SOP SA-6.3.

6. Place the containers in a cooler of ice as soon after collection as possible.

7. Prepare the sample shipment and ship the samples in accordance with SOP SA-6.1.

> ***NOTE***
> Cooling may not be required for some samples depending on the scheduled analyses. Consult the planning documents if in doubt regarding correct sample preservation conditions. When in doubt – Cool to 4°C.

> ***NOTE***
> Head space is permitted in soil sample containers for non-volatile analyses to allow for sample expansion.

6.2.3 Procedure for Collecting Undisturbed Soil Samples

> ***NOTE***
> Use of thin-walled undisturbed tube samplers is restricted by the consistency of the soil to be sampled. Often, very loose and/or wet samples cannot be retrieved by the samplers, and soil with a consistency in excess of very stiff cannot be penetrated by the sampler. Devices such as Dennison or Pitcher core samplers can be used to obtain undisturbed samples of stiff soil. Using these devices normally increases sampling costs, and therefore their use should be weighed against the need for acquiring an undisturbed sample. These devices are not discussed in this SOP because they are not commonly used.

When it is necessary to acquire undisturbed samples of soil for purposes of engineering parameter analysis (e.g., permeability), a thin-walled, seamless tube sampler (Shelby tube) shall be employed using the following collection procedure:

1. In preparation for sampling utilizing a drill rig, field personnel must complete the following activities:

   - Ensure that all subsurface drilling activities are preceded by a utility clearance for the area to be investigated. This includes activities described in SOP HS-1.0, Utility Location and Excavation Clearance, as well as any location-specific procedures that may apply.

REMEMBER

If you are digging near a marked utility (within the diameter of an underground utility that has been marked plus 18 inches), you must first locate the utility through vacuum extraction or hand digging to ensure that your activities will not damage the utility.

- Complete an Equipment Inspection Checklist for the drill rig or direct-push technology (DPT) rig. This checklist will be provided in the HASP.
- Review the Safe Work Permit prior to conducting the activity.
- Review the activity to be conducted.

2. Remove all surface debris (e.g., vegetation, roots, twigs, etc.) from the specific sampling location and drill and/or clean out the borehole to the desired sampling depth. Be careful to minimize potential disturbance of the material to be sampled. In saturated material, withdraw the drill bit slowly to prevent loosening of the soil around the borehole and to maintain the water level in the hole at or above groundwater level.

CAUTION

The use of bottom-discharge bits or jetting through an open-tube sampler to clean out the borehole shall not be allowed. Only the use of side-discharge bits is permitted.

3. Determine whether a stationary piston-type sampler is required to limit sample disturbance and aid in retaining the sample. Either the hydraulically operated or control rod activated-type of stationary piston sampler may be used.

4. Prior to inserting the tube sampler into the borehole, check to ensure that the sampler head contains a check valve. The check valve is necessary to keep water in the rods from pushing the sample out the tube sampler during sample withdrawal. In addition, the check valve maintains a positive suction within the tube to help retain the sample.

5. A stainless steel tube sampler is typically used to minimize chemical reaction between the sample and the sampling tube.

6. With the sampling tube resting on the bottom of the hole and the water level in the boring at groundwater level or above, push the tube into the soil with a continuous and rapid motion, without impacting or twisting. If the soil is too hard to penetrate by pushing alone, careful hammering may be used by minimizing drop distance (tapping) of the hammer. Before pulling the tube, turn it at least one revolution to shear the sample off at the bottom. In no case shall the tube be pushed farther than the length provided for the soil sample. Allow about 3 inches in the tube for cuttings and sludge.

7. Upon removal of the sampling tube from the hole, measure the length of sample in the tube and also the length penetrated.

8. Remove disturbed material in the upper end of the tube and measure the length of sample again.

9. After removing at least 1 inch of soil from the lower end, place enough packing material (clean inert material such as paper or cloth) tightly in each end of the Shelby tube and then pour melted wax into each end to make at least a ½-inch wax plug and then add more packing material to fill the voids at both ends.

10. Place plastic caps on the ends, tape the caps in place, and dip the ends in wax to prevent loss of soil.

11. Affix label(s) to the tube as required and record sample number, depth, penetration, and recovery length on the label.

12. Mark the "up" direction on the side and upper end of the tube with indelible ink.

13. Complete a chain-of-custody form (see SOP SA-6.3) and other required forms (including Attachment A of this SOP).

14. Ship samples protected with suitable resilient packing material to reduce shock, vibration, and disturbance.

CAUTION

To preserve sample integrity do not allow tubes to freeze, and store the samples vertically with the same orientation they had in the ground, (i.e., top of sample is up) in a cool place out of the sun at all times.

CAUTION

A primary concern in the preparation of the wax plugs is the potential for the heat source and melted wax to cause a fire and/or burns. Follow the directions below to prevent injury or fire.

Electrical Heating

Using hot plates to melt the wax is acceptable. In an outdoor setting, make sure a Ground Fault Circuit Interrupter (GFCI) is employed within the electrical circuit. If a portable generator is used, ensure that the generator is an adequate distance from the sampling operation (at least 50 feet). Ensure that the extension cord is rated for the intended load and for outdoor use and is free from recognizable damage. Ensure flammable preservatives are not employed or stored near the hot plate. Although a Hot Work Permit is not required, scene safety evaluation by site personnel of the above elements is. As always, if a fire potential exists, the provisions for extinguishing must be immediately accessible as well as any provisions for first aid measures.

Open Flame

If an open flame is used, the following provisions are necessary:

- Complete a Hot Work Permit and any local permit required for elevated temperature applications. The Hot Work Permit, provided in your HASP, will aid the FOL and/or the SSO in ensuring that fire protection provisions (extinguishers, fire watches, etc.) are in place as well as ensuring that local requirements have been addressed.

- Ensure that water is available to address any wax splashes or contact. If possible, immerse the contacted area. Where this is not possible, run water over the area and apply cold compresses. The need for medical attention or first aid shall be determined on site under the direction of the SSO.

6.3 Shallow Surface Soil Sampling - 0 to 3 inches bgs

The simplest, most direct method of collecting surface soil samples for subsequent analysis is by use of a stainless steel shovel, hand auger, soil corer, or stainless steel or disposable plastic trowel.

> ***NOTE***
> Multiple depth intervals are used to describe surface soil. Sometimes surface soil is defined as soil from 0 to 2 inches below ground surface (bgs), and sometimes it is defined as soil from other depths such as 0 to 2 feet bgs. Ensure that the definition of surface soil depth is clear before collecting surface soil samples.
>
> For the purposes of instruction, the terms "surface soil" (shallow) and "~~near~~ (deep)-surface soil" are used in this SOP as follows:
>
> - Shallow Surface soil - 0 to ~~6~~ 3 inches bgs
> - ~~Near~~ Deep-surface soil - ~~6 to 18~~ 3 to 12 or 0 to 12 inches bgs
> - Subsurface soil - greater than 12 inches bgs
>
> If these intervals are defined differently in the planning documents, substitute the appropriate depth ranges.

In general, the following equipment is necessary for obtaining surface soil samples:

- Stainless steel or pre-cleaned disposable trowel.
- Stainless steel hand auger, soil corer, or shovel.
- Real-time air monitoring instrument (e.g., PID, FID) as directed in project planning document.
- Required PPE.
  - Nitrile surgeon's or latex gloves may be used, layered as necessary.
  - Safety glasses
  - Other – Items identified on the Safe Work Permit may be required based on location-specific requirements such as hearing protection, steel-toed work boots, and a hard hat when working near a drill rig. These provisions will be listed in the HASP or directed by the FOL and/or SSO.

> ***Safety Reminder***
> The use of latex products may elicit an allergic reaction in some people. Should this occur, remove the latex gloves, treat for an allergic reaction, and seek medical attention as necessary.

- Required paperwork (see SOP SA-6.3 and Attachment A of this SOP)
- Required decontamination equipment
- Required sample container(s)
- Wooden stakes or pin flags

- Sealable polyethylene bags (e.g., Ziploc® baggies)
- Heavy duty cooler
- Ice
- Chain-of-custody records and custody seals

When acquiring shallow surface soil samples, from 0 to 3 inches bgs use the following procedure:

1. Place padding or use knee pads when kneeling near the sample location. If necessary, place plastic sheeting to provide a clean surface for sample equipment to avoid possible cross- contamination.
2. Carefully remove vegetation, roots, twigs, litter, etc. to expose ~~an adequate soil surface~~ a 1 foot by 1 foot area to accommodate sample volume requirements.
3. ~~Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting surface soil samples for volatile analysis. Surface soil samples for volatile organic analysis should be collected deeper than 6 inches bgs because shallower material has usually lost most of the volatiles through evaporation. Ensure that the appropriate surface soil depth is being analyzed in accordance with the planning document.~~
4. Using decontaminated sampling tools, thoroughly mix in place a sufficient amount of soil to fill the ~~remaining~~ sample containers. See Section 6.5 of this procedure for hand auger and soil corer instruction, ~~as needed.~~ for samples collected from > 3 inches in depth.
5. Transfer the sample into those containers utilizing a stainless steel trowel or precleaned disposable trowel.
6. Cap and securely tighten all sample containers.
7. Affix a sample label to each container. Be sure to fill out each label carefully and clearly, addressing all the categories described in SOP SA-6.3.
8. Proceed with the handling and processing of each sample container as described in SOP SA-6.~~2~~1.
9. Site restoration – Whenever removing sample materials, always restore the surface. It is our intent to leave the area better than we found it. Do NOT create trip hazards in areas when pedestrian traffic may exist.

~~**6.4 Near-Surface Soil Sampling**~~

~~Collection of samples from near the surface (depth of 6 to 18 inches) can be accomplished with tools such as shovels, hand auger, soil corers, and stainless steel or pre-cleaned disposable trowels and the equipment listed under Section 6.5 of this procedure.~~

~~To obtain near-surface soil samples, the following protocol shall be used:~~

~~1. With a clean shovel, make a series of vertical cuts in the soil to the depth required to form a square approximately 1 foot by 1 foot.~~
~~2. Lever out the formed plug and scrape the bottom of the freshly dug hole with a decontaminated stainless steel or pre-cleaned disposable trowel to remove any loose soil.~~

3. Follow steps 1 through 9 of Section 6.3. Soil Corer or

Deep surface soil (3 to 12 inches bgs) or soil from (0 to 12 inches bgs)
Subsurface soil (greater than 12 inches bg

6.5 ~~Subsurface~~ Soil Sampling With a Hand Auger

* A soil corer is preferred; if the soil corer cannot achieve the depth needed, a hand auger will be used.

A hand augering system generally consists of a variety of stainless steel bucket bits (approximately 6.5 inches long and 2, 2.75, 3.25, and 4 inches in diameter), series of extension rods (available in 2-, 3-, 4- and 5-inch lengths), and a T-handle connected to extension rods and to the auger bucket. ~~A larger-diameter bucket bit is commonly used to bore a hole to the desired sampling depth and then it is withdrawn. The larger-diameter bit is then replaced with a smaller-diameter bit, lowered down the hole, and slowly turned into the soil to the completion depth (approximately 6 inches). 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 either from the surface, or to depths in excess of 12 feet. However, the presence of subsurface rocks and landfill material and collapse of the borehole normally limit sampling depth.

To accomplish soil sampling ~~for~~ this RI using a hand augering system, the following equipment is required:

- Complete hand auger assembly (~~variety of~~ 2-inch bucket bit size~~s~~) or soil corer assembly
- Stainless steel mixing bowls
- The equipment listed in Section 6.3
- Miscellaneous hand tools as required to assemble and disassemble the hand auger units

> ***CAUTION***
>
> Potential hazards associated with hand augering include:
>
> - Muscle strain and sprain due to over twisting and/or over compromising yourself.
> - Equipment failure due to excessive stress on the T-handle or rods through twisting. Failure of any of these components will result in a sudden release and potential injury due to that failure.
>
> As in all situations, any intrusive activities that could damage underground utilities shall be proceeded by a Dig/Excavation permit/ticket. Call the Utility Locating service in the area or your Project Health and Safety Officer for more information. When in doubt – **Get the Ticket!**

To obtain soil samples using a hand auger, or soil corer use the following procedure:

1. Wearing designated PPE, attach a properly decontaminated bucket bit to a clean extension rod and attach the T-handle to the extension rod, or ensure the soil corer is properly decontaminated.
2. Place auger or soil corer tip in existing surface soil sample 1 foot by 1 foot excavation, if applicable, or Clear the area to be sampled of any surface debris (vegetation, twigs, rocks, litter, etc.).
3. Twist the bucket or corer into the ground while pushing vertically downward on the auger or corer. The cutting shoes fill the bucket or corer as it is advanced into the ground.
4. As the auger bucket or corer fills with soil, periodically remove any unneeded soil.

5. Add rod extensions as necessary to extend the reach of the auger or corer. Also, note (in a field notebook, boring log, and/or on a standardized data sheet) any changes in the color, texture or odor of the soil as a function of depth. The project-specific planning document (SAP, HASP, etc.) describe requirements for scanning the soil with a real-time air monitoring instrument (e.g., PID, FID, etc.) and recording the measurements.

6. ~~After reaching the desired depth (e.g., the top of the interval to be sampled), slowly and carefully withdraw the apparatus from the borehole to prevent or minimize movement of soil from shallower intervals to the bottom of the hole~~.

7. ~~Remove the soiled bucket bit from the rod extension and replace it with another properly decontaminated bucket bit. The bucket bit used for sampling is to be smaller in diameter than the bucket bit employed to initiate the borehole.~~

8. ~~Carefully lower the apparatus down the borehole. Care must be taken to avoid scraping the borehole sides.~~

9. ~~Slowly turn the apparatus until the bucket bit is advanced approximately 6 inches.~~

10. Discard the top of the core (approximately 1 inch), which represents any loose material collected by the bucket bit before penetrating the sample material, if the sample depth is greater than the height of the bucket bit or the top of the corer.

11. ~~Using a precleaned syringe or EnCore™ samplers, follow the procedure in Section 6.2.1 for collecting a soil sample for volatile compound analysis directly from the bucket bit.~~

12. Utilizing a properly decontaminated stainless steel trowel or dedicated disposable trowel, remove the ~~remaining~~ sample material from the bucket bit or corer and place into a properly decontaminated stainless steel mixing bowl.

13. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers. Refer to Section 6.2.2.

14. Follow steps 4 through 7 listed in Section 6.3.

6.5.1 Sampling Using Stainless Steel Soil Corers

A soil corer is a stainless steel tube equipped with a cutting shoe and sample window in the side. The soil corer is advanced into the soil by applying downward pressure (body weight). The soil is unloaded by then forcing a ram towards the cutting shoe, which results in the discharge of the soil core through a window in the sleeve.

Use, application, and sample protocol is the same as for hand augering provided above, but without necessarily rotating the corer while advancing it.

SAFETY REMINDER

Hand augering and soil corer sampling can be physically demanding based on the type of geology and subsurface encumbrances encountered. Soil coring has some added hazards such the corer collapsing under your weight. To reduce the potential for muscle strain and damage, the following measures will be incorporated:

- Stretch and limber your muscles before heavy exertion. This hazard becomes more predominant in the early morning hours (prior to muscles becoming limber) and later in the day (as a result of fatigue).

- Job rotation – Share the duties so that repetitive actions do not result in fatigue and injury.
- Increase break frequencies as needed, especially as ambient conditions of heat and/or cold stress may dictate.
- Do not force the hand tools or use cheater pipes or similar devices to bypass an obstruction. Move to another location near the sampling point. Exerting additional forces on the sampling devices can result in damage and/or failure that could potentially injure someone in the immediate vicinity.
- Do not over compromise yourself when applying force to the soil corer or hand auger. If there is a sudden release, it could result in a fall or muscle injury due to strain.

6.6 Subsurface Soil Sampling with a Split-Barrel Sampler

A split-barrel (split-spoon) sampler consists of a heavy carbon steel or stainless steel sampling tube that can be split into two equal halves to reveal the soil sample (see Attachment B). A drive head is attached to the upper end of the tube and serves as a point of attachment for the drill rod. A removable tapered nosepiece/drive shoe attaches to the lower end of the tube and facilitates cutting. A basket-like sample retainer can be fitted to the lower end of the split tube to hold loose, dry soil samples in the tube when the sampler is removed from the drill hole. This split-barrel sampler is made to be attached to a drill rod and forced into the ground by means of a 140-pound or larger casing driver.

Safety Reminder

It is intended through the Equipment Inspection for Drill Rigs form provided in the HASP that the hammer and hemp rope, where applicable, associated with this activity will be inspected (no physical damage is obvious), properly attached to the hammer (suitable knots or sufficient mechanical devices), and is in overall good condition.

Split-barrel samplers are used to collect soil samples from a wide variety of soil types and from depths greater than those attainable with other soil sampling equipment.

The following equipment is used for obtaining split-barrel samples:

- Drilling equipment (provided by subcontractor).
- Split-barrel samplers (2-inch OD, 1-3/8-inch ID, either 20 inches or 26 inches long); Larger OD samplers are available if a larger volume of sample is needed.
- Drive weight assembly, 140-pound weight, driving head, and guide permitting free fall of 30 inches.
- Stainless steel mixing bowls.
- Equipment listed in Section 6.3.

The following steps shall be followed to obtain split-barrel samples (Steps 1 through 4 are typically performed by the drilling subcontractor):

1. Attach the split-barrel sampler to the sampling rods.

2. Lower the sampler into the borehole inside the hollow stem auger bits.

3. Advance the split-barrel sampler by hammering the length (typically 18 or 24 inches) of the split-barrel sampler into the soil using 140-pound or larger hammer.

4. When the desired depth is achieved, extract the drill rods and sampler from the augers and/or borehole.

5. Detach the sampler from the drill rods.

6. Place the sampler securely in a vise so it can be opened using pipe wrenches.

> ***CAUTION***
> Pipe wrenches are used to separate the split spoon into several components. The driller's helper should not apply excessive force through the use of cheater pipes or push or pull in the direction where, if the wrench slips, hands or fingers will be trapped against an immovable object.

7. Remove the drive head and nosepiece with the wrenches, and open the sampler to reveal the soil sample.

8. Immediately scan the sample core with a real-time air monitoring instrument (e.g., FID, PID, etc.) (as project-specific planning documents dictate). Carefully separate (or cut) the soil core, with a decontaminated stainless steel knife or trowel, at about 6-inch intervals while scanning the center of the core for elevated readings. Also scan stained soil, soil lenses, and anomalies (if present), and record readings.

9. If elevated vapor readings were observed, collect the sample scheduled for volatile analysis from the center of the core where elevated readings occurred. If no elevated readings where encountered, the sample material should be collected from the core's center (this area represents the least disturbed area with minimal atmospheric contact) (refer to Section 6.2.1).

10. Using the same trowel, remove remaining sample material from the split-barrel sampler (except for the small portion of disturbed soil usually found at the top of the core sample) and place the soil into a decontaminated stainless steel mixing bowl.

11. Homogenize the sample material as thoroughly as practicable then fill the remaining sample containers (refer to Section 6.2.2).

12. Follow steps 4 through 7 in Section 6.3.

6.7 Subsurface Soil Sampling Using Direct-Push Technology

Subsurface soil samples can be collected to depths of 40+ feet using DPT. DPT equipment, responsibilities, and procedures are described in SOP SA-2.5.

6.8 Excavation and Sampling of Test Pits and Trenches

6.8.1 Applicability

This subsection presents routine test pit or trench excavation techniques and specialized techniques that are applicable under certain conditions.

CAUTION

During the excavation of trenches or pits at hazardous waste sites, several health and safety concerns arise from the method of excavation. No personnel shall enter any test pit or excavation over 4 feet deep except as a last resort, and then only under direct supervision of a Competent Person (as defined in 29 CFR 1929.650 of Subpart P - Excavations). Whenever possible, all required chemical and lithological samples should be collected using the excavator bucket or other remote sampling apparatus. If entrance is required, all test pits or excavations must be stabilized by bracing the pit sides using specifically designed wooden, steel, or aluminum support structures or through sloping and benching. Personnel entering the excavation may be exposed to toxic or explosive gases and oxygen-deficient environments; therefore, monitoring will be conducted by the Competent Person to determine if it is safe to enter. Any entry into a trench greater than 4 feet deep will constitute a Confined Space Entry and must be conducted in conformance with OSHA standard 29 CFR 1910.146. In all cases involving entry, substantial air monitoring, before entry, appropriate respiratory gear and protective clothing determination, and rescue provisions are mandatory. There must be at least three people present at the immediate site before entry by one of the field team members. This minimum number of people will increase based on the potential hazards or complexity of the work to be performed. The reader shall refer to OSHA regulations 29 CFR 1926.650, 29 CFR 1910.120, 29 CFR 1910.134, and 29 CFR 1910.146. High-hazard entries such as this will be supported by members of the Health Sciences Group professionally trained in these activities.

Excavations are generally not practical where a depth of more than about 15 to 20-feet is desired, and they are usually limited to a few feet below the water table. In some cases, a pumping system may be required to control water levels within the pit, providing that pumped water can be adequately stored or disposed. If soil data at depths greater than 15-feet are required, the data are usually obtained through test borings instead of test pits.

In addition, hazardous wastes may be brought to the surface by excavation equipment. This material, whether removed from the site or returned to the subsurface, must be properly handled according to any and all applicable federal, state, and local regulations.

6.8.2 Test Pit and Trench Excavation

Test pits or trench excavations are constructed with the intent that they will provide an open view of subsurface lithology and/or disposal conditions that a boring will not provide. These procedures describe the methods for excavating and logging test pits and trenches installed to determine subsurface soil and rock conditions. Test pit operations shall be logged and documented (see Attachment C).

Test pits and trenches may be excavated by hand or power equipment to permit detailed descriptions of the nature and contamination of the in-situ materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration

- The space required for efficient excavation
- The chemicals of concern
- The economics and efficiency of available equipment

Test pits normally have a cross section that is 4 to 10 feet square; test trenches are usually 3 to 6 feet wide and may be extended for any length required to reveal conditions along a specific line. The following table provides guidelines for design consideration based on equipment efficiencies.

Equipment	Typical Widths, in Feet
Trenching machine	0.25 to 1.0
Backhoe/Track Hoe	2 to 6

The lateral limits of excavation of trenches and the position of test pits shall be carefully marked on area base maps. If precise positioning is required to indicate the location of highly hazardous materials, nearby utilities, or dangerous conditions, the limits of the excavation shall be surveyed. Also, if precise determination of the depth of buried materials is needed for design or environmental assessment purposes, the elevation of the ground surface at the test pit or trench location shall also be determined by survey. If the test pit/trench will not be surveyed immediately, it shall be backfilled and its position identified with stakes placed in the ground at the margin of the excavation for later surveying.

The construction of test pits and trenches shall be planned and designed in advance as much as possible. However, the following field conditions may necessitate revisions to the initial plans:

- Subsurface utilities
- Surface and subsurface encumbrances
- Vehicle and pedestrian traffic patterns
- Purpose for excavation (e.g., the excavation of potential ordnance items)

The final depth and construction method shall be collectively determined by the FOL and designated Competent Person. The actual layout of each test pit, temporary staging area, and spoils pile may further be predicated based on site conditions and wind direction at the time the test pit is excavated. Prior to excavation, the area may be surveyed by magnetometer or metal detector or other passive methods specified in SOP HS1.0, Utility Location and Excavation Clearance, to identify the presence of underground utilities or drums. Where possible, the excavator should be positioned upwind and preferably within an enclosed cab.

No personnel shall enter any test pit or excavation except as a last resort, and then only under direct supervision of a Competent Person. If entrance is required, OSHA requirements must be met (e.g., walls must be braced with wooden or steel braces, ladders must be placed for every 25 feet of lateral travel and extended 3 feet above ground surface). A temporary guard rail or vehicle stop must be placed along the surface of the hole before entry in situations where the excavation may be approached by traffic. Spoils will be stockpiled no closer than 2 feet from the sidewall of the excavation. The excavation equipment operator shall be careful not to undercut sidewalls and will, where necessary, bench back to increase stability. The top cover, when considered clean, will be placed separately from the subsurface materials to permit clean cover. It is emphasized that the project data needs should be structured such that required samples can be collected without requiring entrance into the excavation. For example,

samples of leachate, groundwater, or sidewall soil can be collected with telescoping poles or similar equipment.

Dewatering and watering may be required to ensure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation stable. This is an important consideration for excavations in cohesionless material below the groundwater table and for excavations left open greater than a day. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials. Procedures for the collection and disposal of such materials should be discussed in the site-specific project plans.

Where possible excavations and test pits shall be opened and closed within the same working day. Where this is not possible, the following engineering controls shall be put in place to control access:

- Trench covers/street plates
- Fences encompassing the entire excavation intended to control access
- Warning signs warning personnel of the hazards
- Amber flashing lights to demarcate boundaries of the excavation at night

Excavations left open will have emergency means to exit should someone accidentally enter.

6.8.3 Sampling in Test Pits and Trenches

6.8.3.1 General

Log test pits and trenches as they are excavated in accordance with the Test Pit Log presented in Attachment C. These records include plan and profile sketches of the test pit/trench showing materials encountered, their depth and distribution in the pit/trench, and sample locations. These records also include safety and sample screening information.

Entry of test pits by personnel is extremely dangerous, shall be avoided unless absolutely necessary, and can occur only after all applicable health and safety and OSHA requirements have been met as stated above. These provisions will be reiterated as appropriate in the project-specific HASP.

The final depth and type of samples obtained from each test pit will be determined at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may also be collected.

In some cases, samples of soil may be extracted from the test pit for reasons other than waste sampling and chemical analysis, for instance, to obtain geotechnical information. Such information includes soil types, stratigraphy, strength, etc., and could therefore entail the collection of disturbed (grab or bulk) or relatively undisturbed (hand-carved or pushed/driven) samples that can be tested for geotechnical properties. The purposes of such explorations are very similar to those of shallow exploratory or test borings, but often test pits offer a faster, more cost-effective method of sampling than installing borings.

6.8.3.2 Sampling Equipment

The following equipment is needed for obtaining samples for chemical or geotechnical analysis from test pits and trenches:

- Backhoe or other excavating machinery.
- Shovels, picks, hand augers, and stainless steel trowels/disposable trowels.
- Sample container - bucket with locking lid for large samples; appropriate bottle ware for chemical or geotechnical analysis samples.
- Polyethylene bags for enclosing sample containers; buckets.
- Remote sampler consisting of 10-foot sections of steel conduit (1-inch-diameter), hose clamps, and right angle adapter for conduit (see Attachment D).

6.8.3.3 Sampling Methods

The methods discussed in this section refer to test pit sampling from grade level. If test pit entry is required, see Section 6.8.3.4.

- Excavate the trench or pit in several 0.5- to 1.0-foot depth increments. Where soil types support the use of a sand bar cutting plate, use of this device is recommended to avoid potentially snagging utilities with the excavator teeth. It is recommended that soil probes or similar devices be employed where buried items or utilities may be encountered. This permits the trench floor to be probed prior to the next cut.
- After each increment:
  - the operator shall wait while the sampler inspects the test pit from grade level
  - the sampler shall probe the next interval where this is considered necessary. Practical depth increments for lithological evaluations may range from 2 to 4 feet i or where lithological changes are noted.
- The backhoe operator, who will have the best view of the test pit, shall immediately cease digging if:
  - Any fluid phase, including groundwater seepage, is encountered in the test pit
  - Any drums, other potential waste containers, obstructions, or utility lines are encountered
  - Distinct changes of material being excavated are encountered

This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol. Depending on the conditions encountered, it may be required to excavate more slowly and carefully with the backhoe.

For obtaining test pit samples from grade level, the following procedure shall be followed:

- Use the backhoe to remove loose material from the excavation walls and floor to the greatest extent possible.
- Secure the walls of the pit, if necessary. (There is seldom any need to enter a pit or trench that would justify the expense of shoring the walls. All observations and samples should be taken from the ground surface.)

- Samples of the test pit material are to be obtained either directly from the backhoe bucket or from the material after it has been deposited on the ground, as follows:

  a. The sampler or FOL shall direct the backhoe operator to remove material from the selected depth or location within the test pit/trench.

  b. The backhoe operator shall bring the bucket over to a designated location on the sidewall a sufficient distance from the pit (at least 5 feet) to allow the sampler to work around the bucket.

  c. After the bucket has been set on the ground, the backhoe operator shall either disengage the controls or shut the machine down.

  d. When signaled by the operator that it is safe to do, the sampler will approach the bucket.

  e. The soil shall be monitored with a photoionization or flame ionization detector (PID or FID) as directed in the project-specific planning documents.

  f. The sampler shall collect the sample from the center of the bucket or pile in accordance with surface soil sampling procedures of Section 6.3 or 6.4, as applicable. Collecting samples from the center of a pile or bucket eliminates cross-contamination from the bucket or other depth intervals.

- If a composite sample is desired, several depths or locations within the pit/trench will be selected, and the bucket will be filled from each area. It is preferable to send individual sample bottles filled from each bucket to the laboratory for compositing under the more controlled laboratory conditions. However, if compositing in the field is required, each sample container shall be filled from materials that have been transferred into a mixing bucket and homogenized. Note that homogenization/compositing is not applicable for samples to be subjected to volatile organic analysis.

> ***CAUTION***
>
> Care must be exercised when using the remote sampler described in the next step because of potential instability of trench walls. In situations where someone must move closer than 2 feet to the excavation edge, a board or platform should be used to displace the sampler's weight to minimize the chance of collapse of the excavation edge. Fall protection should also be employed when working near the edges or trenches greater than 6 feet deep. An immediate means to extract people who have fallen into the trench will be immediately available. These means may include ladders or rope anchor points.

- Using the remote sampler shown in Attachment D, samples can be taken at the desired depth from the sidewall or bottom of the pit as follows:

  a. Scrape the face of the pit/trench using a long-handled shovel or hoe to remove the smeared zone that has contacted the backhoe bucket.

  b. Collect the sample directly into the sample jar, by scraping with the jar edge, eliminating the need for sample handling equipment and minimizing the likelihood of cross-contamination.

  c. Cap the sample jar, remove it from the remote sampler assembly, and package the sample for shipment in accordance with SOP SA-6.3.

- Complete documentation as described in SOP SA-6.3 and Attachment C of this SOP.

6.8.3.4 In-Pit Sampling

Under rare conditions, personnel may be required to enter the test pit/trench. This is necessary only when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., excessive mixing of soil or wastes within the test pit/trench) or when samples from relatively small discrete zones within the test pit are required. This approach may also be necessary to sample any seepage occurring at discrete levels or zones in the test pit that are not accessible with remote samplers.

In general, personnel shall sample and log pits and trenches from the ground surface, except as provided for by the following criteria:

- There are no practical alternative means of obtaining such data.
- The SSO and Competent Person determine that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the pit/trench after it is dug (including, at a minimum, measurements of oxygen concentration, flammable gases, and toxic compounds, in that order). Action levels will be provided in project-specific planning documents.
- A company-designated Competent Person determines that the pit/trench is stable trough soil classification evaluation/inspections or is made stable (by cutting/grading the sidewalls or using shoring) prior to entrance of any personnel. OSHA requirements shall be strictly observed.

If these conditions are satisfied, only one person may enter the pit/trench. On potentially hazardous waste sites, this individual shall be dressed in selected PPE as required by the conditions in the pit. He/she shall be affixed to a harness and lifeline and continuously monitored while in the pit.

A second and possible third individual shall be fully dressed in protective clothing including a self-contained breathing device and on standby during all pit entry operations to support self rescue or assisted self rescue. The individual entering the pit shall remain therein for as brief a period as practical, commensurate with performance of his/her work. After removing the smeared zone, samples shall be obtained with a decontaminated trowel or spoon.

6.8.3.5 Geotechnical Sampling

In addition to the equipment described in Section 6.8.3.2, the following equipment is needed for geotechnical sampling:

- Soil sampling equipment, similar to that used in shallow drilled boring (i.e., thin-walled tube samplers), that can be pushed or driven into the floor of the test pit.
- Suitable driving (e.g., sledge hammer) or pushing (e.g., backhoe bucket) equipment used to advance the sampler into the soil.
- Knives, spatulas, and other suitable devices for trimming hand-carved samples.
- Suitable containers (bags, jars, tubes, boxes, etc.), labels, wax, etc. for holding and safely transporting collected soil samples.
- Geotechnical equipment (pocket penetrometer, torvane, etc.) for field testing collected soil samples for classification and strength properties.

Disturbed grab or bulk geotechnical soil samples may be collected for most soil in the same manner as comparable soil samples for chemical analysis. These collected samples may be stored in jars or plastic-lined sacks (larger samples), which will preserve their moisture content. Smaller samples of this type are usually tested for their index properties to aid in soil identification and classification: larger bulk samples are usually required to perform compaction tests.

Relatively undisturbed samples are usually extracted in cohesive soil using thin-walled tube samplers, and such samples are then tested in a geotechnical laboratory for their strength, permeability, and/or compressibility. The techniques for extracting and preserving such samples are similar to those used in performing Shelby tube sampling in borings, except that the sampler is advanced by hand or backhoe, rather than by a drill rig. Also, the sampler may be extracted from the test pit by excavation around the tube when it is difficult to pull it out of the ground. If this excavation requires entry of the test pit, the requirements described in Section 6.8.3.4 shall be followed. The thin-walled tube sampler shall be pushed or driven vertically into the floor or steps excavated in the test pit at the desired sampling elevations. Extracting tube samples horizontally from the walls of the test pit is not appropriate because the sample will not have the correct orientation.

A sledge hammer or backhoe may be used to drive or push the tube into the ground. Place a piece of wood over the top of the sampler or sampling tube to prevent damage during driving/pushing of the sample. Pushing the sampler with a constant thrust is always preferable to driving it with repeated blows, thus minimizing disturbance to the sample. When using a sledge hammer, it is recommended that the sampler be stabilized using a rope/strap wrench or pipe wrench to remove the person's hands holding the sampler from the strike zone. If the sample cannot be extracted by rotating it at least two revolutions (to shear off the sample at the bottom), hook the sampler to the excavator or backhoe and extract. This means an alternative head will be used as a connection point or that multiple choke hitches will be applied to extract the sampler. If this fails and the excavator can dig deeper without potentially impacting subsurface utilities, excavate the sampler. If this fails or if the excavator cannot be used due to subsurface utilities, hand-excavate to remove the soil from around the sides of the sampler. If hand-excavation requires entry into the test pit, the requirements in Section 6.8.3.4 must be followed. Prepare the sample as described in Steps 9 through 13 in Section 6.2.3, and label, pack and transport the sample in the required manner, as described in SOPs SA-6.3 and SA-6.1.

6.8.4 Backfilling of Trenches and Test Pits

All test pits and excavations must be either backfilled, covered, or otherwise protected at the end of each day. No excavations shall remain open during non-working hours unless adequately covered or otherwise protected.

Before backfilling, the onsite crew may photograph, if required by the project-specific work plan, all significant features exposed by the test pit and trench and shall include in the photograph a scale to show dimensions. Photographs of test pits shall be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph shall be entered in the site logbook. All photographs shall be indexed and maintained as part of the project file for future reference.

After inspection, backfill material shall be returned to the pit under the direction of the FOL. Backfill should be returned to the trench or test pit in 6-inch to 1-foot lifts and compacted with the bucket. Remote controlled tampers or rollers may be lowered into the trench and operated from top side. This procedure will continue to the grade surface. It is recommended that the trench be tracked or rolled in. During excavation, clean soil from the top 2 feet may have been separated to be used to cover the last segments. Where these materials are not clean, it is recommended that clean fill be used for the top cover.

~~If a low-permeability layer is penetrated (resulting in groundwater flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil-bentonite mix prepared in a proportion specified by the FOL (representing a permeability equal to or less than original conditions). Backfill can be covered by "clean" soil and graded to the original land contour. Revegetation of the disturbed area may also be required.~~

6.9 Records

The appropriate sample log sheet (see Attachment A of this SOP) must be completed by the site geologist/sampler for all samples collected. All soil sampling locations should be documented by tying in the location of two or more nearby permanent landmarks (building, telephone pole, fence, etc.) or obtaining GPS coordinates; and shall be noted on the appropriate sample log sheet, site map, or field notebook. Surveying may also be necessary, depending on the project requirements.

Test pit logs (see Attachment C of this SOP) shall contain a sketch of pit conditions. If the project-specific work plan requires photographs, at least one photograph with a scale for comparison shall be taken of each pit. Included in the photograph shall be a card showing the test pit number. Boreholes, test pits, and trenches shall be logged by the field geologist in accordance with SOP GH-1.5.

Other data to be recorded in the field logbook include the following:

- Name and location of job
- Date of boring and excavation
- Approximate surface elevation
- Total depth of boring and excavation
- Dimensions of pit
- Method of sample acquisition
- Type and size of samples
- Soil and rock descriptions
- Photographs if required
- Groundwater levels
- PID/FID/LEL/O_2 meter readings
- Other pertinent information, such as waste material encountered

In addition, site-specific documentation to be maintained by the SSO and/or Competent Person will be required including:

- Calibration logs
- Excavation inspection checklists

- Soil type classification

7.0 REFERENCES

American Society for Testing and Materials, 1987. ASTM Standards D1587-83 and D1586-84. ASTM Annual Book of Standards. ASTM. Philadelphia, Pennsylvania. Volume 4.08.

NUS Corporation, 1986. Hazardous Material Handling Training Manual.

NUS Corporation and CH2M Hill, August, 1987. Compendium of Field Operation Methods. Prepared for the U.S. EPA.

OSHA, Excavation, Trenching and Shoring 29 CFR 1926.650-653.

OSHA, Confined Space Entry 29 CFR 1910.146.

USEPA, November 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual.

ATTACHMENT A
SOIL & 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:

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

COMPOSITE SAMPLE DATA:

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

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other

OBSERVATIONS / NOTES:

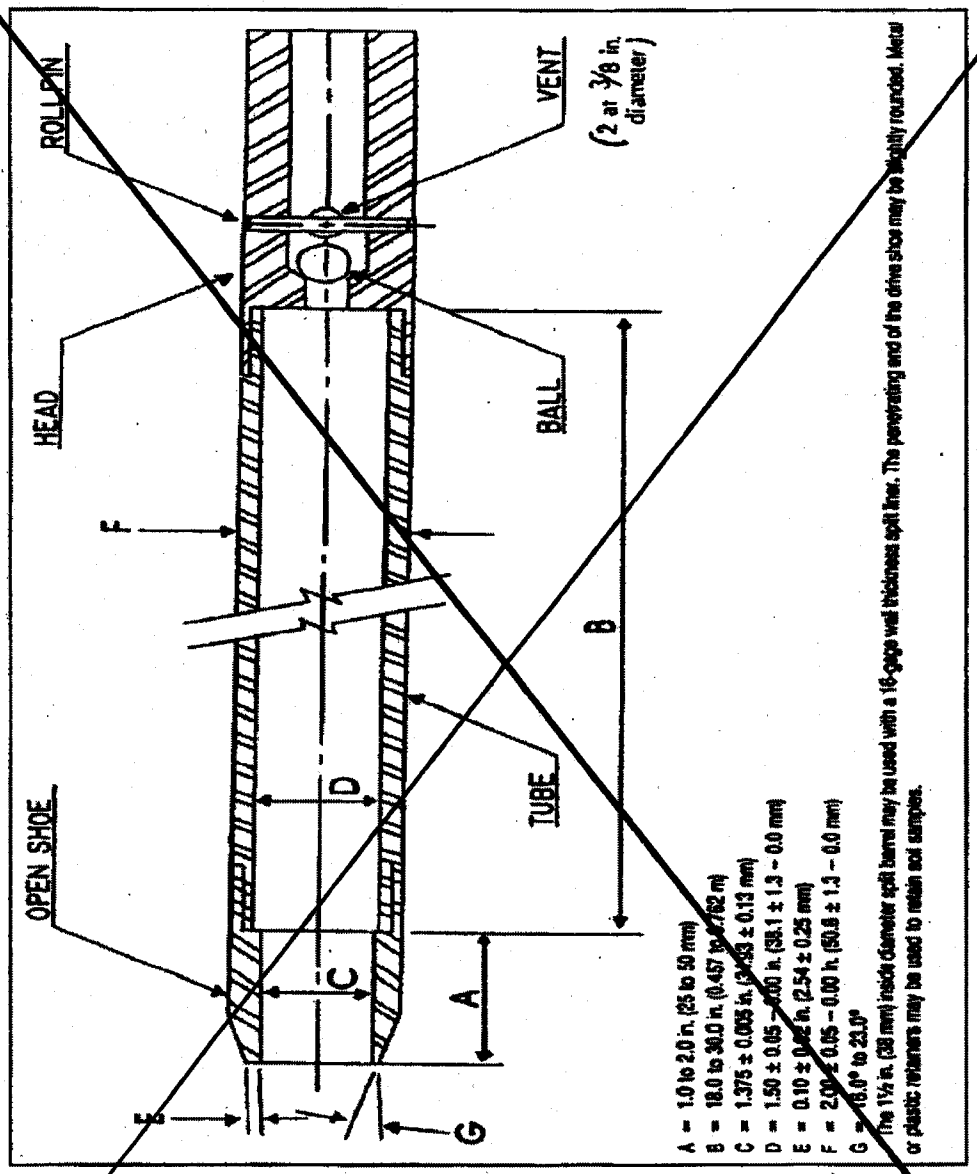
MAP:

Circle If Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

ATTACHMENT B
SPLIT-SPOON SAMPLER



A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375 ± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 – 0.00 in. (38.1 ± 1.3 – 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 – 0.00 in. (50.8 ± 1.3 – 0.0 mm)
G = 16.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

ATTACHMENT C
TEST PIT LOG

TEST PIT LOG

Page ___ of ___

Tetra Tech NUS, Inc.

PROJECT NAME: _____ TEST PIT No.: _____
PROJECT NUMBER: _____ DATE: _____
LOCATION: _____ GEOLOGIST: _____

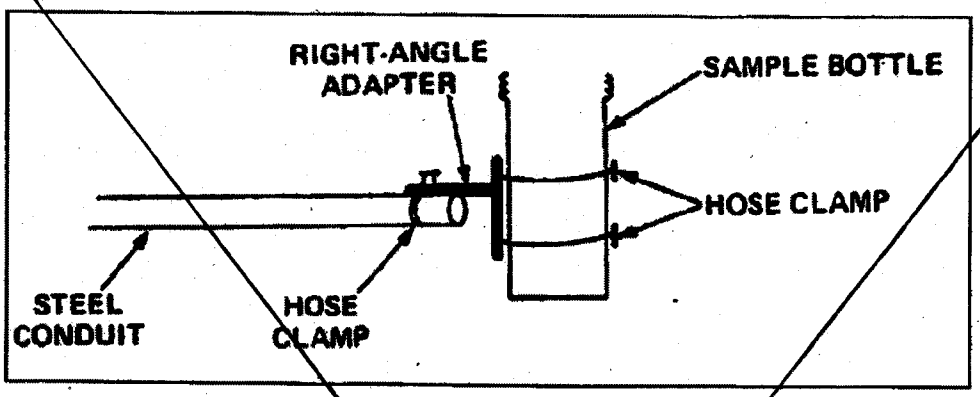
Depth (Ft.)	Lithology Change (Depth/Ft.)	MATERIAL DESCRIPTION Soil/Waste Characteristics (lithology, density, color, etc.)	USCS	Remarks	PID/FID READING Source (ppm)	PID/FID READING Bzt (ppm)

TEST PIT CROSS SECTION AND / OR PLAN VIEW

REMARKS: _____

PHOTO LOG: _____

ATTACHMENT D
REMOTE SAMPLE HOLDER FOR TEST PIT/TRENCH SAMPLING



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1.0 PURPOSE

Utilities such as electric service lines, natural or propane gas lines, water and sewage lines, telecommunications, and steam lines are very often in the immediate vicinity of work locations. Contact with underground or overhead utilities can have serious consequences including employee injury/fatality, property and equipment damage, substantial financial impacts, and loss of utility service to users.

The purpose of this procedure is to provide minimum requirements and technical guidelines regarding the appropriate procedures to be followed when performing subsurface and overhead utility locating services. It is the policy of Tetra Tech NUS, Inc. (TtNUS) to provide a safe and healthful work environment for the protection of our employees. The purpose of this Standard Operating Procedure (SOP) is to aid in achieving the objectives of this policy, to present the acceptable procedures pertaining to utility locating and excavation clearance activities, and to present requirements and restrictions relevant to these types of activities. This SOP must be reviewed by any employee potentially involved with underground or overhead utility locating and avoidance activities.

2.0 SCOPE

This procedure applies to all TtNUS field activities where there may be potential contact with underground or overhead utilities. This procedure provides a description of the principles of operation, instrumentation, applicability, and implementability of typical methods used to determine the presence and avoidance of contact with utility services. This procedure is intended to assist with work planning and scheduling, resource planning, field implementation, and subcontractor procurement. Utility locating and excavation clearance requires site-specific information prior to the initiation of any such activities on a specific project. This SOP is not intended to provide a detailed description of methodology and instrument operation. Specialized expertise during both planning and execution of several of the methods presented may also be required.

3.0 GLOSSARY

Electromagnetic Induction (EMI) Survey - A geophysical exploration method whereby electromagnetic fields are induced in the ground and the resultant secondary electromagnetic fields are detected as a measure of ground conductivity.

Magnetometer – A device used for precise and sensitive measurements of magnetic fields.

Magnetic Survey – A geophysical survey method that depends on detection of magnetic anomalies caused by the presence of buried ferromagnetic objects.

Metal Detection – A geophysical survey method that is based on electromagnetic coupling caused by underground conductive objects.

Vertical Gradiometer – A magnetometer equipped with two sensors that are vertically separated by a fixed distance. It is best suited to map near surface features and is less susceptible to deep geologic features.

Ground Penetrating Radar – Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture.

4.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) - Responsible for ensuring that all field activities are conducted in accordance with this procedure.

Site Manager (SM)/Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved SOPs or as otherwise directed by the approved project plan(s).

Site Health & Safety Officer (SHSO) – Responsible to provide technical assistance and verify full compliance with this SOP. The SHSO is also responsible for reporting any deficiencies to the Corporate Health and Safety Manager (HSM) and to the PM/TOM.

Health & Safety Manager (HSM) – Responsible for preparing, implementing, and modifying corporate health and safety policy and this SOP.

Site Personnel – Responsible for performing their work activities in accordance with this SOP and the TtNUS Health and Safety Policy.

5.0 PROCEDURES

This procedure addresses the requirements and technical procedures that must be performed to minimize the potential for contact with underground and overhead utility services. These procedures are addressed individually from a buried and overhead standpoint.

5.1 Buried Utilities

Buried utilities present a heightened concern because their location is not typically obvious by visual observation, and it is common that their presence and/or location is unknown or incorrectly known on client properties. This procedure must be followed prior to beginning any subsurface probing or excavation that might potentially be in the vicinity of underground utility services. In addition, the Utility Clearance Form (Attachment 3) must be completed for every location or cluster of locations where intrusive activities will occur.

Where the positive identification and de-energizing of underground utilities cannot be obtained and confirmed using the following steps, the PM/TOM is responsible for arranging for the procurement of a qualified, experienced, utility locating subcontractor who will accomplish the utility location and demarcation duties specified herein.

1. A comprehensive review must be made of any available property maps, blue lines, or as-builts prior to site activities. Interviews with local personnel familiar with the area should be performed to provide additional information concerning the location of potential underground utilities. Information regarding utility locations shall be added to project maps upon completion of this exercise.

2., A visual site inspection must be performed to compare the site plan information to actual field conditions. Any findings must be documented and the site plan/maps revised. The area(s) of proposed excavation or other subsurface activities must be marked at the site in white paint or pin flags to identify those locations of the proposed intrusive activities. The site inspection should focus on locating surface indications of potential underground utilities. Items of interest include the presence of nearby area lights, telephone service, drainage grates, fire hydrants, electrical service vaults/panels, asphalt/concrete scares and patches, and topographical depressions. Note the location of any emergency shut off switches. Any additional information regarding utility

locations shall be added to project maps upon completion of this exercise and returned to the PM/TOM.

3. If the planned work is to be conducted on private property (e.g., military installations, manufacturing facilities, etc.) the FOL must identify and contact appropriate facility personnel (e.g., public works or facility engineering) before any intrusive work begins to inquire about (and comply with) property owner requirements. It is important to note that private property owners may require several days to several weeks advance notice prior to locating utilities.

4. If the work location is on public property, the state agency that performs utility clearances must be notified (see Attachment 1). State "one-call" services must be notified prior to commencing fieldwork per their requirements. Most one-call services require, by law, 48- to 72-hour advance notice prior to beginning any excavation. Such services typically assign a "ticket" number to the particular site. This ticket number must be recorded for future reference and is valid for a specific period of time, but may be extended by contacting the service again. The utility service will notify utility representatives who then mark their respective lines within the specified time frame. It should be noted that most military installations own their own utilities but may lease service and maintenance from area providers. Given this situation, "one call" systems may still be required to provide location services on military installations.

5. Utilities must be identified and their locations plainly marked using pin flags, spray paint, or other accepted means. The location of all utilities must be noted on a field sketch for future inclusion on project maps. Utility locations are to be identified using the following industry-standard color code scheme, unless the property owner or utility locator service uses a different color code:

white	excavation/subsurface investigation location
red	electrical
yellow	gas, oil, steam
orange	telephone, communications
blue	water, irrigation, slurry
green	sewer, drain

6. Where utility locations are not confirmed with a high degree of confidence through drawings, schematics, location services, etc., the work area must be thoroughly investigated prior to beginning the excavation. In these situations, utilities must be identified using safe and effective methods such as passive and intrusive surveys, or the use of non-conductive hand tools. Also, in situations where such hand tools are used, they should always be used in conjunction with suitable detection equipment, such as the items described in Section 6.0 of this SOP. Each method has advantages and disadvantages including complexity, applicability, and price. It also should be noted that in some states, initial excavation is required by hand to a specified depth.

7. At each location where trenching or excavating will occur using a backhoe or other heavy equipment, and where utility identifications and locations cannot be confirmed prior to groundbreaking, the soil must be probed using a device such as a tile probe which is made of non-conductive material such as fiberglass. If these efforts are not successful in clearing the excavation area of suspect utilities, hand shoveling must be performed for the perimeter of the intended excavation.

8. All utilities uncovered or undermined during excavation must be structurally supported to prevent potential damage. Unless necessary as an emergency corrective measure, TtNUS shall not make any repairs or modifications to existing utility lines without prior permission of the utility owner, property owner, and Corporate HSM. All repairs require that the line be locked-out/tagged-out prior to work.

5.2 Overhead Power Lines

If it is necessary to work within the minimum clearance distance of an overhead power line, the overhead line must be de-energized and grounded, or re-routed by the utility company or a registered electrician. If protective measures such as guarding, isolating, or insulating are provided, these precautions must be adequate to prevent employees from contacting such lines directly with any part of their body or indirectly though conductive materials, tools, or equipment.

The following table provides the required minimum clearances for working in proximity to overhead power lines.

Nominal Voltage	Minimum Clearance
0 -50 kV	10 feet, or one mast length; whichever is greater
50+ kV	10 feet plus 4 inches for every 10 kV over 50 kV or 1.5 mast lengths; whichever is greater

6.0 UNDERGROUND LOCATING TECHNIQUES

A variety of supplemental utility locating approaches are available and can be applied when additional assurance is needed. The selection of the appropriate method(s) to employ is site-specific and should be tailored to the anticipated conditions, site and project constraints, and personnel capabilities.

6.1 Geophysical Methods

Geophysical methods include electromagnetic induction, magnetics, and ground penetrating radar. Additional details concerning the design and implementation of electromagnetic induction, magnetics, and ground penetrating radar surveys can be found in one or more of the TtNUS SOPs included in the References (Section 8.0).

Electromagnetic Induction

Electromagnetic Induction (EMI) line locators operate either by locating a background signal or by locating a signal introduced into the utility line using a transmitter. A utility line acts like a radio antenna, producing electrons, which can be picked up with a radiofrequency receiver. Electrical current carrying conductors have a 60HZ signal associated with them. This signal occurs in all power lines regardless of voltage. Utilities in close proximity to power lines or used as grounds may also have a 60HZ signal, which can be picked up with an EM receiver. A typical example of this type of geophysical equipment is an EM-61.

EMI locators specifically designed for utility locating use a special signal that is either indirectly induced onto a utility line by placing the transmitter above the line or directly induced using an induction clamp. The clamp induces a signal on the specific utility and is the preferred method of tracing since there is little chance of the resulting signals being interfered with. A good example of this type of equipment is the Schonstedt® MAC-51B locator. The MAC-51B performs inductively traced surveys, simple magnetic locating, and traced nonmetallic surveys.

When access can be gained inside a conduit to be traced, a flexible insulated trace wire can be used. This is very useful for non-metallic conduits but is limited by the availability of gaining access inside the pipe.

Magnetics

Magnetic locators operate by detecting the relative amounts of buried ferrous metal. They are incapable of locating or identifying nonferrous utility lines but can be very useful for locating underground storage tanks (UST's), steel utility lines, and buried electrical lines. A typical example of this type of equipment is the Schonstedt® GA-52Cx locator. The GA-52Cx is capable of locating 4-inch steel pipe up to 8 feet deep.

Non-ferrous lines are often located by using a typical plumbing tool (snake) fed through the line. A signal is then introduced to the snake that is then traced.

Ground Penetrating Radar

Ground Penetrating Radar (GPR) involves specialized radar equipment whereby a signal is sent into the ground via a transmitter. Some portion of the signal will be reflected from the subsurface material, which is then recorded with a receiver and electronically converted into a graphic picture. In general, an object which is harder than the surrounding soil will reflect a stronger signal. Utilities, tunnels, UST's, and footings will reflect a stronger signal than the surrounding soil. Although this surface detection method may determine the location of a utility, this method does not specifically identify utilities (i.e., water vs. gas, electrical vs. telephone); hence, verification may be necessary using other methods. This method is somewhat limited when used in areas with clay soil types or with a high water table.

6.2 Passive Detection Surveys

Acoustic Surveys

Acoustic location methods are generally most applicable to waterlines or gas lines. A highly sensitive Acoustic Receiver listens for background sounds of water flowing (at joints, leaks, etc.) or to sounds introduced into the water main using a transducer. Acoustics may also be applicable to determine the location of plastic gas lines.

Thermal Imaging

Thermal (i.e., infrared) imaging is a passive method for detecting the heat emitted by an object. Electronics in the infrared camera convert subtle heat differentials into a visual image on the viewfinder or a monitor. The operator does not look for an exact temperature, rather they look for heat anomalies (either elevated or suppressed temperatures) characteristic of a potential utility line.

The thermal fingerprint of underground utilities results from differences in temperature between the atmosphere and the fluid present in a pipe or the heat generated by electrical resistance. In addition, infrared scanners may be capable of detecting differences in the compaction, temperature and moisture content of underground utility trenches. High-performance thermal imagery can detect temperature differences to hundredths of a degree.

6.3 Intrusive Detection Surveys

Vacuum Excavation

Vacuum excavation is used to physically expose utility services. The process involves removing the surface material over approximately a 1' x 1' area at the site location. The air-vacuum process proceeds with the simultaneous action of compressed air-jets to loosen soil and vacuum extraction of the resulting

~~debris.~~ This process ensures the integrity of the utility line during the excavation ~~process, as no~~ hammers, blades, or heavy ~~mechanical equipment~~ comes into ~~contact with the~~ utility line, eliminating the risk of damage to utilities. The ~~process continues until the utility is~~ uncovered. Vacuum excavation can be used ~~at the proposed~~ site location to excavate below the "utility window" ~~which is usually 8 feet.~~

Hand Excavation

When the identification and location of underground utilities cannot be positively confirmed through document reviews and/or other methods, borings and excavations may be cleared via the use of non-conductive hand tools. This should always be done in conjunction with the use of detection equipment. This would be required for all locations where there is a potential to impact buried utilities. The minimum hand-excavation depth that must be reached is to be determined considering the geographical location of the work site. This approach recognizes that the placement of buried utilities is influenced by frost line depths that vary by geographical region. Attachment 2 presents frost line depths for the regions of the contiguous United States. At a minimum, hand excavation depths must be at least to the frost line depth (see Attachment 2) plus two (2) feet, but never less than 4 feet below ground surface (bgs). For hand excavation, the hole created must be reamed large enough to be at least the diameter of the drill rig auger or bit prior to drilling. For soil gas surveys, the survey probe shall be placed as close as possible to the cleared hand excavation. It is important to note that a post-hole digger must not be used in this type of hand excavation activity.

Tile Probe Surveys

For some soil types, site conditions, and excavation requirements, non-conductive tile probes may be used. A tile probe is a "T"-handled rod of varying lengths that can be pushed into the soil to determine if any obstructions exist at that location. Tile probes constructed of fiberglass or other nonconductive material are readily-available from numerous vendors. Tile probes must be performed to the same depth requirements as previously specified. As with other types of hand excavating activities, the use of a non-conductive tile probe, should always be in conjunction with suitable utility locating detection equipment.

7.0 INTRUSIVE ACTIVITIES SUMMARY

The following list summarizes the activities that must be performed prior to beginning subsurface activities:

1. Map and mark all subsurface locations and excavation boundaries using white paint or markers specified by the client or property owner.

2. Notify the property owner and/or client that the locations are marked. At this point, drawings of locations or excavation boundaries shall be provided to the property owner and/or client so they may initiate (if applicable) utility clearance.

   Note: Drawings with confirmed locations should be provided to the property owner and/or client as soon as possible to reduce potential time delays.

3. Notify "One Call" service. If possible, arrange for an appointment to show the One Call representative the surface locations or excavation boundaries in person. This will provide a better location designation to the utilities they represent. You should have additional drawings should you need to provide plot plans to the One Call service.

4. Implement supplemental utility detection techniques as necessary and appropriate to conform utility locations or the absence thereof.

5. Complete Attachment 3, Utility Clearance Form. This form should be completed for each excavation location. In situations where multiple subsurface locations exist within the close proximity of one another, one form may be used for multiple locations provided those locations are noted on the Utility Clearance Form. Upon completion, the Utility Clearance Form and revised/annotated utility location map becomes part of the project file.

8.0 REFERENCES

OSHA Letter of Interpretation, Mr. Joseph Caldwell, Attachment 4
OSHA 29 CFR 1926(b)(2)
OSHA 29 CFR 1926(b)(3)
TtNUS Utility Locating and Clearance Policy
TtNUS SOP GH-3.1; Resistivity and Electromagnetic Induction
TtNUS SOP GH-3.2; Magnetic and Metal Detection Surveys
TtNUS SOP GH-3.4; Ground-penetrating Radar Surveys

ATTACHMENT 1
LISTING OF UNDERGROUND UTILITY CLEARANCE RESOURCES

American Public Works Association
2345 Grand Boulevard, Suite 500, Kansas City, MO 64108-2625
Phone (816) 472-6100 • Fax (816) 472-1610
Web www.apwa.net • E-mail apwa@apwa.net

ONE-CALL SYSTEMS INTERNATIONAL CONDENSED DIRECTORY

Alabama
Alabama One-Call
1-800-292-8525

Alaska
Locate Call Center of Alaska, Inc.
1-800-478-3121

Arizona
Arizona Blue Stake
1-800-782-5348

Arkansas
Arkansas One Call System, Inc.
1-800-482-8998

California
Underground Service Alert North
1-800-227-2600
Underground Service Alert of Southern California
1-800-227-2600

Colorado
Utility Notification Center of Colorado
1-800-922-1987

Connecticut
Call Before You Dig
1-800-922-4455

Delaware
Miss Utility of Delmarva
1-800-282-8555

Florida
Sunshine State One-Call of Florida, Inc.
1-800-432-4770

Georgia
Underground Protection Center, Inc.
1-800-282-7411

Hawaii
Underground Service Alert North
1-800-227-2600

Idaho
Dig Line Inc.
1-800-342-1585
Kootenai County One-Call
1-800-428-4950
Shoshone - Benewah One-Call
1-800-398-3285

Illinois
JULIE, Inc.
1-800-892-0123
Digger (Chicago Utility Alert Network)
312-744-7000

Indiana
Indiana Underground Plant Protection Service
1-800-382-5544

Iowa
Iowa One-Call
1-800-292-8989

Kansas
Kansas One-Call System, Inc.
1-800-344-7233

Kentucky
Kentucky Underground Protection Inc.
1-800-752-6007

Louisiana
Louisiana One Call System, Inc.
1-800-272-3020

Maine
Dig Safe System, Inc.
1-888-344-7233

Maryland
Miss Utility
1-800-257-7777
Miss Utility of Delmarva
1-800-282-8555

Massachusetts
Dig Safe System, Inc.
1-888-344-7233

Michigan
Miss Dig System, Inc.
1-800-482-7171

Minnesota
Gopher State One Call
1-800-252-1166

Mississippi
Mississippi One-Call System, Inc
1-800-227-6477

Missouri
Missouri One-Call System, Inc.
1-800-344-7483

Montana
Utilities Underground Protection Center
1-800-424-5555
Montana One Call Center
1-800-551-8344

Nebraska
Diggers Hotline of Nebraska
1-800-331-5666

Nevada
Underground Service Alert North
1-800-227-2600

New Hampshire
Dig Safe System, Inc.
1-888-344-7233

New Jersey
New Jersey One Call
1-800-272-1000

New Mexico
New Mexico One Call System, Inc.
1-800-321-2537
Las Cruces- Dona Ana Blue Stakes
1-888-526-0400

New York
Dig Safely New York
1-800-962-7962
New York City- Long Island One Call Center
1-800-272-4480

North Carolina
The North Carolina One-Call Center, Inc.
1-800-632-4949

North Dakota
North Dakota One-Call
1-800-795-0555

Ohio
Ohio Utilities Protection Service
1-800-362-2764
Oil & Gas Producers Underground Protect'n Svc
1-800-925-0988

Oklahoma
Call Okie
1-800-522-6543

Oregon
Oregon Utility Notification Center/One Call Concepts
1-800-332-2344

Pennsylvania
Pennsylvania One Call System, Inc.
1-800-242-1776

Rhode Island
Dig Safe System, Inc.
1-888-344-7233

South Carolina
Palmetto Utility Protection Service Inc.
1-888-721-7877

South Dakota
South Dakota One Call
1-800-781-7474

Tennessee
Tennessee One-Call System, Inc.
1-800-351-1111

ATTACHMENT 1 (Continued)

Texas
Texas One Call System
1-800-245-4545
Texas Excavation Safety System, Inc.
1-800-344-8377
Lone Star Notification Center
1-800-669-8344

Utah
Blue Stakes of Utah
1-800-662-4111

Vermont
Dig Safe System, Inc.
1-888-344-7233

Virginia
Miss Utility of Virginia
1-800-552-7001
Miss Utility (Northern Virginia)
1-800-257-7777

Washington
Utilities Underground Location Center
1-800-424-5555
Northwest Utility Notification Center
1-800-553-4344
Inland Empire Utility Coordinating Council
509-456-8000

West Virginia
Miss Utility of West Virginia, Inc.
1-800-245-4848

Wisconsin
Diggers Hotline, Inc.
1-800-242-8511

Wyoming
Wyoming One-Call System, Inc.
1-800-348-1030
Call Before You Dig of Wyoming
1-800-849-2476

District of Columbia
Miss Utility
1-800-257-7777

Alberta
Alberta One-Call Corporation
1-800-242-3447

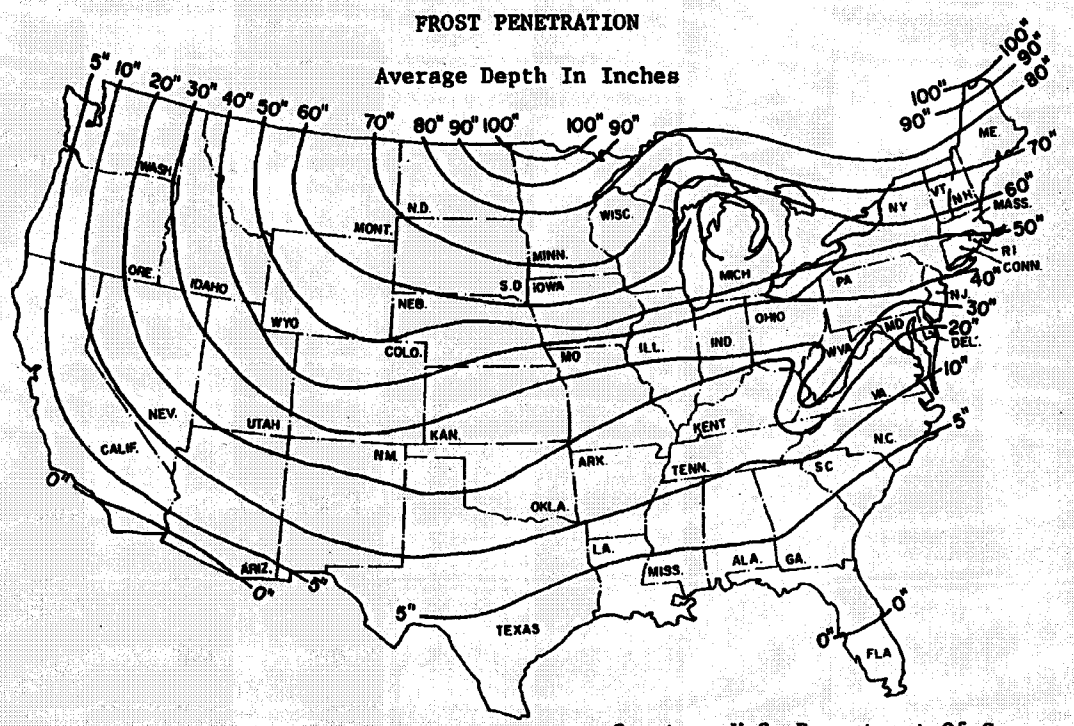
British Columbia
BC One Call
1-800-474-6886

Ontario
Ontario One-Call System
1-800-400-2255

Quebec
Info-Excavation
1-800-663-9228

ATTACHMENT 2

FROST LINE PENETRATION DEPTHS BY GEOGRAPHIC LOCATION



Courtesy U.S. Department Of Commerce

ATTACHMENT 3
UTILITY CLEARANCE FORM

Client: _____ Project Name: _____

Project No.: _____ Completed By: _____

Location Name: _____ Work Date: _____

Excavation Method/Overhead Equipment: _____

1. Underground Utilities — Circle One

a) Review of existing maps? yes no N/A

b) Interview local personnel? yes no N/A

c) Site visit and inspection? yes no N/A

d) Excavation areas marked in the field? yes no N/A

e) Utilities located in the field? yes no N/A

f) Located utilities marked/added to site maps? yes no N/A

g) Client contact notified yes no N/A
Name _____ Telephone: _____ Date: _____

g) State One-Call agency called? yes no N/A
Caller: _____
Ticket Number: _____ Date: _____

h) Geophysical survey performed? yes no N/A
Survey performed by: _____
Method: _____ Date: _____

i) Hand excavation performed (with concurrent use of utility detection device)? yes no N/A
Completed by: _____
Total depth: _____ feet Date: _____

j) Trench/excavation probed? yes no N/A
Probing completed by: _____
Depth/frequency: _____ Date: _____

2. Overhead Utilities — Present Absent

a) Determination of nominal voltage yes no N/A

b) Marked on site maps yes no N/A

c) Necessary to lockout/insulate/re-route yes no N/A

d) Document procedures used to lockout/insulate/re-route yes no N/A

e) Minimum acceptable clearance (SOP Section 5.2): _____

3. Notes:

_____

_____

_____

Approval:

_____ _____
Site Manager/Field Operations Leader Date

c: PM/Project File
Program File

ATTACHMENT 4
OSHA LETTER OF INTERPRETATION

Mr. Joseph Caldwell
Consultant
Governmental Liaison
Pipeline Safety Regulations
211 Wilson Boulevard
Suite 700
Arlington, Virginia 22201

Re: Use of hydro-vacuum or non-conductive hand tools to locate underground utilities.

Dear Mr. Caldwell:

In a letter dated July 7, 2003, we responded to your inquiry of September 18, 2002, regarding the use of hydro-vacuum equipment to locate underground utilities by excavation. After our letter to you was posted on the OSHA website, we received numerous inquiries that make it apparent that aspects of our July 7 letter are being misunderstood. In addition, a number of industry stakeholders, including the National Utility Contractors Association (NUCA), have provided new information regarding equipment that is available for this work.

To clarify these issues, we are withdrawing our July 7 letter and issuing this replacement response to your inquiry.

Question: *Section 1926.651 contains several requirements that relate to the safety of employees engaged in excavation work. Specifically, paragraphs (b)(2) and (b)(3) relate in part to the safety of the means used to locate underground utility installations that, if damaged during an uncovering operation, could pose serious hazards to employees.*

Under these provisions, what constitutes an acceptable method of uncovering underground utility lines, and further, would the use of hydro-vacuum excavation be acceptable under the standard?

Answer

Background

Two sections of 29 CFR 1926 Subpart P (Excavations), 1926.651(Specific excavation requirements), govern methods for uncovering underground utility installations. Specifically, paragraph (b)(2) states:

> When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours * * * or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used. (emphasis added).

Paragraph (b)(3) provides:

ATTACHMENT 4 (Continued)

> When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means. (emphasis added).

Therefore, "acceptable means" must be used where the location of the underground utilities have not been identified by the utility companies and detection equipment is not used.

Subpart P does not contain a definition of either "other acceptable means" or "safe and acceptable means." The preambles to both the proposed rule and the final rule discussed the rationale behind the wording at issue. For example, the preamble to the proposed rule, 52 Fed. Reg. 12301 (April 15, 1987), noted that a 1972 version of this standard contained language that specified "careful probing or hand digging" as the means to uncover utilities. The preamble then noted that an amendment to the 1972 standard later deleted that language "to allow other, *equally effective means* of locating such installations." The preamble continued that in the 1987 proposed rule, OSHA again proposed using language in section (b)(3) that would provide another example of an acceptable method of uncovering utilities that could be used *where the utilities have not been marked and detection equipment is not being used* – "probing with hand-held tools." This method was rejected in the final version of 29 CFR 1926. As OSHA explained in the preamble to the final rule, 54 Fed. Reg. 45916 (October 31, 1989):

> OSHA received two comments * * * and input from ACCSH [OSHA's Advisory Committee on Construction Safety and Health] * * * on this provision. All commenters recommended dropping 'such as probing with hand-held tools' from the proposed provision, because this could create a hazard to employees by damaging the installation or its insulation.

In other words, the commenters objected to the use of hand tools being used unless detection equipment was used in conjunction with them. OSHA then concluded its discussion relative to this provision by agreeing with the commentators and ultimately not including any examples of "acceptable means" in the final provision.

Non-conductive hand tools are permitted

This raises the question of whether the standard permits the use of hand tools alone -- without also using detection equipment. NUCA and other industry stakeholders have recently informed us that non-conductive hand tools that are appropriate to be used to locate underground utilities are now commonly available.

Such tools, such as a "shooter" (which has a non-conductive handle and a snub nose) and non-conductive or insulated probes were not discussed in the rulemaking. Since they were not considered at that time, they were not part of the class of equipment that was thought to be unsafe for this purpose. Therefore, we conclude that the use of these types of hand tools, when used with appropriate caution, is an "acceptable means" for locating underground utilities.

ATTACHMENT 4 (Continued)

Hydro-vacuum excavation

It is our understanding that some hydro-vacuum excavation equipment can be adjusted to use a minimum amount of water and suction pressure. When appropriately adjusted so that the equipment will not damage underground utilities (especially utilities that are particularly vulnerable to damage, such as electrical lines), use of such equipment would be considered a "acceptable means" of locating underground utilities. However, if the equipment cannot be sufficiently adjusted, then this method would not be acceptable under the standard.

Other technologies

We are not suggesting that these are the only devices that would be "acceptable means" under the standard. Industry stakeholders have informed us that there are other types of special excavation equipment designed for safely locating utilities as well.

We apologize for any confusion our July 7 letter may have caused. If you have further concerns or questions, please feel free to contact us again by fax at: U.S. Department of Labor, OSHA, Directorate of Construction, Office of Construction Standards and Compliance Assistance, fax # 202-693-1689. You can also contact us by mail at the above office, Room N3468, 200 Constitution Avenue, N.W., Washington, D.C. 20210, although there will be a delay in our receiving correspondence by mail.

Sincerely,

Russell B. Swanson, Director
Directorate of Construction

NOTE: OSHA requirements are set by statute, standards and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA=s interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at http://www.osha.gov.

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		Effective Date 01/28/2009	Revision 6
		Applicability Tetra Tech NUS, Inc.	
		Prepared Earth Sciences Department	
Subject DECONTAMINATION OF FIELD EQUIPMENT		Approved Tom Johnston	

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ATTACHMENTS

A INVESTIGATION-DERIVED WASTE LABEL 15

1.0 PURPOSE

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

2.0 SCOPE AND APPLICABILITY

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

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

3.0 GLOSSARY

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

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

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

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

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

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

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

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

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

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

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

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

General personnel qualifications for decontamination activities include the following:

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

5.0 HEALTH AND SAFETY

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

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

6.0 EQUIPMENT LIST

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

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

7.0 PROCEDURES

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

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

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

- Combination of some or all of the above

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

7.1 Decontamination Pad Design/Construction Considerations

7.1.1 Temporary Decontamination Pads

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

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

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

  - Well removed from pedestrian/vehicle thoroughfares.

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

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

  - Avoidance of potentially contaminated areas.

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

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

  - Areas where potable water and electricity are provided.

Safety Reminder

When utilizing electrical power sources, either hard-wired or portable-generated sources, ensure that:

- All power is routed through a Ground Fault Circuit Interrupter (GFCI).

- All power cords are in good condition (no physical damage), rated for the intended energy load, and designated for outdoor use.

In situations where accomplishing these elements is not possible, it will be necessary to implement a site electrical grounding program.

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

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

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

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

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

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

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

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

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

- Maintenance – Maintain the decontamination area by:

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

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

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

7.1.2 Decontamination Activities at Drill Rigs/DPT Units

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

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

7.1.3 Decontamination Activities at Remote Sample Locations

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

7.2 Equipment Decontamination Procedures

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

7.2.1 Monitoring Well Sampling Equipment

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

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

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

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

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

5. Rinse external pump components using tap water.

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

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

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

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

9. Drain residual deionized water to the extent possible.

10. Allow components of the equipment to air dry.

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

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

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

7.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

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

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

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

7.2.1.3 Miscellaneous Equipment

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

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

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

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

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

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

7.2.2 Downhole Drilling Equipment

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

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

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

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

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

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

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

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

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

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

SAFETY REMINDER

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

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

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

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

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

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

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

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

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

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

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

7.2.3 Soil/Sediment Sampling Equipment

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

1. Remove all loose soil from the equipment through manual means.
2. Through a combination of scrubbing using soap and water and/or steam cleaning or pressure washing, remove visible dirt/soil from the equipment.
3. Rinse the equipment with tap water.

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

4. If the equipment is contaminated or suspected to be contaminated with oil, grease, PAHs, PCBs, or other hard to remove organic materials, rinse the equipment with pesticide-grade isopropanol.
5. Rinse the equipment with deionized water.
6. To the extent possible, allow components to air dry.
7. If the equipment is to be used immediately after decontamination, screen it with a calibrated PID/FID to ensure that all solvents (if they were used) and trace contaminants have been adequately removed.
8. After the equipment has dried, wrap it in aluminum foil for storage until use.

Dredges employed in sediment sampling are typically decontaminated as follows:

- Remove the sediment sample from the sampling device
- If sufficient associated surface water is available at the sampling site, place the dredge in the water and flush to remove visible sediment.
- Extract the dredge and wash it in soap and water per the project-specific planning documents.

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

7.3 Contact Waste/Materials

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

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

7.3.1 Investigation-Derived Wastes - Decontamination Wash Waters and Sediments

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

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

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

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

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

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

   - Enclose areas accessible by the general public using construction fencing and signs.
   - Stored materials in 55-gallon drums on pallets with four (or fewer) drums per pallet.
   - Maintain the retaining bolt and label on the outside of storage containers where readily visible.
   - Provide at least 4 feet of room between each row of pallets to allow access to containers for sampling, drum removal, and spill response.
   - As directed in project-specific planning documents, maintain an IDW Inventory List and provide the list to the site Point of Contact at the termination of each shift.
   - Maintain spill response equipment at the IDW storage area in case it is required for immediate access.

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

CAUTION

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

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

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

7.4 Decontamination Evaluation

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

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

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

NOTE

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

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

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

  - Single-use disposable equipment – The number of samples should represent different types of equipment as well as different lot numbers of single-use articles.

  - The collection and the frequency of collection of rinsate samples are as follows unless specified differently in the project-specific planning documents:

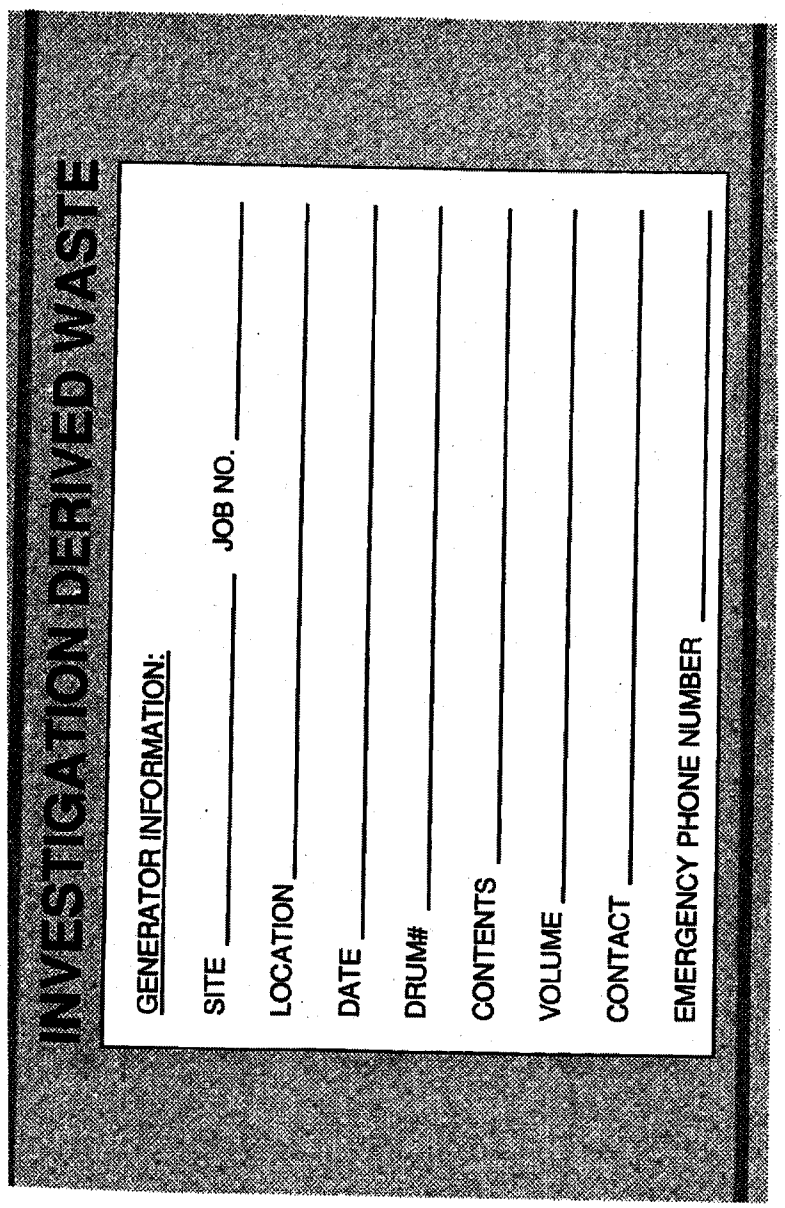
    - Per decontamination method
    - Per disposable article/batch number of disposable articles

NOTE

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and to avoid using a contaminated batch of single-use articles. It is recommended that a follow-up sample be collected later during the execution of the project to ensure that those conditions do not change.

Rinsate samples collection may be driven by types of and/or levels of contaminant. Difficult to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

Attachment A
iDW Label



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1.0 PURPOSE

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

2.0 SCOPE

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

3.0 GLOSSARY

None.

4.0 RESPONSIBILITIES AND PERSONNEL QUALIFICATIONS

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

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

General personnel qualifications for field documentation activities include the following:

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

5.0 PROCEDURES

5.1 SITE LOGBOOK

5.1.1 General

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

- All field personnel present
- Arrival/departure times and names of site visitors
- Times and dates of health and safety training
- Arrival/departure times of equipment
- Times and dates of equipment calibration

- Start and/or completion of borehole, trench, monitoring well installation activities, etc.
- Daily on-site activities
- Sample pickup information
- Health and safety issues (level of protection, personal protective equipment [PPE], etc.)
- Weather conditions

Maintain a site logbook for each project and initiate it at the start of the first on-site activity (e.g., site visit or initial reconnaissance survey). Make entries every day that on-site activities take place involving TtNUS or subcontractor personnel. Upon completion of the fieldwork, provide the site logbook to the PM or designee for inclusion in the project's central file.

Record the following information on the cover of each site logbook:

- Project name
- TtNUS project number
- Sequential book number
- Start date
- End date

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

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

Make all logbook, notebook, and log sheet entries in indelible ink (black pen is preferred). No erasures are permitted. If an incorrect entry is made, cross out the entry with a single strike mark, initial, and date it. At the completion of entries by any individual, the logbook pages used must be signed and dated by the person making the entries. The site logbook must also be signed by the FOL at the end of each day.

5.1.2 Photographs

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

5.2 FIELD NOTEBOOKS

Key field team personnel may maintain a separate dedicated field notebook to document the pertinent field activities conducted directly under their supervision. For example, on large projects with multiple investigative sites and varying operating conditions, the Health and Safety Officer may elect to maintain a

separate field notebook. Where several drill rigs are in operation simultaneously, each site geologist assigned to oversee a rig must maintain a field notebook.

5.3 FIELD FORMS

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

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

5.3.1.1 Sample Log Sheet

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

5.3.1.2 Sample Label

A typical sample label is illustrated in Attachment B. Complete the required information on the adhesive labels and apply them to every sample container. Obtain sample labels from the appropriate program/project source, request that they be electronically generated in house, or request them the laboratory subcontractor.

5.3.1.3 Chain-of-Custody Record

The chain-of-custody record is a multi-part form that is initiated as samples are acquired and accompanies a sample (or group of samples) as they are transferred from person to person. This form must be used as follows for any samples collected for chemical or geotechnical analysis whether the analyses are performed on site or off site:

- Retain one carbonless copy of the completed chain-of custody form in the field.
- Send one copy is sent to the PM (or designee)
- Send the original to the laboratory with the associated samples. Place the original (top, signed copy) of the chain-of custody form inside a large Ziploc®-type bag taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one chain-of custody form, send the form with the cooler containing vials for volatile organic compound (VOC) analysis or the cooler with the air bill attached. Indicate on the air bill how many coolers are included with that shipment.

An example of a chain-of-custody form is provided as Attachment C. After the samples are received at the laboratory, the sample cooler and contents are checked and any problems are noted on the enclosed chain-of custody form (any discrepancies between the sample labels and chain-of custody form and any other problems that are noted are resolved through communication between the laboratory point-of-contact and the TtNUS PM). The chain-of custody form is signed and copied. The laboratory will retain the copy, and the original becomes part of the samples' corresponding analytical data package.

5.3.1.4 Chain-of-Custody Seal

Attachment D is an example of a custody seal. The custody seal is an adhesive-backed label that is part of a chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field and sealed in coolers for transport to the laboratory. Sign and date custody seals

and affix them across the lid and body of each cooler (front and back) containing environmental samples (see SOP SA-6.1). Obtain custody seals from the laboratory (if available) or purchase them from a supplier.

~~5.3.1.5 Geochemical Parameters Log Sheets~~

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

5.3.2 Hydrogeological and Geotechnical Forms

5.3.2.1 Groundwater Level Measurement Sheet

Complete a Groundwater Level Measurement Sheet for each round of water level measurements made at a site.

5.3.2.2 Data Sheet for Pumping Test

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

5.3.2.3 Packer Test Report Form

Complete a Packer Test Report Form for each well at which a packer test is conducted.

5.3.2.4 Boring Log

Complete a Summary Log of Boring, or Boring Log for each soil boring performed to document the materials encountered, operation and driving of casing, and locations/depths of samples collected. In addition, if volatile organics are monitored on cores, samples, cuttings from the borehole, or breathing zone, (using a photoionization detector [PID] or flame ionization detector [FID]), enter these readings on the boring log at the appropriate depth. When they become available, enter the laboratory sample number, concentrations of key contaminants, or other pertinent information in the "Remarks" column. This feature allows direct comparison of contaminant concentrations with soil characteristics.

5.3.2.5 Monitoring Well Construction Details Form

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

5.3.2.6 Test Pit Log

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

5.3.2.7 Miscellaneous Monitoring Well Forms

Miscellaneous monitoring well forms that may be required on a project-specific basis include the Monitoring Well Materials Certificate of Conformance and Monitoring Well Development Record. Use a Monitoring Well Materials Certificate of Conformance to document all materials utilized during each monitoring well installation. Use a Monitoring Well Development Record to document all well development activities.

5.3.2.8 Miscellaneous Field Forms – Quality Assurance and Checklists

Miscellaneous field forms/checklists forms that may be required on a project-specific basis include the following:

- Container Sample and Inspection Sheet – use this form when a container (drum, tank, etc.) is sampled and/or inspected.
- QA Sample Log Sheet – use this form when a QA sample such as an equipment rinsate blank, source blank, etc. is collected.
- Field Task Modification Request (FTMR) – use this form to document deviations from the project planning documents. The FOL is responsible for initiating the FTMRs. Maintain copies of all FTMRs with the on-site planning documents, and place originals in the final evidence file.
- Field Project Daily Activities Checklist and Field Project Pre-Mobilization Checklist – used these during both the planning and field effort to ensure that all necessary tasks are planned for and completed. These two forms are not requirements but are useful tools for most field work.

5.3.3 Equipment Calibration and Maintenance Form

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

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

5.4 FIELD REPORTS

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

5.4.1 Daily Activities Report

To provide timely oversight of on-site contractors, complete and submit Daily Activities Reports (DARs) as described below.

5.4.1.1 Description

The DAR documents the activities and progress for each day's field work. Complete this report on a daily basis whenever there are drilling, test pitting, well construction, or other related activities occurring that involve subcontractor personnel. These sheets summarize the work performed and form the basis of payment to subcontractors. The DAR form can be found on the TtNUS intranet site.

5.4.1.2 Responsibilities

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

5.4.1.3 Submittal and Approval

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

5.4.2 Weekly Status Reports

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

In addition to those described herein, other summary reports may also be contractually required.

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

6.0 LISTING OF FIELD FORMS ON THE TtNUS INTRANET SITE

- Boring Log
- Container Sample and Inspection Sheet
- Daily Activities Checklist
- Daily Activities Record
- Equipment Calibration Log
- Field Task Modification Request
- Field Analytical Log sheet - Geochemical Parameters
- Groundwater Level Measurement Sheet
- Groundwater Sample Log Sheet
- Hydraulic Conductivity Test Data Sheet
- Low Flow Purge Data Sheet
- Bedrock Monitoring Well Construction (Stick Up)
- Bedrock Monitoring Well Construction Flush Mount
- Bedrock Monitoring Well Construction Open Hole
- Confining Layer Monitoring Well Construction
- Monitoring Well Development Record

- Monitoring Well Materials Certificate of Conformance
- Overburden Monitoring Well Construction Flush Mount
- Overburden Monitoring Well Construction Stick Up
- Packer Test Report Form
- Pumping Test Data Sheet
- QA Sample Log Sheet
- Soil/Sediment Sample Log Sheet
- Surface Water Sample Log Sheet
- Test Pit Log
- Field Project Pre-Mobilization Checklist

ATTACHMENT A
TYPICAL SITE LOGBOOK ENTRY

START TIME: _____ DATE: _____

SITE LEADER: _____

PERSONNEL:

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

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

ACTIVITIES:

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

_____

Field Operations Leader

ATTACHMENT B
SAMPLE LABEL

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

ATTACHMENT C
CHAIN-OF-CUSTODY RECORD FORM

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

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

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

CONTAINER TYPE PLASTIC (P) or GLASS (G)
PRESERVATIVE USED
TYPE OF ANALYSIS

DATE YEAR	TIME	SAMPLE ID	LOCATION ID	TOP DEPTH (FT)	BOTTOM DEPTH (FT)	MATRIX (GW, SO, SW, SD, QC, ETC.)	COLLECTION METHOD GRAP (G) COMP (C)	No. OF CONTAINERS									COMMENTS

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

COMMENTS

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

4/02R
FORM NO. TINUS-001

ATTACHMENT D
CHAIN-OF-CUSTODY SEAL

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

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1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide information on sample preservation, packaging, and shipping procedures to be used in handling environmental samples submitted for chemical constituent, biological, or geotechnical analysis. Sample chain-of-custody procedures and other aspects of field documentation are addressed in SOP SA-6.3. Sample identification is addressed in SOP CT-04.

2.0 SCOPE

This procedure describes the appropriate containers to be used for samples depending on the analyses to be performed, and the steps necessary to preserve the samples when shipped off site for chemical analysis.

3.0 GLOSSARY

Hazardous Material - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. Under 49 CFR, the term includes hazardous substances, hazardous wastes, marine pollutants, and elevated temperature materials, as well as materials designated as hazardous under the provisions of §172.101 and §172.102 and materials that meet the defining criteria for hazard classes and divisions in Part 173. With slight modifications, IATA has adopted DOT "hazardous materials" as IATA "Dangerous Goods."

Hazardous Waste - Any substance listed in 40 CFR, Subpart D (~~y~~261.30 et seq.), or otherwise characterized as ignitable, corrosive, reactive, or toxic (as defined by Toxicity Characteristic Leaching Procedure, TCLP, analysis) as specified under 40 CFR, Subpart C (~~y~~261.20 et seq.), that would be subject to manifest requirements specified in 40 CFR 262. Such substances are defined and regulated by EPA.

Marking - A descriptive name, identification number, instructions, cautions, weight, specification or UN marks, or combination thereof required on outer packaging of hazardous materials.

n.o.i - Not otherwise indicated (may be used interchangeably with n.o.s.).

n.o.s. - Not otherwise specified.

Packaging - A receptacle and any other components or materials necessary for compliance with the minimum packaging requirements of 49 CFR 174, including containers (other than freight containers or overpacks), portable tanks, cargo tanks, tank cars, and multi-unit tank-car tanks to perform a containment function in conformance with the minimum packaging requirements of 49 CFR 173.24(a) & (b).

Placard - Color-coded, pictorial sign which depicts the hazard class symbol and name and which is placed on the side of a vehicle transporting certain hazardous materials.

Common Preservatives:

- Hydrochloric Acid - HCl
- Sulfuric Acid - H_2SO_4
- Nitric Acid - HNO_3
- Sodium Hydroxide - NaOH

Other Preservatives

- Zinc Acetate
- Sodium Thiosulfate - $Na_2S_2O_3$

Normality (N) - Concentration of a solution expressed as equivalent per liter, an equivalent being the amount of a substance containing 1 gram-atom of replaceable hydrogen or its equivalent.

Reportable Quantity (RQ) - For the purposes of this SOP, means the quantity specified in column 3 of the Appendix to DOT 49 CFR §172.101 for any material identified in column 1 of the appendix. A spill greater than the amount specified must be reported to the National Response Center.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the location and time of collection.

4.0 RESPONSIBILITIES

Field Operations Leader - Directly responsible for the bottling, preservation, labeling, packaging, shipping, and custody of samples up to and including release to the shipper.

Field Samplers - Responsible for initiating the Chain-of-Custody Record (per SOP SA-6.3), implementing the packaging and shipping requirements, and maintaining custody of samples until they are relinquished to another custodian or to the shipper.

5.0 PROCEDURES

Sample identification, labeling, documentation, and chain-of-custody are addressed by SOP SA-6.3.

5.1 Sample Containers

Different types of chemicals react differently with sample containers made of various materials. For example, trace metals adsorb more strongly to glass than to plastic, whereas many organic chemicals may dissolve various types of plastic containers. Attachments A and B show proper containers (as well as other information) per 40 CFR 136. In general, the sample container shall allow approximately 5-10 percent air space ("ullage") to allow for expansion/vaporization if the sample warms during transport. ~~However, for collection of volatile organic compounds, head space shall be omitted~~. The analytical laboratory will generally provide certified-clean containers for samples to be analyzed for chemical constituents. ~~Shelby tubes or other sample containers are generally provided by the driller for samples requiring geotechnical analysis~~. Sufficient lead time shall be allowed for a delivery of sample container orders. Therefore, it is critical to use the correct container to maintain the integrity of the sample prior to analysis.

Once opened, the container must be used at once for storage of a particular sample. Unused but opened containers are to be considered contaminated and must be discarded. Because of the potential for introduction of contamination, they cannot be reclosed and saved for later use. Likewise, any unused containers which appear contaminated upon receipt, or which are found to have loose caps or a missing Teflon liner (if required for the container), shall be discarded.

5.2 Sample Preservation

Many water and soil samples are unstable and therefore require preservation to prevent changes in either the concentration or the physical condition of the constituent(s) requiring analysis. Although complete and irreversible preservation of samples is not possible, preservation does retard the chemical and biological

changes that inevitably take place after the sample is collected. Preservation techniques for this RI are ~~usually~~ limited to pH control, chemical addition(s), and refrigeration/ freezing ~~(certain biological samples only)~~.

5.2.1 Overview

The preservation techniques (for aqueous samples) to be used for various analytes are listed in Attachments A and B. Reagents required for sample preservation will ~~either~~ be added to the sample containers by the laboratory prior to their shipment to the field ~~or be added in the field (in a clean environment)~~. Only high purity reagents shall be used for preservation. In general, aqueous samples of low-concentration organics (or soil samples of low- or medium-concentration organics) are cooled to 4°C. Medium-concentration aqueous samples, high-hazard organic samples, and some gas samples are typically not preserved. Low-concentration aqueous samples for metals are acidified with HNO_3, whereas medium-concentration and high-hazard aqueous metal samples are not preserved. Low- or medium-concentration soil samples for metals are cooled to 4°C, whereas high-hazard samples are not cooled.

The following subsections describe the procedures for preparing and adding chemical preservatives. Attachments A and B indicate the specific analytes which require these preservatives.

The FOL is responsible for ensuring that an accurate Chemical Inventory is created and maintained for all hazardous chemicals brought to the work site (see Section 5 of the TtNUS Health and Safety Guidance Manual). Furthermore, the FOL must ensure that a corresponding Material Safety Data Sheet (MSDS) is collected for every substance entered on the site Chemical Inventory, and that all persons using/handling/ disposing of these substances review the appropriate MSDS for substances they will work with. The Chemical Inventory and the MSDSs must be maintained at each work site in a location and manner where they are readily-accessible to all personnel.

5.2.2 Preparation and Addition of Reagents

Addition of the following acids or bases may be specified for sample preservation; these reagents shall be analytical reagent (AR) grade or purer and shall be diluted to the required concentration with deionized water before field sampling commences. To avoid uncontrolled reactions, be sure to Add Acid to water (not vice versa). A dilutions guide is provided below.

Acid/Base	Dilution	Concentration	Estimated Amount Required for Preservation
Hydrochloric Acid (HCl)	1 part concentrated HCl: 1 part double-distilled, deionized water	6N	5-10 mL
Sulfuric Acid (H_2SO_4)	1 part concentrated H_2SO_4: 1 part double-distilled, deionized water	18N	2 - 5 mL
Nitric Acid (HNO_3)	Undiluted concentrated HNO_3	16N	2 - 5 mL
Sodium Hydroxide (NaOH)	400 grams solid NaOH dissolved in 870 mL double-distilled, deionized water; yields 1 liter of solution	10N	2 mL

The amounts required for preservation shown in the above table assumes proper preparation of the preservative and addition of the preservative to one liter of aqueous sample. This assumes that the sample is initially at pH 7, is poorly buffered, and does not contain particulate matter; as these conditions vary, more preservative may be required. Consequently, the final sample pH must be checked using narrow-range pH paper, as described in the generalized procedure detailed below:

- Pour off 5-10 mL of sample into a dedicated, clean container. Use some of this sample to check the initial sample pH using wide range (0-14) pH paper. Never dip the pH paper into the sample; always apply a drop of sample to the pH paper using a clean stirring rod or pipette.

- Add about one-half of the estimated preservative required to the original sample bottle. Cap and invert gently several times to mix. Check pH (as described above) using medium range pH paper (pH 0-6 or pH 7.5-14, as applicable).

- Cap sample bottle and seal securely.

Additional considerations are discussed below:

- To test if ascorbic acid must be used to remove oxidizing agents present in the sample before it can be properly preserved, place a drop of sample on KI-starch paper. A blue color indicates the need for ascorbic acid addition.

  If required, add a few crystals of ascorbic acid to the sample and retest with the KI-starch paper. Repeat until a drop of sample produces no color on the KI-starch paper. Then add an additional 0.6 grams of ascorbic acid per each liter of sample volume.

  Continue with proper base preservation of the sample as described above.

- Samples for sulfide analysis must be treated by the addition of 4 drops (0.2 mL) of 2N zinc acetate solution per 100 ml of sample.

  The 2N zinc acetate solution is made by dissolving 220 grams of zinc acetate in 870 mL of double-distilled, deionized water to make 1 liter of solution.

  The sample pH is then raised to 9 using the NaOH preservative.

- Sodium thiosulfate must be added to remove residual chlorine from a sample. To test the sample for residual chlorine use a field test kit specially made for this purpose.

  If residual chlorine is present, add 0.08 grams of sodium thiosulfate per liter of sample to remove the residual chlorine.

  Continue with proper acidification of the sample as described above.

For biological samples, 10% buffered formalin or isopropanol may also be required for preservation. Questions regarding preservation requirements should be resolved through communication with the laboratory before sampling begins.

5.3 Field Filtration

At times, field-filtration may be required to provide for the analysis of dissolved chemical constituents. Field-filtration must be performed prior to the preservation of samples as described above. General procedures for field filtration are described below:

- The sample shall be filtered through a non-metallic, 0.45-micron membrane filter, immediately after collection. The filtration system shall consist of dedicated filter canister, dedicated tubing, and a peristaltic pump with pressure or vacuum pumping squeeze action (since the sample is filtered by mechanical peristalsis, the sample travels only through the tubing).

- To perform filtration, thread the tubing through the peristaltic pump head. Attach the filter canister to the discharge end of the silicon tubing (note flow direction arrow); attach the aqueous sample container to the intake end of the silicon tubing. Turn the peristaltic pump on and perform filtration. Run approximately 100 ml of sample through the filter and discard prior to sample collection.

- Continue by preserving the filtrate (contained in the filter canister), as applicable and generally described above.

5.4 Sample Packaging and Shipping

Only employees who have successfully completed the TtNUS "Shipping Hazardous Materials" training course are authorized to package and ship hazardous substances. These trained individuals are responsible for performing shipping duties in accordance with this training.

Samples collected for shipment from a site shall be classified as either environmental or hazardous material samples. Samples from drums containing materials other than Investigative Derived Waste (IDW) and samples obtained from waste piles or bulk storage tanks are generally shipped as hazardous materials. A distinction must be made between the two types of samples in order to:

- Determine appropriate procedures for transportation of samples (if there is any doubt, a sample shall be considered hazardous and shipped accordingly.)

- Protect the health and safety of transport and laboratory personnel receiving the samples (special precautions are used by the shipper and at laboratories when hazardous materials are received.)

Detailed procedures for packaging environmental samples are outlined in the remainder of this section.

5.4.1 Environmental Samples

Environmental samples are packaged as follows:

- Place properly identified sample container, with lid securely fastened, in a plastic bag (e.g. Ziploc baggie), and seal the bag.

- Place sample in a cooler constructed of sturdy material which has been lined with a large, plastic bag (e.g. "garbage" bag). Drain plugs on coolers must be taped shut.

- Pack with enough cushioning materials such as bubble wrap (shoulders of bottles must be iced if required) to minimize the possibility of the container breaking.

- If cooling is required (see Attachments A and B), place ice around sample container shoulders, and on top of packing material (minimum of 8 pounds of ice for a medium-size cooler).

- Seal (i.e., tape or tie top in knot) large liner bag.

- The original (top, signed copy) of the COC form shall be placed inside a large Ziploc-type bag and taped inside the lid of the shipping cooler. If multiple coolers are sent but are included on one COC form, the COC form should be sent with the cooler containing the vials for VOC analysis. The COC form should then state how many coolers are included with that shipment.

- Close and seal outside of cooler as described in SOP SA-6.3. Signed custody seals must be used.

Coolers must be marked as containing "Environmental Samples." The appropriate side of the container must be marked "This End Up" and arrows placed appropriately. No DOT marking or labeling is required; there are no DOT restrictions on mode of transportation.

6.0 REFERENCES

American Public Health Association, 1981. Standard Methods for the Examination of Water and Wastewater, 15th Edition. APHA, Washington, D.C.

International Air Transport Association (latest issue). Dangerous Goods Regulations, Montreal, Quebec, Canada.

U.S. Department of Transportation (latest issue). Hazardous Materials Regulations, 49 CFR 171-177.

U.S. EPA, 1984. "Guidelines Establishing Test Procedures for the Analysis of Pollutants under Clean Water Act." Federal Register, Volume 49 (209), October 26, 1984, p. 43234.

U.S. EPA, 1979. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020, U.S. EPA-EMSL, Cincinnati, Ohio.

ATTACHMENT A

GENERAL SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample Type and Concentration		Container[1]	Sample Size	Preservation[2]	Holding Time[2]
WATER					
Organics (GC&GC/MS)	VOC Low	Borosilicate glass	2 x 40 mL	Cool to 4°C HCl to ≤ 2	14 days[9]
	Extractables (Low SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	Cool to 4°C	7 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticide/PCBs)	Amber glass	2x2 L or 4x1 L	None	7 days to extraction; 40 days after extraction
Inorganics	Metals Low	High-density polyethylene	1 L	HNO_3 to pH ≤2	6 months (Hg-28 days)
	Medium	Wide-mouth glass	16 oz.	None	6 months
	Cyanide Low	High-density polyethylene	1 L	NaOH to pH>12	14 days
	Cyanide Medium	Wide-mouth glass	16 oz.	None	14 days
Organic/ Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	14 days
SOIL					
Organics (GC&GC/MS)	VOC	EnCore Sampler	(3) 5 g Samplers	Cool to 4°C	48 hours to lab preservation
	Extractables (Low SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
	Extractables (Medium SVOCs and pesticides/PCBs)	Wide-mouth glass	8 oz.	Cool to 4°C	14 days to extraction; 40 days after extraction
Inorganics	Low/Medium	Wide-mouth glass	8 oz.	Cool to 4°C	6 months (Hg - 28 days) Cyanide (14 days)
Organic/Inorganic	High Hazard	Wide-mouth glass	8 oz.	None	NA
Dioxin/Furan	All	Wide-mouth glass	4 oz.	None	35 days until extraction; 40 days after extraction
TCLP	All	Wide-mouth glass	8 oz.	None	7 days until preparation; analysis as per fraction
AIR					
Volatile Organics	Low/Medium	Charcoal tube -- 7 cm long, 6 mm OD, 4 mm ID	100 L air	Cool to 4°C	5 days recommended

1 All glass containers should have Teflon cap liners or septa.
2 See Attachment E. Preservation and maximum holding time allowances per 40 CFR 136.

ATTACHMENT B

ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
INORGANIC TESTS:			
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Biochemical Oxygen Demand (BOD)	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Chemical Oxygen Demand (COD)	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Chloride	P, G	None required	28 days
Chlorine, Total Residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, Total and Amenable to Chlorination	P, G	Cool, 4°C; NaOH to pH 12; 0.6 g ascorbic acid[5]	14 days[6]
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH 2; H_2SO_4 to pH 2	6 months
Total Kjeldahl and Organic Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrate - Nitrogen	P, G	None required	48 hours
Nitrate-Nitrite - Nitrogen	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Nitrite - Nitrogen	P, G	Cool, 4°C	48 hours
Oil & Grease	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Total Organic Carbon (TOC)	P, G	Cool, 4°C; HCl or H_2SO_4 to pH 2	28 days
Orthophosphate	P, G	Filter immediately; Cool, 4°C	48 hours
Oxygen, Dissolved-Probe	G Bottle & top	None required	Analyze immediately
Oxygen, Dissolved-Winkler	G Bottle & top	Fix on site and store in dark	8 hours
Phenols	G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Phosphorus, Total	P, G	Cool, 4°C; H_2SO_4 to pH 2	28 days
Residue, Total	P, G	Cool, 4°C	7 days
Residue, Filterable (TDS)	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, Volatile (Ash Content)	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific Conductance	P, G	Cool, 4°C	28 days
Sulfate	P, G	Cool, 4°C	28 days

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE TWO

Parameter Number/Name	Container[1]	Preservation[2][3]	Maximum Holding Time[4]
~~INORGANIC TESTS (Cont'd):~~			
~~Sulfide~~	~~P, G~~	~~Cool, 4°C; add zinc acetate plus sodium hydroxide to pH 9~~	~~7 days~~
~~Sulfite~~	~~P, G~~	~~None required~~	~~Analyze immediately~~
~~Turbidity~~	~~P, G~~	~~Cool, 4°C~~	~~48 hours~~
METALS:[7]			
~~Chromium VI (Hexachrome)~~	~~P, G~~	~~Cool, 4°C~~	~~24 hours~~
Mercury (Hg)	P, G	HNO_3 to pH 2	28 days
Metals, except Chromium VI and Mercury	P, G	HNO_3 to pH 2	6 months
ORGANIC TESTS:[8]			
~~Purgeable Halocarbons~~	~~G, Teflon-lined septum~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]~~	~~14 days~~
~~Purgeable Aromatic Hydrocarbons~~	~~G, Teflon-lined septum~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5] HCl to pH 2 [9]~~	~~14 days~~
~~Acrolein and Acrylonitrile~~	~~G, Teflon-lined septum~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5] adjust pH to 4-5 [10]~~	~~14 days~~
~~Phenols[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]~~	~~7 days until extraction; 40 days after extraction~~
~~Benzidines[11], [12]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]~~	~~7 days until extraction[13]~~
~~Phthalate esters[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C~~	~~7 days until extraction; 40 days after extraction~~
~~Nitrosamines[11], [14]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; store in dark; 0.008% $Na_2S_2O_3$[5]~~	~~7 days until extraction; 40 days after extraction~~
~~PCBs[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C~~	~~7 days until extraction; 40 days after extraction~~
~~Nitroaromatics & Isophorone[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]; store in dark~~	~~7 days until extraction; 40 days after extraction~~
~~Polynuclear Aromatic Hydrocarbons (PAHs)[11], [14]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]; store in dark~~	~~7 days until extraction; 40 days after extraction~~
~~Haloethers[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]~~	~~7 days until extraction; 40 days after extraction~~
~~Dioxin/Furan (TCDD/TCDF)[11]~~	~~G, Teflon-lined cap~~	~~Cool, 4°C; 0.008% $Na_2S_2O_3$[5]~~	~~7 days until extraction; 40 days after extraction~~

ATTACHMENT B
ADDITIONAL REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
PAGE THREE

(1) Polyethylene (P): generally 500 ml or Glass (G): generally 1L.
(2) Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. ~~When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.~~
(3) When any sample is to be shipped by common carrier or sent through the United States Mail, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172).
(4) Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer periods, and has received a variance from the Regional Administrator.
(5) ~~Should only be used in the presence of residual chlorine.~~
(6) ~~Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments are made to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.~~
(7) ~~Samples should be filtered immediately on site before adding preservative for dissolved metals.~~
(8) Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
(9) Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
(10) The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
(11) ~~When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for 7 days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re: the analysis of benzidine).~~
(12) ~~If 1,2-diphenylthydrazine is likely to be present, adjust the pH of the sample to 4.0±0.2 to prevent rearrangement to benzidine.~~
(13) ~~Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.~~
(14) ~~For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.~~
(15) ~~The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.~~

APPENDIX E

LABORATORY QUALIFICATIONS

LABORATORY ACCREDITATION BUREAU

Certificate # L2223

Scope of Accreditation
For
Katahdin Analytical Services, Inc.

600 Technology Way
Scarborough, ME 04074
Leslie Dimond
207-874-2400

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.2) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to Katahdin Analytical Services to perform the following tests:

Accreditation granted through: **November 4, 2012**

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 608 / 8081B	4,4`-DDD
GC/ECD	EPA 608 / 8081B	4,4`-DDE
GC/ECD	EPA 608 / 8081B	4,4`-DDT
GC/ECD	EPA 608 / 8081B	Aldrin
GC/ECD	EPA 608 / 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane
GC/ECD	EPA 608 / 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608 / 8081B	Chlordane (tech.)
GC/ECD	EPA 608 / 8081B	delta-BHC
GC/ECD	EPA 608 / 8081B	Dieldrin
GC/ECD	EPA 608 / 8081B	Endosulfan I
GC/ECD	EPA 608 / 8081B	Endosulfan II
GC/ECD	EPA 608 / 8081B	Endosulfan sulfate
GC/ECD	EPA 608 / 8081B	Endrin
GC/ECD	EPA 608 / 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 608 / 8081B	Heptachlor
GC/ECD	EPA 608 / 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 608 / 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 608 / 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 608 / 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 608 / 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 608 / 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 608 / 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 608 / 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 608 / 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5'-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4', 5-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	2, 3, 3’, 4, 4’, 5, 5’-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3’, 4, 4’, 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4’, 5-Tetrachlorobiphenyl (BZ 81)
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015B/C MOD	Diesel range organics (DRO)
GC/FID	EPA 8015B/C MOD	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011 / 504	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011 / 504	1, 2-Dibromo-3-chloropropane
GC/FID	RSK-175	Methane Ethane Ethene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C / 524.2	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 1-Trichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1, 2-Trichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1-Dichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 1-Dichloroethene
GC/MS	EPA 8260B,C / 524.2	1, 1-Dichloropropene
GC/MS	EPA 8260B,C / 524.2	1, 2, 3-Trichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B,C / 524.2	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 2, 4-Trimethylbenzene
GC/MS	EPA 8260B,C / 524.2	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C / 524.2	1, 2-Dibromoethane (EDB)
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichlorobenzene
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 2-Dichloropropane
GC/MS	EPA 8260B,C / 524.2	1, 3, 5-Trimethylbenzene
GC/MS	EPA 624 / 8260B,C / 524.2	1, 3-Dichlorobenzene
GC/MS	EPA 8260B,C / 524.2	1, 3-Dichloropropane
GC/MS	EPA 624 / 8260B,C / 524.2	1, 4-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 4-Dioxane
GC/MS	EPA 8260B,C / 524.2	2, 2-Dichloropropane
GC/MS	EPA 8260B,C / 524.2	2-Butanone
GC/MS	EPA 624 / 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C / 524.2	2-Chlorotoluene
GC/MS	EPA 8260B,C / 524.2	2-Hexanone
GC/MS	EPA 8260B,C / 524.2	4-Chlorotoluene
GC/MS	EPA 8260B,C / 524.2	4-Methyl-2-pentanone
GC/MS	EPA 8260B,C / 524.2	Acetone
GC/MS	EPA 8260B,C	Acetonitrile
GC/MS	EPA 624 / 8260B,C	Acrolein
GC/MS	EPA 624 / 8260B,C / 524.2	Acrylonitrile

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C / 524.2	Allyl chloride
GC/MS	EPA 624 / 8260B,C / 524.2	Benzene
GC/MS	EPA 8260B,C / 524.2	Bromobenzene
GC/MS	EPA 8260B,C / 524.2	Bromochloromethane
GC/MS	EPA 624 / 8260B,C / 524.2	Bromodichloromethane
GC/MS	EPA 624 / 8260B,C / 524.2	Bromoform
GC/MS	EPA 8260B,C / 524.2	Carbon disulfide
GC/MS	EPA 624 / 8260B,C / 524.2	Carbon tetrachloride
GC/MS	EPA 624 / 8260B,C / 524.2	Chlorobenzene
GC/MS	EPA 624 / 8260B,C / 524.2	Chloroethane
GC/MS	EPA 624 / 8260B,C / 524.2	Chloroform
GC/MS	EPA 8260B,C	Chloroprene
GC/MS	EPA 8260B,C / 524.2	cis-1, 2-Dichloroethene
GC/MS	EPA 624 / 8260B,C / 524.2	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B,C	Cyclohexane
GC/MS	EPA 624 / 8260B,C / 524.2	Dibromochloromethane
GC/MS	EPA 8260B,C / 524.2	Dibromomethane
GC/MS	EPA 624 / 8260B,C / 524.2	Dichlorodifluoromethane
GC/MS	EPA 8260B,C / 524.2	Diethyl ether
GC/MS	EPA 8260B,C	Di-isopropylether
GC/MS	EPA 8260B,C / 524.2	Ethyl methacrylate
GC/MS	EPA 624 / 8260B,C / 524.2	Ethylbenzene
GC/MS	EPA 8260B,C	Ethyl-t-butylether
GC/MS	EPA 8260B,C / 524.2	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Iodomethane
GC/MS	EPA 8260B,C	Isobutyl alcohol
GC/MS	EPA 8260B,C / 524.2	Isopropyl benzene
GC/MS	EPA 8260B,C / 524.2	m p-xylenes
GC/MS	EPA 8260B, C	Methyl acetate
GC/MS	EPA 8260B,C / 524.2	Methacrylonitrile
GC/MS	EPA 624 / 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 624 / 8260B,C / 524.2	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B,C / 524.2	Methyl methacrylate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C / 524.2	Methyl tert-butyl ether
GC/MS	EPA 8260B,C	Methylcyclohexane
GC/MS	EPA 624 / 8260B,C / 524.2	Methylene chloride
GC/MS	EPA 8260B,C / 524.2	Naphthalene
GC/MS	EPA 8260B,C / 524.2	n-Butylbenzene
GC/MS	EPA 8260B,C / 524.2	n-Propylbenzene
GC/MS	EPA 8260B,C / 524.2	o-Xylene
GC/MS	EPA 8260B,C / 524.2	p-Isopropyltoluene
GC/MS	EPA 8260B,C / 524.2	Propionitrile
GC/MS	EPA 8260B,C / 524.2	sec-butylbenzene
GC/MS	EPA 8260B,C / 524.2	Styrene
GC/MS	EPA 8260B,C	t-Amylmethylether
GC/MS	EPA 8260B,C / 524.2	tert-Butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 624 / 8260B,C / 524.2	Tetrachloroethene (Perchloroethylene)
GC/MS	EPA 8260B,C / 524.2	Tetrahydrofuran
GC/MS	EPA 624 / 8260B,C / 524.2	Toluene
GC/MS	EPA 624 / 8260B,C / 524.2	trans-1, 2-Dichloroethylene
GC/MS	EPA 624 / 8260B,C / 524.2	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B,C / 524.2	trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 624 / 8260B,C / 524.2	Trichloroethene (Trichloroethylene)
GC/MS	EPA 624 / 8260B,C / 524.2	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 624 / 8260B,C / 524.2	Vinyl chloride
GC/MS	EPA 624 / 8260B,C	Xylene
GC/MS	EPA 8270C,D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 625 / 8270C,D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 625 / 8270C,D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Diphenylhydrazine
GC/MS	EPA 8270C,D	1, 3, 5-Trinitrobenzene
GC/MS	EPA 625 / 8270C,D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 3-Dinitrobenzene
GC/MS	EPA 625 / 8270C,D	1, 4-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1, 4-Dioxane
GC/MS	EPA 8270C,D	1, 4-Naphthoquinone
GC/MS	EPA 8270C,D	1, 4-Phenylenediamine
GC/MS	EPA 8270C,D	1-Methylnaphthalene
GC/MS	EPA 8270C,D	1-Naphthylamine
GC/MS	EPA 8270C,D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C,D	2, 4, 5-Trochlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4, 6-Trichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dimethylphenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dinitrophenol
GC/MS	EPA 625 / 8270C,D	2, 4-Dinitrotoluene (2, 4-DNT)
GC/MS	EPA 8270C,D	2, 6-Dichlorophenol
GC/MS	EPA 625 / 8270C,D	2, 6-Dinitrotoluene (2, 6-DNT)
GC/MS	EPA 8270C,D	2-Acetylaminofluorene
GC/MS	EPA 625 / 8270C,D	2-Chloronaphthalene
GC/MS	EPA 625 / 8270C,D	2-Chlorophenol
GC/MS	EPA 625 / 8270C,D	2-Methyl-4 6-dinitrophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol
GC/MS	EPA 8270C,D	2-Naphthylamine
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 625 / 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	2-Picoline
GC/MS	EPA 625 / 8270C,D	3, 3’-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3’-Dimethylbenzidine
GC/MS	EPA 8270C,D	3-Methylcholanthrene
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Aminobiphenyl
GC/MS	EPA 625 / 8270C,D	4-Bromophenyl phenyl ether
GC/MS	EPA 625 / 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 625 / 8270C,D	4-Chlorophenyl phenylether

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C,D	4-Methylphenol
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 625 / 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
GC/MS	EPA 8270C,D	7,12-Dimethylphenethylamine
GC/MS	EPA 8270C,D	a a-Dimethylphenethylamine
GC/MS	EPA 625 / 8270C,D	Acenaphthene
GC/MS	EPA 625 / 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline
GC/MS	EPA 625 / 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Aramite
GC/MS	EPA 8270C,D	Atrazine
GC/MS	EPA 8270C,D	Benzaldehyde
GC/MS	EPA 625 / 8270C,D	Benzidine
GC/MS	EPA 625 / 8270C,D	Benzo(a)anthracene
GC/MS	EPA 625 / 8270C,D	Benzo(a)pyrene
GC/MS	EPA 625 / 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 625 / 8270C,D	Benzo(g h i)perylene
GC/MS	EPA 625 / 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic Acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	Biphenyl
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 625 / 8270C,D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
GC/MS	EPA 625 / 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 625 / 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Caprolactam
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chlorobenzilate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625 / 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Diallate
GC/MS	EPA 625 / 8270C,D	Dibenz(a h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 625 / 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Dimethoate
GC/MS	EPA 625 / 8270C,D	Dimethyl phthalate
GC/MS	EPA 625 / 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 625 / 8270C,D	Di-n-octyl phthalate
GC/MS	EPA 8270C,D	Ethyl methanesulfonate
GC/MS	EPA 8270C,D	Famfur
GC/MS	EPA 625 / 8270C,D	Fluoranthene
GC/MS	EPA 625 / 8270C,D	Fluorene
GC/MS	EPA 625 / 8270C,D	Hexachlorobenzene
GC/MS	EPA 625 / 8270C,D	Hexachlorobutadiene
GC/MS	EPA 625 / 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 625 / 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Hexachloropropene
GC/MS	EPA 625 / 8270C,D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C,D	Isodrin
GC/MS	EPA 625 / 8270C,D	Isophorone
GC/MS	EPA 8270C,D	Isosafrole
GC/MS	EPA 8270C,D	Methapyriline
GC/MS	EPA 8270C,D	Methy methanesulfonate
GC/MS	EPA 8270C,D	Methyl parathion
GC/MS	EPA 625 / 8270C,D	Naphthalene
GC/MS	EPA 625 / 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	Nitroquinoline-1-oxide
GC/MS	EPA 8270C,D	n-Nitrosodiethylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitroso-di-n-butylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 625 / 8270C,D	n-Nitrosodiphenylamine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C,D	n-Nitrosomorpholine
GC/MS	EPA 8270C,D	n-Nitrosopiperidine
GC/MS	EPA 8270C,D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C,D	o o o-Triethyl phosphorothioate
GC/MS	EPA 8270C,D	o-Toluidine
GC/MS	EPA 8270C,D	Pentachlorobenzene
GC/MS	EPA 8270C,D	Pentachloronitrobenzene
GC/MS	EPA 625 / 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenacetin
GC/MS	EPA 625 / 8270C,D	Phenanthrene
GC/MS	EPA 625 / 8270C,D	Phenol
GC/MS	EPA 8270C,D	Phorate
GC/MS	EPA 8270C,D	Pronamide
GC/MS	EPA 625 / 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyrididne
GC/MS	EPA 8270C,D	Safrole
GC/MS	EPA 8270C,D	Thionazin
HPLC/UV	EPA 8330A/8330B	1, 3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A/8330B	1, 3-Dinitrobenzene
HPLC/UV	EPA 8330A/8330B	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A/8330B	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2-Amino-4, 6 -Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	2-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	3-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	3,5-Dinitroaniline
HPLC/UV	EPA 8330A/8330B	4-Amino-2,3-Dinitrotoluene
HPLC/UV	EPA 8330A/8330B	4-Nitrotoluene
HPLC/UV	EPA 8330A/8330B	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A/8330B	Hexahydro-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A/8330B	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330B	Nitroglycerin
HPLC/UV	EPA 8330A/8330B	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A/8330B	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A/8330B	Tetryl
CVAA	EPA 245.1 / 7470A	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 200.7 / 6010B,C	Aluminum
ICP/AES	EPA 200.7 / 6010B,C	Antimony
ICP/AES	EPA 200.7 / 6010B,C	Arsenic
ICP/AES	EPA 200.7 / 6010B,C	Barium
ICP/AES	EPA 200.7 / 6010B,C	Beryllium
ICP/AES	EPA 200.7 / 6010B,C	Boron
ICP/AES	EPA 200.7 / 6010B,C	Cadmium
ICP/AES	EPA 200.7 / 6010B,C	Calcium
ICP/AES	EPA 200.7 / 6010B,C	Chromium
ICP/AES	EPA 200.7 / 6010B,C	Cobalt
ICP/AES	EPA 200.7 / 6010B,C	Copper
ICP/AES	EPA 200.7 / 6010B,C	Iron
ICP/AES	EPA 200.7 / 6010B,C	Lead
ICP/AES	EPA 200.7 / 6010B,C	Magnesium
ICP/AES	EPA 200.7 / 6010B,C	Manganese
ICP/AES	EPA 200.7 / 6010B,C	Molybdenum
ICP/AES	EPA 200.7 / 6010B,C	Nickel
ICP/AES	EPA 200.7 / 6010B,C	Potassium
ICP/AES	EPA 200.7 / 6010B,C	Selenium
ICP/AES	EPA 200.7	Silicon
ICP/AES	EPA 200.7 / 6010B,C	Silver
ICP/AES	EPA 200.7 / 6010B,C	Sodium
ICP/AES	EPA 6010B,C	Strontium
ICP/AES	EPA 200.7 / 6010B,C	Thallium
ICP/AES	EPA 200.7 / 6010B,C	Tin
ICP/AES	EPA 200.7 / 6010B,C	Titanium
ICP/AES	EPA 200.7 / 6010B,C	Vanadium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/AES	EPA 200.7 / 6010B,C	Zinc
ICP/MS	EPA 200.8 / 6020A	Aluminum
ICP/MS	EPA 200.8 / 6020A	Antimony
ICP/MS	EPA 200.8 / 6020A	Arsenic
ICP/MS	EPA 200.8 / 6020A	Barium
ICP/MS	EPA 200.8 / 6020A	Beryllium
ICP/MS	EPA 200.8 / 6020A	Boron
ICP/MS	EPA 200.8 / 6020A	Cadmium
ICP/MS	EPA 200.8 / 6020A	Calcium
ICP/MS	EPA 200.8 / 6020A	Chromium
ICP/MS	EPA 200.8 / 6020A	Cobalt
ICP/MS	EPA 200.8 / 6020A	Copper
ICP/MS	EPA 200.8 / 6020A	Iron
ICP/MS	EPA 200.8 / 6020A	Lead
ICP/MS	EPA 200.8 / 6020A	Magnesium
ICP/MS	EPA 200.8 / 6020A	Manganese
ICP/MS	EPA 200.8 / 6020A	Molybdenum
ICP/MS	EPA 200.8 / 6020A	Nickel
ICP/MS	EPA 200.8 / 6020A	Potassium
ICP/MS	EPA 200.8 / 6020A	Selenium
ICP/MS	EPA 200.8 / 6020A	Silicon
ICP/MS	EPA 200.8 / 6020A	Silver
ICP/MS	EPA 200.8 / 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 200.8 / 6020A	Thallium
ICP/MS	EPA 200.8 / 6020A	Tin
ICP/MS	EPA 200.8 / 6020A	Titanium
ICP/MS	EPA 200.8 / 6020A	Tungsten
ICP/MS	EPA 200.8	Uranium
ICP/MS	EPA 200.8 / 6020A	Vanadium
ICP/MS	EPA 200.8 / 6020A	Zinc
IC	EPA 300.0 / 9056A	Bromide
IC	EPA 300.0 / 9056A	Chloride

Non-Potable Water		
Technology	**Method**	**Analyte**
IC	EPA 300.0 / 9056A	Nitrate as N
IC	EPA 300.0 / 9056A	Nitrite as N
IC	EPA 300.0 / 9056A	Nitrate + Nitrite
IC	EPA 300.0 / 9056A	Orthophosphate as P
IC	EPA 300.0 / 9056A	Sulfate
Titration	EPA 310.2 / SM 2320B	Alkalinity
Caculation	SM 2340C	Hardness
Gravimetric	EPA 1664A	Oil and Grease
Gravimetric	SM 2540B,C,D	Solids
ISE	EPA 120.1 / SM 2510B	Conductivity
ISE	SM 2520B	Practical Salinity
ISE	SM 4500F- C	Fluoride
ISE	SM 4500H+ B	pH
ISE	SM 5210B	TBOD / CBOD
Physical	EPA 1010A	Ignitability
Physical	EPA 9040C	pH
Titration	SM 2340B	Hardness
Titration	SM 4500SO_3 B	Sulfite
Titration	EPA 9034 / SM 4500S^{2-} E	Sulfide
Titration	Chap. 7.3.4	Reactive Sulfide
IR	EPA 9060A / SM 5310B	Total organic carbon
Turbidimetric	EPA 180.1 / SM 2130B	Turbidity
Turbidimetric	EPA 9038 / ASTM 516-02	Sulfate
UV/VIS	EPA 335.4 / EPA 9012B / SM 4500-CN G	Amenable cyanide
UV/VIS	EPA 350.1 / SM 4500NH3 H	Ammonia as N
UV/VIS	SM 3500Fe D	Ferrous Iron
UV/VIS	EPA 351.2	Kjeldahl nitrogen - total
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrate + Nitrite
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrate as N
UV/VIS	EPA 353.2 / SM 4500NO3 F	Nitrite as N
UV/VIS	EPA 365.1 / SM 4500P E	Orthophosphate as P
UV/VIS	EPA 365.4	Phosphorus total

Non-Potable Water		
Technology	**Method**	**Analyte**
UV/VIS	EPA 376.3	AVS-SEM
UV/VIS	EPA 410.4	COD
UV/VIS	EPA 420.1 / 9065	Total Phenolics
UV/VIS	SM 4500Cl G	Total Residual Chlorine
UV/VIS	SM 5540C	MBAS
UV/VIS	EPA 7196A / SM 3500-Cr D	Chromium VI
UV/VIS	EPA 9012B / 335.4	Total Cyanide
UV/VIS	EPA 9251 / SM 4500Cl E	Chloride
UV/VIS	Chap. 7.3.4	Reactive Cyanide
Preparation	**Method**	**Type**
Cleanup Methods	EPA 3640A	Gel Permeation Clean-up
Cleanup Methods	EPA 3630C	Silica Gel
Cleanup Methods	EPA 3660B	Sulfur Clean-Up
Cleanup Methods	EPA 3665A	Sulfuric Acid Clean-Up
Organic Preparation	EPA 3510C	Separatory Funnel Extraction
Organic Preparation	EPA 3520C	Continuous Liquid-Liquid Extraction
Inorganic Preparation	EPA 3010A	Hotblock
Volatile Organic Preparation	EPA 5030C	Purge and Trap

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	4, 4`-DDD
GC/ECD	EPA 8081B	4, 4`-DDE
GC/ECD	EPA 8081B	4, 4`-DDT
GC/ECD	EPA 8081B	Aldrin
GC/ECD	EPA 8081B	alpha-BHC (alpha-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	Alpha-Chlordane
GC/ECD	EPA 8081B	beta-BHC (beta-Hexachlorocyclohexane)
GC/ECD	EPA 608 / 8081B	Chlordane (tech.)
GC/ECD	EPA 8081B	delta-BHC
GC/ECD	EPA 8081B	Dieldrin

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8081B	Endosulfan I
GC/ECD	EPA 8081B	Endosulfan II
GC/ECD	EPA 8081B	Endosulfan sulfate
GC/ECD	EPA 8081B	Endrin
GC/ECD	EPA 8081B	Endrin aldehyde
GC/ECD	EPA 8081B	Endrin Ketone
GC/ECD	EPA 8081B	gamma-BHC (Lindane gamma-Hexachlorocyclohexane)
GC/ECD	EPA 8081B	gamma-Chlordane
GC/ECD	EPA 8081B	Heptachlor
GC/ECD	EPA 8081B	Heptachlor epoxide
GC/ECD	EPA 8081B	Methoxychlor
GC/ECD	EPA 8081B	Toxaphene (Chlorinated camphene)
GC/ECD	EPA 8082A	Aroclor-1016 (PCB-1016)
GC/ECD	EPA 8082A	Aroclor-1221 (PCB-1221)
GC/ECD	EPA 8082A	Aroclor-1232 (PCB-1232)
GC/ECD	EPA 8082A	Aroclor-1242 (PCB-1242)
GC/ECD	EPA 8082A	Aroclor-1248 (PCB-1248)
GC/ECD	EPA 8082A	Aroclor-1254 (PCB-1254)
GC/ECD	EPA 8082A	Aroclor-1260 (PCB-1260)
GC/ECD	EPA 8082A MOD	Aroclor-1262 (PCB-1262)
GC/ECD	EPA 8082A MOD	Aroclor-1268 (PCB-1268)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 5', 6-Nonachlorobiphenyl (BZ 206)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5, 6-Octachlorobiphenyl (BZ 195)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4', 5-Heptachlorobiphenyl (BZ 170)
GC/ECD	EPA 8082A	2, 2', 3, 3', 4, 4'-Hexachlorobiphenyl (BZ 128)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5, 5'-Heptachlorobiphenyl (BZ 180)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5', 6-Heptachlorobiphenyl (BZ 183)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 5'-Hexachlorobiphenyl (BZ 138)
GC/ECD	EPA 8082A	2, 2', 3, 4, 4', 6, 6'-Heptachlorobiphenyl (BZ 184)
GC/ECD	EPA 8082A	2, 2', 3, 4', 5, 5', 6-Heptachlorobiphenyl (BZ 187)
GC/ECD	EPA 8082A	2, 2', 3, 4, 5'-Pentachlorobiphenyl (BZ 87)
GC/ECD	EPA 8082A	2, 2', 3, 5'-Tetrachlorobiphenyl (BZ 44)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/ECD	EPA 8082A	2, 2', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 153)
GC/ECD	EPA 8082A	2, 2', 4, 5, 5'-Pentachlorobiphenyl (BZ 101)
GC/ECD	EPA 8082A	2, 2', 4', 5-Tetrachlorobiphenyl (BZ 49)
GC/ECD	EPA 8082A	2, 2', 5, 5'-Tetrachlorobiphenyl (BZ 52)
GC/ECD	EPA 8082A	2, 2', 5-Trichlorobiphenyl (BZ 18)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5-Hexachlorobiphenyl (BZ 156)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4', 5'-Hexachlorobiphenyl (BZ 157)
GC/ECD	EPA 8082A	2, 3, 3', 4, 4'-Pentachlorobiphenyl (BZ 105)
GC/ECD	EPA 8082A	2, 3, 3’, 4, 4’, 5, 5’-Heptachlorobiphenyl (BZ 189)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 167)
GC/ECD	EPA 8082A	2, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 118)
GC/ECD	EPA 8082A	2, 3', 4, 4',5-Pentachlorobiphenyl (BZ 123)
GC/ECD	EPA 8082A	2, 3', 4, 4'-Tetrachlorobiphenyl (BZ 66)
GC/ECD	EPA 8082A	2, 3’, 4, 4’, 5-Pentachlorobiphenyl (BZ 114)
GC/ECD	EPA 8082A	2, 4, 4'-Trichlorobiphenyl (BZ 28)
GC/ECD	EPA 8082A	2, 4'-Dichlorobiphenyl (BZ 8)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5, 5'-Hexachlorobiphenyl (BZ 169)
GC/ECD	EPA 8082A	3, 3', 4, 4', 5-Pentachlorobiphenyl (BZ 126)
GC/ECD	EPA 8082A	3, 3', 4, 4'-Tetrachlorobiphenyl (BZ 77)
GC/ECD	EPA 8082A	3, 4, 4’, 5-Tetrachlorobiphenyl (BZ 81)
GC/ECD	EPA 8082A	Decachlorobiphenyl (BZ 209)
GC/ECD	EPA 8151A	2, 4, 5-T
GC/ECD	EPA 8151A	2, 4-D
GC/ECD	EPA 8151A	2, 4-DB
GC/ECD	EPA 8151A	Dalapon
GC/ECD	EPA 8151A	Dicamba
GC/ECD	EPA 8151A	Dichloroprop
GC/ECD	EPA 8151A	Dinoseb
GC/ECD	EPA 8151A	MCPA
GC/ECD	EPA 8151A	MCPP
GC/ECD	EPA 8151A	Pentachlorophenol
GC/ECD	EPA 8151A	Silvex (2, 4, 5-TP)
GC/FID	EPA 8015C	Diesel range organics (DRO)

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/FID	EPA 8015C	Gasoline range organics (GRO)
GC/FID/PID	MA DEP VPH	Volatile Organic Hydrocarbons
GC/FID	MA DEP EPH	Extractable Petroleum Hydrocarbons
GC/FID	TNRCC Method 1005	Total Petroleum Hydrocarbons
GC/FID	FL-PRO	Petroleum Range Organics
GC/ECD	EPA 8011	1, 2-Dibromoethane (EDB)
GC/ECD	EPA 8011	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C	1, 1, 1, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1,1,2-Trichloro-1,2,2-trifluoroethane
GC/MS	EPA 8260B,C	1, 1, 1-Trichloroethane
GC/MS	EPA 8260B,C	1, 1, 2, 2-Tetrachloroethane
GC/MS	EPA 8260B,C	1, 1, 2-Trichloroethane
GC/MS	EPA 8260B,C	1, 1-Dichloroethane
GC/MS	EPA 8260B,C	1, 1-Dichloroethylene
GC/MS	EPA 8260B,C	1, 1-Dichloropropene
GC/MS	EPA 8260B,C	1, 2, 3-Trichlorobenzene
GC/MS	EPA 8260B,C	1, 2, 3-Trichloropropane
GC/MS	EPA 8260B,C	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8260B,C	1, 2, 4-Trimethylbenzene
GC/MS	EPA 8260B,C	1, 2-Dibromo-3-chloropropane
GC/MS	EPA 8260B,C	1, 2-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 2-Dichloroethane
GC/MS	EPA 8260B,C	1, 2-Dichloropropane
GC/MS	EPA 8260B,C	1, 3, 5-Trimethylbenzene
GC/MS	EPA 8260B,C	1, 3-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 3-Dichloropropane
GC/MS	EPA 8260B,C	1, 4-Dichlorobenzene
GC/MS	EPA 8260B,C	1, 4-Dioxane
GC/MS	EPA 8260B,C	2, 2-Dichloropropane
GC/MS	EPA 8260B,C	2-Butanone
GC/MS	EPA 8260B,C	2-Chloroethyl vinyl ether
GC/MS	EPA 8260B,C	2-Chlorotoluene
GC/MS	EPA 8260B,C	2-Hexanone

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	4-Chlorotoluene
GC/MS	EPA 8260B,C	4-Methyl-2-pentanone
GC/MS	EPA 8260B,C	Acetone
GC/MS	EPA 8260B,C	Acetonitrile
GC/MS	EPA 8260B,C	Acrolein
GC/MS	EPA 8260B,C	Acrylonitrile
GC/MS	EPA 8260B,C	Allyl chloride
GC/MS	EPA 8260B,C	Benzene
GC/MS	EPA 8260B,C	Bromobenzene
GC/MS	EPA 8260B,C	Bromochloromethane
GC/MS	EPA 8260B,C	Bromodichloromethane
GC/MS	EPA 8260B,C	Bromoform
GC/MS	EPA 8260B,C	Carbon disulfide
GC/MS	EPA 8260B,C	Carbon tetrachloride
GC/MS	EPA 8260B,C	Chlorobenzene
GC/MS	EPA 8260B,C	Chloroethane
GC/MS	EPA 8260B,C	Chloroform
GC/MS	EPA 8260B,C	Chloroprene
GC/MS	EPA 8260B,C	cis-1, 2-Dichloroethene
GC/MS	EPA 8260B,C	cis-1, 3-Dichloropropene
GC/MS	EPA 8260B,C	Cyclohexane
GC/MS	EPA 8260B,C	Dibromochloromethane
GC/MS	EPA 8260B,C	Dibromomethane
GC/MS	EPA 8260B,C	Dichlorodifluoromethane
GC/MS	EPA 8260B,C	Diethyl ether
GC/MS	EPA 8260B,C	Di-isopropylether
GC/MS	EPA 8260B,C	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260B,C	Ethyl methacrylate
GC/MS	EPA 8260B,C	Ethylbenzene
GC/MS	EPA 8260B,C	Ethyl-t-butylether
GC/MS	EPA 8260B,C	Hexachlorobutadiene
GC/MS	EPA 8260B,C	Iodomethane
GC/MS	EPA 8260B,C	Isobutyl alcohol

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260B,C	Isopropyl benzene
GC/MS	EPA 8260B, C	Methyl acetate
GC/MS	EPA 8260B,C	Methacrylonitrile
GC/MS	EPA 8260B,C	Methyl bromide (Bromomethane)
GC/MS	EPA 8260B,C	Methyl chloride (Chloromethane)
GC/MS	EPA 8260B,C	Methyl methacrylate
GC/MS	EPA 8260B,C	Methyl tert-butyl ether
GC/MS	EPA 8260B,C	Methylcyclohexane
GC/MS	EPA 8260B,C	Methylene chloride
GC/MS	EPA 8260B,C	Naphthalene
GC/MS	EPA 8260B,C	n-Butylbenzene
GC/MS	EPA 8260B,C	n-proplybenzene
GC/MS	EPA 8260B,C	o-Xylene
GC/MS	EPA 8260B,C	p-Isopropyltoluene
GC/MS	EPA 8260B,C	Propionitrile
GC/MS	EPA 8260B,C	sec-butylbenzene
GC/MS	EPA 8260B,C	Styrene
GC/MS	EPA 8260B,C	t-Amylmethylether
GC/MS	EPA 8260B,C	tert-Butyl alcohol
GC/MS	EPA 8260B,C	tert-Butylbenzene
GC/MS	EPA 8260B,C	Tetrachloroethylene (Perchloroethylene)
GC/MS	EPA 8260B,C	Tetrahydrofuran
GC/MS	EPA 8260B,C	Toluene
GC/MS	EPA 8260B,C	trans-1, 2-Dichloroethylene
GC/MS	EPA 8260B,C	trans-1, 3-Dichloropropylene
GC/MS	EPA 8260B,C	Trans-1, 4-Dichloro-2-butuene
GC/MS	EPA 8260B,C	Trichloroethene (Trichloroethylene)
GC/MS	EPA 8260B,C	Trichlorofluoromethane
GC/MS	EPA 8260B,C	Vinyl acetate
GC/MS	EPA 8260B,C	Vinyl chloride
GC/MS	EPA 8260B,C	Xylene
GC/MS	EPA 8270C,D	1-Methylnaphthalene
GC/MS	EPA 8270C,D	1-Naphthylamine

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	2-Acetylaminofluorene
GC/MS	EPA 8270C,D	2-Chloronaphthalene
GC/MS	EPA 8270C,D	2-Chlorophenol
GC/MS	EPA 8270C,D	2-Methylnaphthalene
GC/MS	EPA 8270C,D	2-Methylphenol
GC/MS	EPA 8270C,D	2-Naphthylamine
GC/MS	EPA 8270C,D	2-Nitroaniline
GC/MS	EPA 8270C,D	2-Nitrophenol
GC/MS	EPA 8270C,D	2-Picoline
GC/MS	EPA 8270C,D	3-Methylcholanthrene
GC/MS	EPA 8270C,D	3-Nitroaniline
GC/MS	EPA 8270C,D	4-Aminobiphenyl
GC/MS	EPA 8270C,D	4-Bromophenyl phenyl ether
GC/MS	EPA 8270C,D	4-Chloro-3-methylphenol
GC/MS	EPA 8270C,D	4-Chloroaniline
GC/MS	EPA 8270C,D	4-Chlorophenyl phenylether
GC/MS	EPA 8270C,D	4-Dimethyl aminoazobenzene
GC/MS	EPA 8270C,D	4-Methylphenol
GC/MS	EPA 8270C,D	4-Nitroaniline
GC/MS	EPA 8270C,D	4-Nitrophenol
GC/MS	EPA 8270C,D	5-Nitro-o-toluidine
GC/MS	EPA 8270C,D	a a-Dimethylphenethylamine
GC/MS	EPA 8270C,D	Acenaphthene
GC/MS	EPA 8270C,D	Acenaphthylene
GC/MS	EPA 8270C,D	Acetophenone
GC/MS	EPA 8270C,D	Aniline
GC/MS	EPA 8270C,D	Anthracene
GC/MS	EPA 8270C,D	Aramite
GC/MS	EPA 8270C,D	Atrazine
GC/MS	EPA 8270C,D	Benzaldehyde
GC/MS	EPA 8270C,D	Benzidine
GC/MS	EPA 8270C,D	Benzo(a)anthracene
GC/MS	EPA 8270C,D	Benzo(a)pyrene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Benzo(b)fluoranthene
GC/MS	EPA 8270C,D	Benzo(g h i)perylene
GC/MS	EPA 8270C,D	Benzo(k)fluoranthene
GC/MS	EPA 8270C,D	Benzoic Acid
GC/MS	EPA 8270C,D	Benzyl alcohol
GC/MS	EPA 8270C,D	Biphenyl
GC/MS	EPA 8270C,D	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270C,D	bis(2-Chloroethyl) ether
GC/MS	EPA 8270C,D	bis(2-Ethylhexyl) phthalate (DEHP)
GC/MS	EPA 8270C,D	Butyl benzyl phthalate
GC/MS	EPA 8270C,D	Caprolactam
GC/MS	EPA 8270C,D	Carbazole
GC/MS	EPA 8270C,D	Chlorobenzilate
GC/MS	EPA 8270C,D	Chrysene
GC/MS	EPA 8270C,D	Diallate
GC/MS	EPA 8270C,D	Dibenz(a h)anthracene
GC/MS	EPA 8270C,D	Dibenzofuran
GC/MS	EPA 8270C,D	Diethyl phthalate
GC/MS	EPA 8270C,D	Dimethoate
GC/MS	EPA 8270C,D	Dimethyl phthalate
GC/MS	EPA 8270C,D	Di-n-butyl phthalate
GC/MS	EPA 8270C,D	Di-n-octyl phthalate
GC/MS	EPA 8270C,D	Ethyl methanesulfonate
GC/MS	EPA 8270C,D	Famfur
GC/MS	EPA 8270C,D	Fluoranthene
GC/MS	EPA 8270C,D	Fluorene
GC/MS	EPA 8270C,D	Hexachlorobenzene
GC/MS	EPA 8270C,D	Hexachlorobutadiene
GC/MS	EPA 8270C,D	Hexachlorocyclopentadiene
GC/MS	EPA 8270C,D	Hexachloroethane
GC/MS	EPA 8270C,D	Hexachloropropene
GC/MS	EPA 8270C,D	Isodrin
GC/MS	EPA 8270C,D	Isophorone

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	Isosafrole
GC/MS	EPA 8270C,D	Methapyriline
GC/MS	EPA 8270C,D	Methyl methanesulfonate
GC/MS	EPA 8270C,D	Methyl parathion
GC/MS	EPA 8270C,D	Naphthalene
GC/MS	EPA 8270C,D	Nitrobenzene
GC/MS	EPA 8270C,D	Nitroquinoline-1-oxide
GC/MS	EPA 8270C,D	n-Nitrosodiethylamine
GC/MS	EPA 8270C,D	n-Nitrosodimethylamine
GC/MS	EPA 8270C,D	n-Nitroso-di-n-butylamine
GC/MS	EPA 8270C,D	n-Nitrosodi-n-propylamine
GC/MS	EPA 8270C,D	n-Nitrosodiphenylamine
GC/MS	EPA 8270C,D	n-Nitrosomethylethylamine
GC/MS	EPA 8270C,D	n-Nitrosomorpholine
GC/MS	EPA 8270C,D	n-Nitrosopiperidine
GC/MS	EPA 8270C,D	n-Nitrosopyrrolidine
GC/MS	EPA 8270C,D	o o o-Triethyl phosphorothioate
GC/MS	EPA 8270C,D	o-Toluidine
GC/MS	EPA 8270C,D	Pentachlorobenzene
GC/MS	EPA 8270C,D	Pentachloronitrobenzene
GC/MS	EPA 8270C,D	Pentachlorophenol
GC/MS	EPA 8270C,D	Phenacetin
GC/MS	EPA 8270C,D	Phenanthrene
GC/MS	EPA 8270C,D	Phenol
GC/MS	EPA 8270C,D	Phorate
GC/MS	EPA 8270C,D	Pronamide
GC/MS	EPA 8270C,D	Pyrene
GC/MS	EPA 8270C,D	Pyrididne
GC/MS	EPA 8270C,D	Safrole
GC/MS	EPA 8270C,D	Thionazin
GC/MS	EPA 8270C,D	Indeno(1, 2, 3-cd)pyrene
GC/MS	EPA 8270C,D	1, 2, 4-Trichlorobenzene
GC/MS	EPA 8270C,D	1, 3, 5-Trinitrobenzene

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270C,D	1, 2, 4, 5-Tetrachlorobenzene
GC/MS	EPA 8270C,D	2, 4, 5-Trochlorophenol
GC/MS	EPA 8270C,D	2, 4, 6-Trichlorophenol
GC/MS	EPA 8270C,D	2, 3, 4, 6-Tetrachlorophenol
GC/MS	EPA 8270C,D	1, 2-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 2-Diphenylhydrazine
GC/MS	EPA 8270C,D	1, 3-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 3-Dinitrobenzene
GC/MS	EPA 8270C,D	1, 4-Dichlorobenzene
GC/MS	EPA 8270C,D	1, 4-Dioxane
GC/MS	EPA 8270C,D	1, 4-Naphthoquinone
GC/MS	EPA 8270C,D	1, 4-Phenylenediamine
GC/MS	EPA 8270C,D	bis(2-Chloroisopropyl) ether (2, 2`-Oxybis(1-chloropropane))
GC/MS	EPA 8270C,D	2, 4-Dichlorophenol
GC/MS	EPA 8270C,D	2, 4-Dimethylphenol
GC/MS	EPA 8270C,D	2, 4-Dinitrophenol
GC/MS	EPA 8270C,D	2, 4-Dinitrotoluene (2 4-DNT)
GC/MS	EPA 8270C,D	2, 6-Dichlorophenol
GC/MS	EPA 8270C,D	2, 6-Dinitrotoluene (2 6-DNT)
GC/MS	EPA 8270C,D	3, 3`-Dichlorobenzidine
GC/MS	EPA 8270C,D	3, 3’-Dimethylbenzidine
GC/MS	EPA 8270C,D	2-Methyl-4, 6-dinitrophenol
GC/MS	EPA 8270C,D	7,12-Dimethylphenethylamine
HPLC/UV	EPA 8330A	1 ,3, 5-Trinitrobenzene
HPLC/UV	EPA 8330A	1, 3-Dinitrobenzene
HPLC/UV	EPA 8330A	2, 4, 6-Trinitrotoluene
HPLC/UV	EPA 8330A	2, 4-Dinitrotoluene
HPLC/UV	EPA 8330A	2, 6-Dinitrotoluene
HPLC/UV	EPA 8330A	2-Amino-4, 6 -dinitrotoluene
HPLC/UV	EPA 8330A	2-Nitrotoluene
HPLC/UV	EPA 8330A	3-Nitrotoluene
HPLC/UV	EPA 8330A	3,5-Dinitroaniline

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
HPLC/UV	EPA 8330A	4-Amino-2,3-dinitrotoluene
HPLC/UV	EPA 8330A	4-Nitrotoluene
HPLC/UV	EPA 8330A	Ethylene glycol dinitrate (EGDN)
HPLC/UV	EPA 8330A	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	EPA 8330A	Nitrobenzene
HPLC/UV	EPA 8330A MOD	Nitroglycerin
HPLC/UV	EPA 8330A	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	EPA 8330A	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	EPA 8330A	Tetryl
HPLC/UV	8330B (W/O Soil Grinding)	1, 3, 5-Trinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	1, 3-Dinitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	2, 4, 6-Trinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2, 4-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2, 6-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Amino-4, 6 -Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	2-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	3,5-Dinitroaniline
HPLC/UV	8330B (W/O Soil Grinding)	4-Amino-2,3-Dinitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	4-Nitrotoluene
HPLC/UV	8330B (W/O Soil Grinding)	Ethylene glycol dinitrate (EGDN)
HPLC/UV	8330B (W/O Soil Grinding)	Hexahydr-1, 3, 5-trinitro-1, 3, 5-triazine (RDX)
HPLC/UV	8330B (W/O Soil Grinding)	Nitrobenzene
HPLC/UV	8330B (W/O Soil Grinding)	Nitroglycerin
HPLC/UV	8330B (W/O Soil Grinding)	Octahydro-1, 3, 5, 7-tetrazocine (HMX)
HPLC/UV	8330B (W/O Soil Grinding)	Pentaerythritol Tetranitrate (PETN)
HPLC/UV	8330B (W/O Soil Grinding)	Tetryl
CVAA	EPA 7471B	Mercury
CVAF	EPA 1631E	Low Level Mercury
ICP/AES	EPA 6010B,C	Aluminum
ICP/AES	EPA 6010B,C	Antimony
ICP/AES	EPA 6010B,C	Arsenic
ICP/AES	EPA 6010B,C	Barium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/AES	EPA 6010B,C	Beryllium
ICP/AES	EPA 6010B,C	Boron
ICP/AES	EPA 6010B,C	Cadmium
ICP/AES	EPA 6010B,C	Calcium
ICP/AES	EPA 6010B,C	Chromium
ICP/AES	EPA 6010B,C	Cobalt
ICP/AES	EPA 6010B,C	Copper
ICP/AES	EPA 6010B,C	Iron
ICP/AES	EPA 6010B,C	Lead
ICP/AES	EPA 6010B,C	Magnesium
ICP/AES	EPA 6010B,C	Manganese
ICP/AES	EPA 6010B,C	Molybdenum
ICP/AES	EPA 6010B,C	Nickel
ICP/AES	EPA 6010B,C	Potassium
ICP/AES	EPA 6010B,C	Selenium
ICP/AES	EPA 200.7	Silicon
ICP/AES	EPA 6010B,C	Silver
ICP/AES	EPA 6010B,C	Sodium
ICP/AES	EPA 6010B,C	Strontium
ICP/AES	EPA 6010B,C	Thallium
ICP/AES	EPA 6010B,C	Tin
ICP/AES	EPA 6010B,C	Titanium
ICP/AES	EPA 6010B,C	Vanadium
ICP/AES	EPA 6010B,C	Zinc
ICP/MS	EPA 6020A	Aluminum
ICP/MS	EPA 6020A	Antimony
ICP/MS	EPA 6020A	Arsenic
ICP/MS	EPA 6020A	Barium
ICP/MS	EPA 6020A	Beryllium
ICP/MS	EPA 6020A	Boron
ICP/MS	EPA 6020A	Cadmium
ICP/MS	EPA 6020A	Calcium
ICP/MS	EPA 6020A	Chromium

Solid and Chemical Waste		
Technology	**Method**	**Analyte**
ICP/MS	EPA 6020A	Cobalt
ICP/MS	EPA 6020A	Copper
ICP/MS	EPA 6020A	Iron
ICP/MS	EPA 6020A	Lead
ICP/MS	EPA 6020A	Magnesium
ICP/MS	EPA 6020A	Manganese
ICP/MS	EPA 6020A	Molybdenum
ICP/MS	EPA 6020A	Nickel
ICP/MS	EPA 6020A	Potassium
ICP/MS	EPA 6020A	Selenium
ICP/MS	EPA 6020A	Silver
ICP/MS	EPA 6020A	Sodium
ICP/MS	EPA 6020A	Strontium
ICP/MS	EPA 6020A	Thallium
ICP/MS	EPA 6020A	Tin
ICP/MS	EPA 6020A	Titanium
ICP/MS	EPA 6020A	Tungsten
ICP/MS	EPA 6020A	Vanadium
ICP/MS	EPA 6020A	Zinc
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Nitrate as N
IC	EPA 9056A	Nitrite as N
IC	EPA 9056A	Sulfate
Gravimetric	EPA 9070A / 9071B	Oil and Grease
Physical	EPA 1010A	Ignitability
Physical	EPA 9045D	pH
Titration	Chap 7.3.4	Reactive Sulfide
IR	Lloyd Kahn	Total organic carbon
Turbidimetric	EPA 9038 / ASTM 516-02	Sulfate
UV/VIS	EPA 350.1 / SM 4500NH3 H	Ammonia as N
UV/VIS	EPA 9251 / SM 4500Cl E	Chloride
UV/VIS	Chap. 7.3.4	Reactive Cyanide

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Solid and Chemical Waste		
Technology	**Method**	**Analyte**
UV/VIS	EPA 376.3	AVS-SEM
UV/VIS	SM 3500Fe D	Ferrous Iron
Cleanup Methods	EPA 3630C	Silica Gel
UV/VIS	EPA 7196	Chromium VI
UV/VIS	EPA 7196A	Chromium VI
UV/VIS	EPA 9012B	Total cyanide
Preparation	**Method**	**Type**
Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure
Preparation	EPA 1312	Synthetic Precipitation Leaching Procedure
Cleanup Methods	EPA 3660B	Sulfur Clean-up
Cleanup Methods	EPA 3620C	Florsil Clean-up
Cleanup Methods	EPA 3630C	Silica Gel Clean-up
Cleanup Methods	EPA 3640A	GPC Clean-up
Organic Preparation	EPA 3540C	Soxhlet Extraction
Organic Preparation	EPA 3545A	Pressurized Fluid Extraction
Organic Preparation	EPA 3550C	Sonication
Inorganics Preparation	EPA 3050B	Hotblock
Inorganics Preparation	EPA 3060A	Alkaline Digestion
Volatile Organics Preparation	EPA 5035/5035A	Closed System Purge and Trap

Notes:

1) This laboratory offers commercial testing service.

Approved By: _____ Date: May 26, 2011

R. Douglas Leonard
Chief Technical Officer

Issued: 11/04/09 Revised: 01/11/10 Revised: 04/06/10 Revised: 9/9/10 Revised: 10/13/10
Revised: 1/20/11 Revised: 4/13/11 Revised: 5/26/11

State of Maine

Laboratory Certification Program

Awards Certification To

Katahdin Analytical Services

Located at

600 Technology Way
Scarborough, ME, 04074

For the demonstration of capability of performing the analyses listed on the attached certified analytes list(s) as required by 22 M.R.S.A., Chapter 157-A.

Laboratory ID: ME00019
Certificate Number: 2010040
Date of Issue: 6/1/2010
Expiration Date: 6/1/2012

Certification Officer

This certificate must be displayed with the corresponding analyte list.
This certificate supersedes all previously issued certificates.
Continuing certification status is dependent on successful ongoing participation in the program.
Customers may verify the laboratory's current certification status by calling (207) 287-1929.

Maine Center for Disease Control and Prevention
An Office of the Department of Health and Human Services
John E. Baldacci, Governor Brenda M. Harvey, Commissioner

Department of Health and Human Services
Maine Center for Disease Control and Prevention
286 Water Street
11 State House Station
Augusta, Maine 04333-0011
Tel: (207) 287-1929; Fax: (207) 287-4172
TTY: 1-800-606-0215

Field of Testing Summary for:

Katahdin Analytical Services

(207) 874-2400

600 Technology Way
Scarborough ME 04074

As required by 22 M.R.S.A Chapter 157-A the laboratory demonstrated the capability to analyze analtyes under 10-144 CMR 263, the rules for laboratory certification and is hereby granted certification for:

ASTM D516-02	
Sulfate	Clean Water Program (NPW)
EPA 1010A	
Ignitability	Resource Conservation Recovery Program (NPW)
Ignitability	Resource Conservation Recovery Program (S)
EPA 120.1	
Conductivity	Clean Water Program (NPW)
EPA 1311	
Extraction/Preparation	Resource Conservation Recovery Program (NPW)
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 1312	
Extraction/Preparation	Resource Conservation Recovery Program (NPW)
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 1631B	
Mercury	Clean Water Program (NPW)
EPA 1664A	
Oil & Grease	Clean Water Program (NPW)
EPA 1664A (HEM)	
n-Hexane Extractable Material (O&G)	Clean Water Program (NPW)
EPA 180.1 2	
Turbidity	Safe Drinking Water Program (DW)
EPA 200.7 4.4	
Aluminum	Clean Water Program (NPW)
Antimony	Clean Water Program (NPW)
Arsenic	Clean Water Program (NPW)
Barium	Clean Water Program (NPW)
Barium	Safe Drinking Water Program (DW)
Beryllium	Clean Water Program (NPW)
Beryllium	Safe Drinking Water Program (DW)
Boron	Clean Water Program (NPW)
Cadmium	Clean Water Program (NPW)
Cadmium	Safe Drinking Water Program (DW)
Calcium	Clean Water Program (NPW)
Calcium	Safe Drinking Water Program (DW)
Chromium	Clean Water Program (NPW)
Chromium	Safe Drinking Water Program (DW)
Cobalt	Clean Water Program (NPW)
Copper	Clean Water Program (NPW)
Copper	Safe Drinking Water Program (DW)
Iron	Clean Water Program (NPW)
Lead	Clean Water Program (NPW)
Magnesium	Clean Water Program (NPW)
Magnesium	Safe Drinking Water Program (DW)
Manganese	Clean Water Program (NPW)
Molybdenum	Clean Water Program (NPW)

To be considered valid, this Fields of Testing Summary must be displayed with a current certificate.

ME00019
Certificate Number: 2010040
FOT Issue Date: 6/22/2010
Expiration Date: 6/1/2012

Matthew J. Sica, Certification Officer

Nickel	Clean Water Program (NPW)
Nickel	Safe Drinking Water Program (DW)
Potassium	Clean Water Program (NPW)
Selenium	Clean Water Program (NPW)
Silica as SiO2	Clean Water Program (NPW)
Silica as SiO2	Safe Drinking Water Program (DW)
Silver	Clean Water Program (NPW)
Sodium	Clean Water Program (NPW)
Sodium	Safe Drinking Water Program (DW)
Thallium	Clean Water Program (NPW)
Tin	Clean Water Program (NPW)
Vanadium	Clean Water Program (NPW)
Zinc	Clean Water Program (NPW)
EPA 200.8 5.4	
Aluminum	Clean Water Program (NPW)
Antimony	Clean Water Program (NPW)
Antimony	Safe Drinking Water Program (DW)
Arsenic	Clean Water Program (NPW)
Arsenic	Safe Drinking Water Program (DW)
Barium	Clean Water Program (NPW)
Barium	Safe Drinking Water Program (DW)
Beryllium	Clean Water Program (NPW)
Beryllium	Safe Drinking Water Program (DW)
Cadmium	Clean Water Program (NPW)
Cadmium	Safe Drinking Water Program (DW)
Calcium	Clean Water Program (NPW)
Chromium	Clean Water Program (NPW)
Chromium	Safe Drinking Water Program (DW)
Cobalt	Clean Water Program (NPW)
Copper	Clean Water Program (NPW)
Copper	Safe Drinking Water Program (DW)
Lead	Clean Water Program (NPW)
Lead	Safe Drinking Water Program (DW)
Manganese	Clean Water Program (NPW)
Molybdenum	Clean Water Program (NPW)
Nickel	Clean Water Program (NPW)
Nickel	Safe Drinking Water Program (DW)
Selenium	Clean Water Program (NPW)
Selenium	Safe Drinking Water Program (DW)
Silver	Clean Water Program (NPW)
Thallium	Clean Water Program (NPW)
Thallium	Safe Drinking Water Program (DW)
Uranium	Safe Drinking Water Program (DW)
Vanadium	Clean Water Program (NPW)
Zinc	Clean Water Program (NPW)
EPA 245.1 3	
Mercury	Clean Water Program (NPW)
Mercury	Safe Drinking Water Program (DW)
EPA 300.0 2.1	
Bromide	Clean Water Program (NPW)
Bromide	Safe Drinking Water Program (DW)
Chloride	Clean Water Program (NPW)
Nitrate as N	Clean Water Program (NPW)
Nitrate as N	Safe Drinking Water Program (DW)
Nitrite as N	Safe Drinking Water Program (DW)
Orthophosphate as P	Clean Water Program (NPW)
Sulfate	Clean Water Program (NPW)
EPA 300.1 1	
Nitrite as N	Clean Water Program (NPW)
EPA 3005A	
Extraction/Preparation	Resource Conservation Recovery Program (NPW)
EPA 3050A	
Extraction/Preparation	Resource Conservation Recovery Program (S)

EPA 3050B	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 3060A	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 335.4	
Total Cyanide	Clean Water Program (NPW)
Total Cyanide	Safe Drinking Water Program (DW)
EPA 350.1 2	
Ammonia as N	Clean Water Program (NPW)
EPA 351.2 2	
Kjeldahl nitrogen - total	Clean Water Program (NPW)
EPA 3510C	
Extraction/Preparation	Resource Conservation Recovery Program (NPW)
EPA 3520C	
Extraction/Preparation	Resource Conservation Recovery Program (NPW)
EPA 353.2 2	
Nitrate as N	Clean Water Program (NPW)
Nitrate as N	Safe Drinking Water Program (DW)
Nitrite as N	Clean Water Program (NPW)
Nitrite as N	Safe Drinking Water Program (DW)
EPA 3540C	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 3545A	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 3550B	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 3580A	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 3640A	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 365.4	
Phosphorus, total	Clean Water Program (NPW)
EPA 3660B	
Extraction/Preparation	Resource Conservation Recovery Program (S)
EPA 410.4 2	
Chemical oxygen demand	Clean Water Program (NPW)
EPA 420.1	
Total Phenolics	Clean Water Program (NPW)
EPA 504.1 1.1	
1,2-Dibromo-3-chloropropane (DBCP)	Safe Drinking Water Program (DW)
1,2-Dibromoethane (EDB, Ethylene dibromide)	Safe Drinking Water Program (DW)
EPA 524.2 4.1	
1,1,1-Trichloroethane	Safe Drinking Water Program (DW)
1,1,2-Trichloroethane	Safe Drinking Water Program (DW)
1,1-Dichloroethylene	Safe Drinking Water Program (DW)
1,2,4-Trichlorobenzene	Safe Drinking Water Program (DW)
1,2-Dichlorobenzene	Safe Drinking Water Program (DW)
1,2-Dichloroethane	Safe Drinking Water Program (DW)
1,2-Dichloropropane	Safe Drinking Water Program (DW)
1,4-Dichlorobenzene	Safe Drinking Water Program (DW)
Benzene	Safe Drinking Water Program (DW)
Bromodichloromethane	Safe Drinking Water Program (DW)
Bromoform	Safe Drinking Water Program (DW)
Carbon tetrachloride	Safe Drinking Water Program (DW)
Chlorobenzene	Safe Drinking Water Program (DW)
Chloroform	Safe Drinking Water Program (DW)
cis-1,2-Dichloroethylene	Safe Drinking Water Program (DW)
Dibromochloromethane	Safe Drinking Water Program (DW)
Dichloromethane (Methylene chloride)	Safe Drinking Water Program (DW)
Ethylbenzene	Safe Drinking Water Program (DW)
Styrene	Safe Drinking Water Program (DW)
Tetrachloroethylene	Safe Drinking Water Program (DW)

Toluene	Safe Drinking Water Program (DW)
Total Trihalomethanes	Safe Drinking Water Program (DW)
trans-1,2-Dicloroethylene	Safe Drinking Water Program (DW)
Trichloroethene (Trichloroethylene)	Safe Drinking Water Program (DW)
Vinyl chloride	Safe Drinking Water Program (DW)
Xylene (total)	Safe Drinking Water Program (DW)
EPA 6010B	
Aluminum	Resource Conservation Recovery Program (NPW)
Aluminum	Resource Conservation Recovery Program (S)
Antimony	Resource Conservation Recovery Program (NPW)
Antimony	Resource Conservation Recovery Program (S)
Arsenic	Resource Conservation Recovery Program (NPW)
Arsenic	Resource Conservation Recovery Program (S)
Barium	Resource Conservation Recovery Program (NPW)
Barium	Resource Conservation Recovery Program (S)
Beryllium	Resource Conservation Recovery Program (NPW)
Beryllium	Resource Conservation Recovery Program (S)
Boron	Resource Conservation Recovery Program (NPW)
Boron	Resource Conservation Recovery Program (S)
Cadmium	Resource Conservation Recovery Program (NPW)
Cadmium	Resource Conservation Recovery Program (S)
Calcium	Resource Conservation Recovery Program (NPW)
Calcium	Resource Conservation Recovery Program (S)
Chromium	Resource Conservation Recovery Program (NPW)
Chromium	Resource Conservation Recovery Program (S)
Cobalt	Resource Conservation Recovery Program (NPW)
Cobalt	Resource Conservation Recovery Program (S)
Copper	Resource Conservation Recovery Program (NPW)
Copper	Resource Conservation Recovery Program (S)
Hardness (calc.)	Resource Conservation Recovery Program (NPW)
Hardness (calc.)	Resource Conservation Recovery Program (S)
Iron	Resource Conservation Recovery Program (NPW)
Iron	Resource Conservation Recovery Program (S)
Lead	Resource Conservation Recovery Program (NPW)
Lead	Resource Conservation Recovery Program (S)
Magnesium	Resource Conservation Recovery Program (NPW)
Magnesium	Resource Conservation Recovery Program (S)
Manganese	Resource Conservation Recovery Program (NPW)
Manganese	Resource Conservation Recovery Program (S)
Molybdenum	Resource Conservation Recovery Program (NPW)
Molybdenum	Resource Conservation Recovery Program (S)
Nickel	Resource Conservation Recovery Program (NPW)
Nickel	Resource Conservation Recovery Program (S)
Potassium	Resource Conservation Recovery Program (NPW)
Potassium	Resource Conservation Recovery Program (S)
Selenium	Resource Conservation Recovery Program (NPW)
Selenium	Resource Conservation Recovery Program (S)
Silicon	Resource Conservation Recovery Program (NPW)
Silicon	Resource Conservation Recovery Program (S)
Silver	Resource Conservation Recovery Program (NPW)
Silver	Resource Conservation Recovery Program (S)
Sodium	Resource Conservation Recovery Program (NPW)
Sodium	Resource Conservation Recovery Program (S)
Strontium	Resource Conservation Recovery Program (NPW)
Strontium	Resource Conservation Recovery Program (S)
Thallium	Resource Conservation Recovery Program (NPW)
Thallium	Resource Conservation Recovery Program (S)
Tin	Resource Conservation Recovery Program (NPW)
Tin	Resource Conservation Recovery Program (S)
Vanadium	Resource Conservation Recovery Program (NPW)
Vanadium	Resource Conservation Recovery Program (S)
Zinc	Resource Conservation Recovery Program (NPW)
Zinc	Resource Conservation Recovery Program (S)
EPA 6010C	

Aluminum	Resource Conservation Recovery Program (NPW)
Aluminum	Resource Conservation Recovery Program (S)
Antimony	Resource Conservation Recovery Program (NPW)
Antimony	Resource Conservation Recovery Program (S)
Arsenic	Resource Conservation Recovery Program (NPW)
Arsenic	Resource Conservation Recovery Program (S)
Barium	Resource Conservation Recovery Program (NPW)
Barium	Resource Conservation Recovery Program (S)
Beryllium	Resource Conservation Recovery Program (NPW)
Beryllium	Resource Conservation Recovery Program (S)
Boron	Resource Conservation Recovery Program (NPW)
Boron	Resource Conservation Recovery Program (S)
Cadmium	Resource Conservation Recovery Program (NPW)
Cadmium	Resource Conservation Recovery Program (S)
Calcium	Resource Conservation Recovery Program (NPW)
Calcium	Resource Conservation Recovery Program (S)
Chromium	Resource Conservation Recovery Program (NPW)
Chromium	Resource Conservation Recovery Program (S)
Cobalt	Resource Conservation Recovery Program (NPW)
Cobalt	Resource Conservation Recovery Program (S)
Copper	Resource Conservation Recovery Program (NPW)
Copper	Resource Conservation Recovery Program (S)
Iron	Resource Conservation Recovery Program (NPW)
Iron	Resource Conservation Recovery Program (S)
Lead	Resource Conservation Recovery Program (NPW)
Lead	Resource Conservation Recovery Program (S)
Magnesium	Resource Conservation Recovery Program (NPW)
Magnesium	Resource Conservation Recovery Program (S)
Manganese	Resource Conservation Recovery Program (NPW)
Manganese	Resource Conservation Recovery Program (S)
Molybdenum	Resource Conservation Recovery Program (NPW)
Molybdenum	Resource Conservation Recovery Program (S)
Nickel	Resource Conservation Recovery Program (NPW)
Nickel	Resource Conservation Recovery Program (S)
Potassium	Resource Conservation Recovery Program (NPW)
Potassium	Resource Conservation Recovery Program (S)
Selenium	Resource Conservation Recovery Program (NPW)
Selenium	Resource Conservation Recovery Program (S)
Silicon	Resource Conservation Recovery Program (NPW)
Silicon	Resource Conservation Recovery Program (S)
Silver	Resource Conservation Recovery Program (NPW)
Silver	Resource Conservation Recovery Program (S)
Sodium	Resource Conservation Recovery Program (NPW)
Sodium	Resource Conservation Recovery Program (S)
Strontium	Resource Conservation Recovery Program (NPW)
Strontium	Resource Conservation Recovery Program (S)
Thallium	Resource Conservation Recovery Program (NPW)
Thallium	Resource Conservation Recovery Program (S)
Tin	Resource Conservation Recovery Program (NPW)
Tin	Resource Conservation Recovery Program (S)
Vanadium	Resource Conservation Recovery Program (NPW)
Vanadium	Resource Conservation Recovery Program (S)
Zinc	Resource Conservation Recovery Program (NPW)
Zinc	Resource Conservation Recovery Program (S)
EPA 6020	
Aluminum	Resource Conservation Recovery Program (NPW)
Aluminum	Resource Conservation Recovery Program (S)
Antimony	Resource Conservation Recovery Program (NPW)
Antimony	Resource Conservation Recovery Program (S)
Arsenic	Resource Conservation Recovery Program (NPW)
Arsenic	Resource Conservation Recovery Program (S)
Barium	Resource Conservation Recovery Program (NPW)
Barium	Resource Conservation Recovery Program (S)
Beryllium	Resource Conservation Recovery Program (NPW)

Beryllium	Resource Conservation Recovery Program (S)
Boron	Resource Conservation Recovery Program (NPW)
Boron	Resource Conservation Recovery Program (S)
Cadmium	Resource Conservation Recovery Program (NPW)
Cadmium	Resource Conservation Recovery Program (S)
Calcium	Resource Conservation Recovery Program (NPW)
Calcium	Resource Conservation Recovery Program (S)
Chromium	Resource Conservation Recovery Program (NPW)
Chromium	Resource Conservation Recovery Program (S)
Cobalt	Resource Conservation Recovery Program (NPW)
Cobalt	Resource Conservation Recovery Program (S)
Copper	Resource Conservation Recovery Program (NPW)
Copper	Resource Conservation Recovery Program (S)
Iron	Resource Conservation Recovery Program (NPW)
Iron	Resource Conservation Recovery Program (S)
Lead	Resource Conservation Recovery Program (NPW)
Lead	Resource Conservation Recovery Program (S)
Magnesium	Resource Conservation Recovery Program (NPW)
Magnesium	Resource Conservation Recovery Program (S)
Manganese	Resource Conservation Recovery Program (NPW)
Manganese	Resource Conservation Recovery Program (S)
Molybdenum	Resource Conservation Recovery Program (NPW)
Molybdenum	Resource Conservation Recovery Program (S)
Nickel	Resource Conservation Recovery Program (NPW)
Nickel	Resource Conservation Recovery Program (S)
Potassium	Resource Conservation Recovery Program (NPW)
Potassium	Resource Conservation Recovery Program (S)
Selenium	Resource Conservation Recovery Program (NPW)
Selenium	Resource Conservation Recovery Program (S)
Silver	Resource Conservation Recovery Program (NPW)
Silver	Resource Conservation Recovery Program (S)
Sodium	Resource Conservation Recovery Program (NPW)
Sodium	Resource Conservation Recovery Program (S)
Strontium	Resource Conservation Recovery Program (NPW)
Strontium	Resource Conservation Recovery Program (S)
Thallium	Resource Conservation Recovery Program (NPW)
Thallium	Resource Conservation Recovery Program (S)
Tin	Resource Conservation Recovery Program (NPW)
Tin	Resource Conservation Recovery Program (S)
Uranium	Resource Conservation Recovery Program (NPW)
Uranium	Resource Conservation Recovery Program (S)
Vanadium	Resource Conservation Recovery Program (NPW)
Vanadium	Resource Conservation Recovery Program (S)
Zinc	Resource Conservation Recovery Program (NPW)
Zinc	Resource Conservation Recovery Program (S)
EPA 6020A	
Aluminum	Resource Conservation Recovery Program (NPW)
Aluminum	Resource Conservation Recovery Program (S)
Antimony	Resource Conservation Recovery Program (NPW)
Antimony	Resource Conservation Recovery Program (S)
Arsenic	Resource Conservation Recovery Program (NPW)
Arsenic	Resource Conservation Recovery Program (S)
Barium	Resource Conservation Recovery Program (NPW)
Barium	Resource Conservation Recovery Program (S)
Beryllium	Resource Conservation Recovery Program (NPW)
Beryllium	Resource Conservation Recovery Program (S)
Boron	Resource Conservation Recovery Program (NPW)
Boron	Resource Conservation Recovery Program (S)
Cadmium	Resource Conservation Recovery Program (NPW)
Cadmium	Resource Conservation Recovery Program (S)
Calcium	Resource Conservation Recovery Program (NPW)
Calcium	Resource Conservation Recovery Program (S)
Chromium	Resource Conservation Recovery Program (NPW)
Chromium	Resource Conservation Recovery Program (S)

Cobalt	Resource Conservation Recovery Program (NPW)
Cobalt	Resource Conservation Recovery Program (S)
Copper	Resource Conservation Recovery Program (NPW)
Copper	Resource Conservation Recovery Program (S)
Iron	Resource Conservation Recovery Program (NPW)
Iron	Resource Conservation Recovery Program (S)
Lead	Resource Conservation Recovery Program (NPW)
Lead	Resource Conservation Recovery Program (S)
Magnesium	Resource Conservation Recovery Program (NPW)
Magnesium	Resource Conservation Recovery Program (S)
Manganese	Resource Conservation Recovery Program (NPW)
Manganese	Resource Conservation Recovery Program (S)
Molybdenum	Resource Conservation Recovery Program (NPW)
Molybdenum	Resource Conservation Recovery Program (S)
Nickel	Resource Conservation Recovery Program (NPW)
Nickel	Resource Conservation Recovery Program (S)
Potassium	Resource Conservation Recovery Program (NPW)
Potassium	Resource Conservation Recovery Program (S)
Selenium	Resource Conservation Recovery Program (NPW)
Selenium	Resource Conservation Recovery Program (S)
Silicon	Resource Conservation Recovery Program (NPW)
Silicon	Resource Conservation Recovery Program (S)
Silver	Resource Conservation Recovery Program (NPW)
Silver	Resource Conservation Recovery Program (S)
Sodium	Resource Conservation Recovery Program (NPW)
Sodium	Resource Conservation Recovery Program (S)
Strontium	Resource Conservation Recovery Program (NPW)
Strontium	Resource Conservation Recovery Program (S)
Thallium	Resource Conservation Recovery Program (NPW)
Thallium	Resource Conservation Recovery Program (S)
Tin	Resource Conservation Recovery Program (NPW)
Tin	Resource Conservation Recovery Program (S)
Uranium	Resource Conservation Recovery Program (NPW)
Uranium	Resource Conservation Recovery Program (S)
Vanadium	Resource Conservation Recovery Program (NPW)
Vanadium	Resource Conservation Recovery Program (S)
Zinc	Resource Conservation Recovery Program (NPW)
Zinc	Resource Conservation Recovery Program (S)
EPA 608	
4,4'-DDD	Clean Water Program (NPW)
4,4'-DDE	Clean Water Program (NPW)
4,4'-DDT	Clean Water Program (NPW)
Aldrin	Clean Water Program (NPW)
alpha-BHC	Clean Water Program (NPW)
Aroclor-1016 (PCB-1016)	Clean Water Program (NPW)
Aroclor-1221 (PCB-1221)	Clean Water Program (NPW)
Aroclor-1232 (PCB-1232)	Clean Water Program (NPW)
Aroclor-1242 (PCB-1242)	Clean Water Program (NPW)
Aroclor-1248 (PCB-1248)	Clean Water Program (NPW)
Aroclor-1254 (PCB-1254)	Clean Water Program (NPW)
Aroclor-1260 (PCB-1260)	Clean Water Program (NPW)
beta-BHC	Clean Water Program (NPW)
Chlordane (tech.)	Clean Water Program (NPW)
delta-BHC	Clean Water Program (NPW)
Dieldrin	Clean Water Program (NPW)
Endosulfan I	Clean Water Program (NPW)
Endosulfan II	Clean Water Program (NPW)
Endosulfan sulfate	Clean Water Program (NPW)
Endrin	Clean Water Program (NPW)
Endrin aldehyde	Clean Water Program (NPW)
gamma-BHC	Clean Water Program (NPW)
Heptachlor	Clean Water Program (NPW)
Heptachlor epoxide	Clean Water Program (NPW)
Toxaphene	Clean Water Program (NPW)

EPA 624

1,1,1-Trichloroethane	Clean Water Program (NPW)
1,1,2,2-Tetrachloroethane	Clean Water Program (NPW)
1,1,2-Trichloroethane	Clean Water Program (NPW)
1,1-Dichloroethane	Clean Water Program (NPW)
1,1-Dichloroethylene	Clean Water Program (NPW)
1,2-Dichlorobenzene	Clean Water Program (NPW)
1,2-Dichloroethane	Clean Water Program (NPW)
1,2-Dichloropropane	Clean Water Program (NPW)
1,3-Dichlorobenzene	Clean Water Program (NPW)
1,4-Dichlorobenzene	Clean Water Program (NPW)
2-Chloroethyl vinyl ether	Clean Water Program (NPW)
Acrolein	Clean Water Program (NPW)
Acrylonitrile	Clean Water Program (NPW)
Benzene	Clean Water Program (NPW)
Bromodichloromethane	Clean Water Program (NPW)
Bromoform	Clean Water Program (NPW)
Bromomethane (Methyl bromide)	Clean Water Program (NPW)
Carbon tetrachloride	Clean Water Program (NPW)
Chlorobenzene	Clean Water Program (NPW)
Chloroethane	Clean Water Program (NPW)
Chloroform	Clean Water Program (NPW)
cis-1,3-Dichloropropene	Clean Water Program (NPW)
Dibromochloromethane	Clean Water Program (NPW)
Dichlorodifluoromethane	Clean Water Program (NPW)
Dichloromethane (Methylene chloride)	Clean Water Program (NPW)
Ethylbenzene	Clean Water Program (NPW)
Methyl chloride (Chloromethane)	Clean Water Program (NPW)
Tetrachloroethylene	Clean Water Program (NPW)
Toluene	Clean Water Program (NPW)
trans-1,2-Dicloroethylene	Clean Water Program (NPW)
trans-1,3-Dichloropropylene	Clean Water Program (NPW)
Trichloroethene (Trichloroethylene)	Clean Water Program (NPW)
Trichlorofluoromethane	Clean Water Program (NPW)
Vinyl chloride	Clean Water Program (NPW)

EPA 625

1,2,4-Trichlorobenzene	Clean Water Program (NPW)
2,4,6-Trichlorophenol	Clean Water Program (NPW)
2,4-Dichlorophenol	Clean Water Program (NPW)
2,4-Dimethylphenol	Clean Water Program (NPW)
2,4-Dinitrophenol	Clean Water Program (NPW)
2,4-Dinitrotoluene (2,4-DNT)	Clean Water Program (NPW)
2,6-Dinitrotoluene (2,6-DNT)	Clean Water Program (NPW)
2-Chloronaphthalene	Clean Water Program (NPW)
2-Chlorophenol	Clean Water Program (NPW)
2-Methyl-4,6-dinitrophenol	Clean Water Program (NPW)
2-Nitrophenol	Clean Water Program (NPW)
3,3'-Dichlorobenzidine	Clean Water Program (NPW)
4,6-Dinitro-2-methylphenol	Clean Water Program (NPW)
4-Bromophenyl phenyl ether	Clean Water Program (NPW)
4-Chloro-3-methylphenol	Clean Water Program (NPW)
4-Chlorophenyl phenylether	Clean Water Program (NPW)
4-Nitrophenol	Clean Water Program (NPW)
Acenaphthene	Clean Water Program (NPW)
Acenaphthylene	Clean Water Program (NPW)
Anthracene	Clean Water Program (NPW)
Benzidine	Clean Water Program (NPW)
Benzo[a]anthracene	Clean Water Program (NPW)
Benzo[a]pyrene	Clean Water Program (NPW)
Benzo[b]fluoranthene	Clean Water Program (NPW)
Benzo[g,h,i]perylene	Clean Water Program (NPW)
Benzo[k]fluoranthene	Clean Water Program (NPW)
bis(2-Chloroethoxy)methane	Clean Water Program (NPW)
bis(2-Chloroethyl)ether	Clean Water Program (NPW)

bis(2-Chloroisopropyl)ether	Clean Water Program (NPW)
bis(2-Ethylhexyl)phthalate (DEHP)	Clean Water Program (NPW)
Butyl benzyl phthalate	Clean Water Program (NPW)
Chrysene	Clean Water Program (NPW)
Dibenz[a,h]anthracene	Clean Water Program (NPW)
Diethyl phthalate	Clean Water Program (NPW)
Dimethyl phthalate	Clean Water Program (NPW)
Di-n-butyl phthalate	Clean Water Program (NPW)
Di-n-octyl phthalate	Clean Water Program (NPW)
Fluoranthene	Clean Water Program (NPW)
Fluorene	Clean Water Program (NPW)
Hexachlorobenzene	Clean Water Program (NPW)
Hexachlorobutadiene	Clean Water Program (NPW)
Hexachlorocyclopentadiene	Clean Water Program (NPW)
Hexachloroethane	Clean Water Program (NPW)
Indeno[1,2,3-cd]pyrene	Clean Water Program (NPW)
Isophorone	Clean Water Program (NPW)
Naphthalene	Clean Water Program (NPW)
Nitrobenzene	Clean Water Program (NPW)
n-Nitrosodimethylamine	Clean Water Program (NPW)
n-Nitroso-di-n-propylamine	Clean Water Program (NPW)
n-Nitrosodiphenylamine	Clean Water Program (NPW)
Pentachlorophenol	Clean Water Program (NPW)
Phenanthrene	Clean Water Program (NPW)
Phenol	Clean Water Program (NPW)
Pyrene	Clean Water Program (NPW)
EPA 7196A 1	
Chromium VI	Resource Conservation Recovery Program (NPW)
Chromium VI	Resource Conservation Recovery Program (S)
EPA 7470A	
Mercury	Resource Conservation Recovery Program (NPW)
EPA 7471A	
Mercury	Resource Conservation Recovery Program (S)
EPA 7471B	
Mercury	Resource Conservation Recovery Program (S)
EPA 8015B	
Ethanol	Resource Conservation Recovery Program (S)
Ethylene glycol	Resource Conservation Recovery Program (S)
Isopropyl alcohol	Resource Conservation Recovery Program (S)
Methanol	Resource Conservation Recovery Program (S)
Propylene Glycol	Resource Conservation Recovery Program (S)
EPA 8015C	
Ethanol	Resource Conservation Recovery Program (S)
Isopropanol	Resource Conservation Recovery Program (S)
Methanol	Resource Conservation Recovery Program (S)
EPA 8081A	
4,4'-DDD	Resource Conservation Recovery Program (NPW)
4,4'-DDD	Resource Conservation Recovery Program (S)
4,4'-DDE	Resource Conservation Recovery Program (NPW)
4,4'-DDE	Resource Conservation Recovery Program (S)
4,4'-DDT	Resource Conservation Recovery Program (NPW)
4,4'-DDT	Resource Conservation Recovery Program (S)
Aldrin	Resource Conservation Recovery Program (NPW)
Aldrin	Resource Conservation Recovery Program (S)
alpha-BHC	Resource Conservation Recovery Program (NPW)
alpha-BHC	Resource Conservation Recovery Program (S)
alpha-Chlordane	Resource Conservation Recovery Program (NPW)
alpha-Chlordane	Resource Conservation Recovery Program (S)
beta-BHC	Resource Conservation Recovery Program (NPW)
beta-BHC	Resource Conservation Recovery Program (S)
Chlordane (tech.)	Resource Conservation Recovery Program (NPW)
Chlordane (tech.)	Resource Conservation Recovery Program (S)
delta-BHC	Resource Conservation Recovery Program (NPW)

delta-BHC	Resource Conservation Recovery Program (S)
Dieldrin	Resource Conservation Recovery Program (NPW)
Dieldrin	Resource Conservation Recovery Program (S)
Endosulfan I	Resource Conservation Recovery Program (NPW)
Endosulfan I	Resource Conservation Recovery Program (S)
Endosulfan II	Resource Conservation Recovery Program (NPW)
Endosulfan II	Resource Conservation Recovery Program (S)
Endosulfan sulfate	Resource Conservation Recovery Program (NPW)
Endosulfan sulfate	Resource Conservation Recovery Program (S)
Endrin	Resource Conservation Recovery Program (NPW)
Endrin	Resource Conservation Recovery Program (S)
Endrin aldehyde	Resource Conservation Recovery Program (NPW)
Endrin aldehyde	Resource Conservation Recovery Program (S)
Endrin ketone	Resource Conservation Recovery Program (NPW)
Endrin ketone	Resource Conservation Recovery Program (S)
gamma-BHC	Resource Conservation Recovery Program (NPW)
gamma-BHC	Resource Conservation Recovery Program (S)
gamma-Chlordane	Resource Conservation Recovery Program (NPW)
gamma-Chlordane	Resource Conservation Recovery Program (S)
Heptachlor	Resource Conservation Recovery Program (NPW)
Heptachlor	Resource Conservation Recovery Program (S)
Heptachlor epoxide	Resource Conservation Recovery Program (NPW)
Heptachlor epoxide	Resource Conservation Recovery Program (S)
Methoxychlor	Resource Conservation Recovery Program (NPW)
Methoxychlor	Resource Conservation Recovery Program (S)
Toxaphene	Resource Conservation Recovery Program (NPW)
Toxaphene	Resource Conservation Recovery Program (S)
EPA 8081B	
4,4'-DDD	Resource Conservation Recovery Program (NPW)
4,4'-DDD	Resource Conservation Recovery Program (S)
4,4'-DDE	Resource Conservation Recovery Program (NPW)
4,4'-DDE	Resource Conservation Recovery Program (S)
4,4'-DDT	Resource Conservation Recovery Program (NPW)
4,4'-DDT	Resource Conservation Recovery Program (S)
Aldrin	Resource Conservation Recovery Program (NPW)
Aldrin	Resource Conservation Recovery Program (S)
alpha-BHC	Resource Conservation Recovery Program (NPW)
alpha-BHC	Resource Conservation Recovery Program (S)
alpha-Chlordane	Resource Conservation Recovery Program (NPW)
alpha-Chlordane	Resource Conservation Recovery Program (S)
beta-BHC	Resource Conservation Recovery Program (NPW)
beta-BHC	Resource Conservation Recovery Program (S)
Chlordane (tech.)	Resource Conservation Recovery Program (NPW)
Chlordane (tech.)	Resource Conservation Recovery Program (S)
delta-BHC	Resource Conservation Recovery Program (NPW)
delta-BHC	Resource Conservation Recovery Program (S)
Dieldrin	Resource Conservation Recovery Program (NPW)
Dieldrin	Resource Conservation Recovery Program (S)
Endosulfan I	Resource Conservation Recovery Program (NPW)
Endosulfan I	Resource Conservation Recovery Program (S)
Endosulfan II	Resource Conservation Recovery Program (NPW)
Endosulfan II	Resource Conservation Recovery Program (S)
Endosulfan sulfate	Resource Conservation Recovery Program (NPW)
Endosulfan sulfate	Resource Conservation Recovery Program (S)
Endrin	Resource Conservation Recovery Program (NPW)
Endrin	Resource Conservation Recovery Program (S)
Endrin aldehyde	Resource Conservation Recovery Program (NPW)
Endrin aldehyde	Resource Conservation Recovery Program (S)
Endrin ketone	Resource Conservation Recovery Program (NPW)
Endrin ketone	Resource Conservation Recovery Program (S)
gamma-BHC	Resource Conservation Recovery Program (NPW)
gamma-BHC	Resource Conservation Recovery Program (S)
gamma-Chlordane	Resource Conservation Recovery Program (NPW)
gamma-Chlordane	Resource Conservation Recovery Program (S)

Heptachlor	Resource Conservation Recovery Program (NPW)
Heptachlor	Resource Conservation Recovery Program (S)
Heptachlor epoxide	Resource Conservation Recovery Program (NPW)
Heptachlor epoxide	Resource Conservation Recovery Program (S)
Methoxychlor	Resource Conservation Recovery Program (NPW)
Methoxychlor	Resource Conservation Recovery Program (S)
Toxaphene	Resource Conservation Recovery Program (NPW)
Toxaphene	Resource Conservation Recovery Program (S)
EPA 8082	
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,3',4,4',5,6-Octachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,3',4,4',5,6-Octachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,3',4,4',5-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,3',4,4',5-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,3',4,4'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,3',4,4'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4,4',5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4,4',5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4',5,5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4',5,5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4,5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4,5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',4,5,5'-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',4,5,5'-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',5,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',5,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',5-Trichlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',5-Trichlorobiphenyl	Resource Conservation Recovery Program (S)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3,3',4,4'-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3,3',4,4'-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3',4,4',5'-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3',4,4',5'-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3',4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3',4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3,4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3,4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
2,4,4'-Trichlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,4,4'-Trichlorobiphenyl	Resource Conservation Recovery Program (S)
2,4'-Dichlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,4'-Dichlorobiphenyl	Resource Conservation Recovery Program (S)
3,3',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
3,3',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
3,3',4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (NPW)
3,3',4,4',5-Pentachlorobiphenyl	Resource Conservation Recovery Program (S)
3,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
3,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
3,4,4',5-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
3,4,4',5-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
Aroclor-1016 (PCB-1016)	Resource Conservation Recovery Program (NPW)

Aroclor-1016 (PCB-1016)	Resource Conservation Recovery Program (S)
Aroclor-1221 (PCB-1221)	Resource Conservation Recovery Program (NPW)
Aroclor-1221 (PCB-1221)	Resource Conservation Recovery Program (S)
Aroclor-1232 (PCB-1232)	Resource Conservation Recovery Program (NPW)
Aroclor-1232 (PCB-1232)	Resource Conservation Recovery Program (S)
Aroclor-1242 (PCB-1242)	Resource Conservation Recovery Program (NPW)
Aroclor-1242 (PCB-1242)	Resource Conservation Recovery Program (S)
Aroclor-1248 (PCB-1248)	Resource Conservation Recovery Program (NPW)
Aroclor-1248 (PCB-1248)	Resource Conservation Recovery Program (S)
Aroclor-1254 (PCB-1254)	Resource Conservation Recovery Program (NPW)
Aroclor-1254 (PCB-1254)	Resource Conservation Recovery Program (S)
Aroclor-1260 (PCB-1260)	Resource Conservation Recovery Program (NPW)
Aroclor-1260 (PCB-1260)	Resource Conservation Recovery Program (S)
Aroclor-1262 (PCB 1262)	Resource Conservation Recovery Program (NPW)
Aroclor-1262 (PCB 1262)	Resource Conservation Recovery Program (S)
Aroclor-1268 (PCB-1268)	Resource Conservation Recovery Program (NPW)
Aroclor-1268 (PCB-1268)	Resource Conservation Recovery Program (S)
Decachlorobiphenyl	Resource Conservation Recovery Program (NPW)
Decachlorobiphenyl	Resource Conservation Recovery Program (S)
EPA 8082A	
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4,4',5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4,4',5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,4',5,5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,4',5,5',6-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',3,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',3,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',4,4',5,5'-Hexachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',5,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',5,5'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
2,2',5-Trichlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,2',5-Trichlorobiphenyl	Resource Conservation Recovery Program (S)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	Resource Conservation Recovery Program (S)
2,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (NPW)
2,3',4,4'-Tetrachlorobiphenyl	Resource Conservation Recovery Program (S)
Aroclor-1016 (PCB-1016)	Resource Conservation Recovery Program (NPW)
Aroclor-1016 (PCB-1016)	Resource Conservation Recovery Program (S)
Aroclor-1221 (PCB-1221)	Resource Conservation Recovery Program (NPW)
Aroclor-1221 (PCB-1221)	Resource Conservation Recovery Program (S)
Aroclor-1232 (PCB-1232)	Resource Conservation Recovery Program (NPW)
Aroclor-1232 (PCB-1232)	Resource Conservation Recovery Program (S)
Aroclor-1242 (PCB-1242)	Resource Conservation Recovery Program (NPW)
Aroclor-1242 (PCB-1242)	Resource Conservation Recovery Program (S)
Aroclor-1248 (PCB-1248)	Resource Conservation Recovery Program (NPW)
Aroclor-1248 (PCB-1248)	Resource Conservation Recovery Program (S)
Aroclor-1254 (PCB-1254)	Resource Conservation Recovery Program (NPW)
Aroclor-1254 (PCB-1254)	Resource Conservation Recovery Program (S)
Aroclor-1260 (PCB-1260)	Resource Conservation Recovery Program (NPW)
Aroclor-1260 (PCB-1260)	Resource Conservation Recovery Program (S)
Aroclor-1262 (PCB 1262)	Resource Conservation Recovery Program (NPW)
Aroclor-1262 (PCB 1262)	Resource Conservation Recovery Program (S)
Aroclor-1268 (PCB-1268)	Resource Conservation Recovery Program (NPW)
Aroclor-1268 (PCB-1268)	Resource Conservation Recovery Program (S)
EPA 8151A	
2,4,5-T	Resource Conservation Recovery Program (NPW)
2,4,5-T	Resource Conservation Recovery Program (S)
2,4-D	Resource Conservation Recovery Program (NPW)
2,4-D	Resource Conservation Recovery Program (S)
2,4-DB	Resource Conservation Recovery Program (NPW)
2,4-DB	Resource Conservation Recovery Program (S)
Dalapon	Resource Conservation Recovery Program (NPW)

Dalapon	Resource Conservation Recovery Program (S)
Dicamba	Resource Conservation Recovery Program (NPW)
Dicamba	Resource Conservation Recovery Program (S)
Dichloroprop	Resource Conservation Recovery Program (NPW)
Dichloroprop	Resource Conservation Recovery Program (S)
Dinoseb	Resource Conservation Recovery Program (NPW)
Dinoseb	Resource Conservation Recovery Program (S)
MCPA	Resource Conservation Recovery Program (NPW)
MCPA	Resource Conservation Recovery Program (S)
MCPP	Resource Conservation Recovery Program (NPW)
MCPP	Resource Conservation Recovery Program (S)
Pentachlorophenol	Resource Conservation Recovery Program (NPW)
Pentachlorophenol	Resource Conservation Recovery Program (S)
Silvex (2,4,5-TP)	Resource Conservation Recovery Program (NPW)
Silvex (2,4,5-TP)	Resource Conservation Recovery Program (S)
EPA 8260B	
1,1,1,2-Tetrachloroethane	Resource Conservation Recovery Program (NPW)
1,1,1,2-Tetrachloroethane	Resource Conservation Recovery Program (S)
1,1,1-Trichloroethane	Resource Conservation Recovery Program (NPW)
1,1,1-Trichloroethane	Resource Conservation Recovery Program (S)
1,1,2,2-Tetrachloroethane	Resource Conservation Recovery Program (NPW)
1,1,2,2-Tetrachloroethane	Resource Conservation Recovery Program (S)
1,1,2-Trichloro-1,2,2-trifluoroethane	Resource Conservation Recovery Program (NPW)
1,1,2-Trichloro-1,2,2-trifluoroethane	Resource Conservation Recovery Program (S)
1,1,2-Trichloroethane	Resource Conservation Recovery Program (NPW)
1,1,2-Trichloroethane	Resource Conservation Recovery Program (S)
1,1-Dichloroethane	Resource Conservation Recovery Program (NPW)
1,1-Dichloroethane	Resource Conservation Recovery Program (S)
1,1-Dichloroethylene	Resource Conservation Recovery Program (NPW)
1,1-Dichloroethylene	Resource Conservation Recovery Program (S)
1,1-Dichloropropene	Resource Conservation Recovery Program (NPW)
1,1-Dichloropropene	Resource Conservation Recovery Program (S)
1,2,3-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,3-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2,3-Trichloropropane	Resource Conservation Recovery Program (NPW)
1,2,3-Trichloropropane	Resource Conservation Recovery Program (S)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2,4-Trimethylbenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trimethylbenzene	Resource Conservation Recovery Program (S)
1,2-Dibromo-3-chloropropane (DBCP)	Resource Conservation Recovery Program (NPW)
1,2-Dibromo-3-chloropropane (DBCP)	Resource Conservation Recovery Program (S)
1,2-Dibromoethane (EDB, Ethylene dibromide)	Resource Conservation Recovery Program (NPW)
1,2-Dibromoethane (EDB, Ethylene dibromide)	Resource Conservation Recovery Program (S)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Dichloroethane	Resource Conservation Recovery Program (NPW)
1,2-Dichloroethane	Resource Conservation Recovery Program (S)
1,2-Dichloropropane	Resource Conservation Recovery Program (NPW)
1,2-Dichloropropane	Resource Conservation Recovery Program (S)
1,3,5-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3,5-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,3,5-Trimethylbenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,3-Dichloropropane	Resource Conservation Recovery Program (NPW)
1,3-Dichloropropane	Resource Conservation Recovery Program (S)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (NPW)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (S)
1-Chlorohexane	Resource Conservation Recovery Program (NPW)
1-Chlorohexane	Resource Conservation Recovery Program (S)
2,2-Dichloropropane	Resource Conservation Recovery Program (NPW)

2,2-Dichloropropane	Resource Conservation Recovery Program (S)
2-Butanone (Methyl ethyl ketone, MEK)	Resource Conservation Recovery Program (NPW)
2-Butanone (Methyl ethyl ketone, MEK)	Resource Conservation Recovery Program (S)
2-Chloroethyl vinyl ether	Resource Conservation Recovery Program (NPW)
2-Chloroethyl vinyl ether	Resource Conservation Recovery Program (S)
2-Chlorotoluene	Resource Conservation Recovery Program (NPW)
2-Chlorotoluene	Resource Conservation Recovery Program (S)
2-Hexanone	Resource Conservation Recovery Program (NPW)
2-Hexanone	Resource Conservation Recovery Program (S)
4-Chlorotoluene	Resource Conservation Recovery Program (NPW)
4-Chlorotoluene	Resource Conservation Recovery Program (S)
4-Methyl-2-pentanone (MIBK)	Resource Conservation Recovery Program (NPW)
4-Methyl-2-pentanone (MIBK)	Resource Conservation Recovery Program (S)
Acetone	Resource Conservation Recovery Program (NPW)
Acetone	Resource Conservation Recovery Program (S)
Acetonitrile	Resource Conservation Recovery Program (NPW)
Acetonitrile	Resource Conservation Recovery Program (S)
Acrolein	Resource Conservation Recovery Program (NPW)
Acrolein	Resource Conservation Recovery Program (S)
Allyl chloride	Resource Conservation Recovery Program (NPW)
Allyl chloride	Resource Conservation Recovery Program (S)
Benzene	Resource Conservation Recovery Program (NPW)
Benzene	Resource Conservation Recovery Program (S)
Bromobenzene	Resource Conservation Recovery Program (NPW)
Bromobenzene	Resource Conservation Recovery Program (S)
Bromochloromethane	Resource Conservation Recovery Program (NPW)
Bromochloromethane	Resource Conservation Recovery Program (S)
Bromodichloromethane	Resource Conservation Recovery Program (NPW)
Bromodichloromethane	Resource Conservation Recovery Program (S)
Bromoform	Resource Conservation Recovery Program (NPW)
Bromoform	Resource Conservation Recovery Program (S)
Bromomethane (Methyl bromide)	Resource Conservation Recovery Program (NPW)
Bromomethane (Methyl bromide)	Resource Conservation Recovery Program (S)
Carbon disulfide	Resource Conservation Recovery Program (NPW)
Carbon disulfide	Resource Conservation Recovery Program (S)
Carbon tetrachloride	Resource Conservation Recovery Program (NPW)
Carbon tetrachloride	Resource Conservation Recovery Program (S)
Chlorobenzene	Resource Conservation Recovery Program (NPW)
Chlorobenzene	Resource Conservation Recovery Program (S)
Chloroethane	Resource Conservation Recovery Program (NPW)
Chloroethane	Resource Conservation Recovery Program (S)
Chloroform	Resource Conservation Recovery Program (NPW)
Chloroform	Resource Conservation Recovery Program (S)
Chloroprene	Resource Conservation Recovery Program (NPW)
Chloroprene	Resource Conservation Recovery Program (S)
cis-1,2-Dichloroethylene	Resource Conservation Recovery Program (NPW)
cis-1,2-Dichloroethylene	Resource Conservation Recovery Program (S)
cis-1,3-Dichloropropene	Resource Conservation Recovery Program (NPW)
cis-1,3-Dichloropropene	Resource Conservation Recovery Program (S)
cis-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (NPW)
cis-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (S)
Cyclohexane	Resource Conservation Recovery Program (NPW)
Cyclohexane	Resource Conservation Recovery Program (S)
Dibromochloromethane	Resource Conservation Recovery Program (NPW)
Dibromochloromethane	Resource Conservation Recovery Program (S)
Dibromomethane	Resource Conservation Recovery Program (NPW)
Dibromomethane	Resource Conservation Recovery Program (S)
Dichlorodifluoromethane	Resource Conservation Recovery Program (NPW)
Dichlorodifluoromethane	Resource Conservation Recovery Program (S)
Dichloromethane (Methylene chloride)	Resource Conservation Recovery Program (NPW)
Dichloromethane (Methylene chloride)	Resource Conservation Recovery Program (S)
Diethyl ether	Resource Conservation Recovery Program (NPW)
Diethyl ether	Resource Conservation Recovery Program (S)
Diisopropylether (DIPE)	Resource Conservation Recovery Program (NPW)

Diisopropylether (DIPE)	Resource Conservation Recovery Program (S)
Ethyl methacrylate	Resource Conservation Recovery Program (NPW)
Ethyl methacrylate	Resource Conservation Recovery Program (S)
Ethylbenzene	Resource Conservation Recovery Program (NPW)
Ethylbenzene	Resource Conservation Recovery Program (S)
Freon-113 (Trichlorotrifluoroethane)	Resource Conservation Recovery Program (NPW)
Freon-113 (Trichlorotrifluoroethane)	Resource Conservation Recovery Program (S)
Hexachlorobutadiene	Resource Conservation Recovery Program (NPW)
Hexachlorobutadiene	Resource Conservation Recovery Program (S)
Iodomethane (Methyl iodide)	Resource Conservation Recovery Program (NPW)
Iodomethane (Methyl iodide)	Resource Conservation Recovery Program (S)
Isobutyl alcohol	Resource Conservation Recovery Program (NPW)
Isobutyl alcohol	Resource Conservation Recovery Program (S)
Isopropylbenzene	Resource Conservation Recovery Program (NPW)
Isopropylbenzene	Resource Conservation Recovery Program (S)
Methacrylonitrile	Resource Conservation Recovery Program (NPW)
Methacrylonitrile	Resource Conservation Recovery Program (S)
Methyl acetate	Resource Conservation Recovery Program (NPW)
Methyl acetate	Resource Conservation Recovery Program (S)
Methyl chloride (Chloromethane)	Resource Conservation Recovery Program (NPW)
Methyl chloride (Chloromethane)	Resource Conservation Recovery Program (S)
Methyl isobutyl ketone (MIBK)	Resource Conservation Recovery Program (NPW)
Methyl isobutyl ketone (MIBK)	Resource Conservation Recovery Program (S)
Methyl methacrylate	Resource Conservation Recovery Program (NPW)
Methyl methacrylate	Resource Conservation Recovery Program (S)
Methyl tert-butyl ether (MTBE)	Resource Conservation Recovery Program (NPW)
Methyl tert-butyl ether (MTBE)	Resource Conservation Recovery Program (S)
Methylcyclohexane	Resource Conservation Recovery Program (NPW)
Methylcyclohexane	Resource Conservation Recovery Program (S)
m-Xylene	Resource Conservation Recovery Program (NPW)
m-Xylene	Resource Conservation Recovery Program (S)
Naphthalene	Resource Conservation Recovery Program (NPW)
Naphthalene	Resource Conservation Recovery Program (S)
n-Butylbenzene	Resource Conservation Recovery Program (NPW)
n-Butylbenzene	Resource Conservation Recovery Program (S)
n-Propylbenzene	Resource Conservation Recovery Program (NPW)
n-Propylbenzene	Resource Conservation Recovery Program (S)
Pentachloroethane	Resource Conservation Recovery Program (NPW)
Pentachloroethane	Resource Conservation Recovery Program (S)
p-Isopropyltoluene	Resource Conservation Recovery Program (NPW)
p-Isopropyltoluene	Resource Conservation Recovery Program (S)
Propionitrile (Ethyl cyanide)	Resource Conservation Recovery Program (NPW)
Propionitrile (Ethyl cyanide)	Resource Conservation Recovery Program (S)
p-Xylene	Resource Conservation Recovery Program (NPW)
p-Xylene	Resource Conservation Recovery Program (S)
sec-Butylbenzene	Resource Conservation Recovery Program (NPW)
sec-Butylbenzene	Resource Conservation Recovery Program (S)
Styrene	Resource Conservation Recovery Program (NPW)
Styrene	Resource Conservation Recovery Program (S)
tert-Amyl methyl ether (TAME)	Resource Conservation Recovery Program (NPW)
tert-Amyl methyl ether (TAME)	Resource Conservation Recovery Program (S)
tert-Butyl alcohol	Resource Conservation Recovery Program (NPW)
tert-Butyl alcohol	Resource Conservation Recovery Program (S)
tert-Butylbenzene	Resource Conservation Recovery Program (NPW)
tert-Butylbenzene	Resource Conservation Recovery Program (S)
Tetrachloroethylene	Resource Conservation Recovery Program (NPW)
Tetrachloroethylene	Resource Conservation Recovery Program (S)
Tetrahydrofuran (THF)	Resource Conservation Recovery Program (NPW)
Tetrahydrofuran (THF)	Resource Conservation Recovery Program (S)
Toluene	Resource Conservation Recovery Program (NPW)
Toluene	Resource Conservation Recovery Program (S)
trans-1,2-Dicloroethylene	Resource Conservation Recovery Program (NPW)
trans-1,2-Dicloroethylene	Resource Conservation Recovery Program (S)
trans-1,3-Dichloropropylene	Resource Conservation Recovery Program (NPW)

trans-1,3-Dichloropropylene	Resource Conservation Recovery Program (S)
trans-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (NPW)
trans-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (S)
Trichloroethene (Trichloroethylene)	Resource Conservation Recovery Program (NPW)
Trichloroethene (Trichloroethylene)	Resource Conservation Recovery Program (S)
Trichlorofluoromethane	Resource Conservation Recovery Program (NPW)
Trichlorofluoromethane	Resource Conservation Recovery Program (S)
Vinyl acetate	Resource Conservation Recovery Program (NPW)
Vinyl acetate	Resource Conservation Recovery Program (S)
Vinyl chloride	Resource Conservation Recovery Program (NPW)
Vinyl chloride	Resource Conservation Recovery Program (S)
Xylene (total)	Resource Conservation Recovery Program (NPW)
Xylene (total)	Resource Conservation Recovery Program (S)
EPA 8260C	
1,1,1,2-Tetrachloroethane	Resource Conservation Recovery Program (NPW)
1,1,1,2-Tetrachloroethane	Resource Conservation Recovery Program (S)
1,1,1-Trichloroethane	Resource Conservation Recovery Program (NPW)
1,1,1-Trichloroethane	Resource Conservation Recovery Program (S)
1,1,2,2-Tetrachloroethane	Resource Conservation Recovery Program (NPW)
1,1,2,2-Tetrachloroethane	Resource Conservation Recovery Program (S)
1,1,2-Trichloro-1,2,2-trifluoroethane	Resource Conservation Recovery Program (NPW)
1,1,2-Trichloro-1,2,2-trifluoroethane	Resource Conservation Recovery Program (S)
1,1,2-Trichloroethane	Resource Conservation Recovery Program (NPW)
1,1,2-Trichloroethane	Resource Conservation Recovery Program (S)
1,1-Dichloroethane	Resource Conservation Recovery Program (NPW)
1,1-Dichloroethane	Resource Conservation Recovery Program (S)
1,1-Dichloroethylene	Resource Conservation Recovery Program (NPW)
1,1-Dichloroethylene	Resource Conservation Recovery Program (S)
1,1-Dichloropropene	Resource Conservation Recovery Program (NPW)
1,1-Dichloropropene	Resource Conservation Recovery Program (S)
1,2,3-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,3-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2,3-Trichloropropane	Resource Conservation Recovery Program (NPW)
1,2,3-Trichloropropane	Resource Conservation Recovery Program (S)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2,4-Trimethylbenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trimethylbenzene	Resource Conservation Recovery Program (S)
1,2-Dibromo-3-chloropropane (DBCP)	Resource Conservation Recovery Program (NPW)
1,2-Dibromo-3-chloropropane (DBCP)	Resource Conservation Recovery Program (S)
1,2-Dibromoethane (EDB, Ethylene dibromide)	Resource Conservation Recovery Program (NPW)
1,2-Dibromoethane (EDB, Ethylene dibromide)	Resource Conservation Recovery Program (S)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Dichloroethane	Resource Conservation Recovery Program (NPW)
1,2-Dichloroethane	Resource Conservation Recovery Program (S)
1,2-Dichloropropane	Resource Conservation Recovery Program (NPW)
1,2-Dichloropropane	Resource Conservation Recovery Program (S)
1,3,5-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3,5-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,3,5-Trimethylbenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,3-Dichloropropane	Resource Conservation Recovery Program (NPW)
1,3-Dichloropropane	Resource Conservation Recovery Program (S)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (NPW)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (S)
1-Chlorohexane	Resource Conservation Recovery Program (NPW)
1-Chlorohexane	Resource Conservation Recovery Program (S)
2,2-Dichloropropane	Resource Conservation Recovery Program (NPW)
2,2-Dichloropropane	Resource Conservation Recovery Program (S)
2-Butanone (Methyl ethyl ketone, MEK)	Resource Conservation Recovery Program (NPW)

2-Butanone (Methyl ethyl ketone, MEK)	Resource Conservation Recovery Program (S)
2-Chloroethyl vinyl ether	Resource Conservation Recovery Program (NPW)
2-Chloroethyl vinyl ether	Resource Conservation Recovery Program (S)
2-Chlorotoluene	Resource Conservation Recovery Program (NPW)
2-Chlorotoluene	Resource Conservation Recovery Program (S)
2-Hexanone	Resource Conservation Recovery Program (NPW)
2-Hexanone	Resource Conservation Recovery Program (S)
4-Chlorotoluene	Resource Conservation Recovery Program (NPW)
4-Chlorotoluene	Resource Conservation Recovery Program (S)
4-Methyl-2-pentanone (MIBK)	Resource Conservation Recovery Program (NPW)
4-Methyl-2-pentanone (MIBK)	Resource Conservation Recovery Program (S)
Acetone	Resource Conservation Recovery Program (NPW)
Acetone	Resource Conservation Recovery Program (S)
Acetonitrile	Resource Conservation Recovery Program (NPW)
Acetonitrile	Resource Conservation Recovery Program (S)
Acrolein	Resource Conservation Recovery Program (NPW)
Acrolein	Resource Conservation Recovery Program (S)
Allyl chloride	Resource Conservation Recovery Program (NPW)
Allyl chloride	Resource Conservation Recovery Program (S)
Benzene	Resource Conservation Recovery Program (NPW)
Benzene	Resource Conservation Recovery Program (S)
Bromobenzene	Resource Conservation Recovery Program (NPW)
Bromobenzene	Resource Conservation Recovery Program (S)
Bromochloromethane	Resource Conservation Recovery Program (NPW)
Bromochloromethane	Resource Conservation Recovery Program (S)
Bromodichloromethane	Resource Conservation Recovery Program (NPW)
Bromodichloromethane	Resource Conservation Recovery Program (S)
Bromoform	Resource Conservation Recovery Program (NPW)
Bromoform	Resource Conservation Recovery Program (S)
Bromomethane (Methyl bromide)	Resource Conservation Recovery Program (NPW)
Bromomethane (Methyl bromide)	Resource Conservation Recovery Program (S)
Carbon disulfide	Resource Conservation Recovery Program (NPW)
Carbon disulfide	Resource Conservation Recovery Program (S)
Carbon tetrachloride	Resource Conservation Recovery Program (NPW)
Carbon tetrachloride	Resource Conservation Recovery Program (S)
Chlorobenzene	Resource Conservation Recovery Program (NPW)
Chlorobenzene	Resource Conservation Recovery Program (S)
Chloroethane	Resource Conservation Recovery Program (NPW)
Chloroethane	Resource Conservation Recovery Program (S)
Chloroform	Resource Conservation Recovery Program (NPW)
Chloroform	Resource Conservation Recovery Program (S)
Chloroprene	Resource Conservation Recovery Program (NPW)
Chloroprene	Resource Conservation Recovery Program (S)
cis-1,2-Dichloroethylene	Resource Conservation Recovery Program (NPW)
cis-1,2-Dichloroethylene	Resource Conservation Recovery Program (S)
cis-1,3-Dichloropropene	Resource Conservation Recovery Program (NPW)
cis-1,3-Dichloropropene	Resource Conservation Recovery Program (S)
cis-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (NPW)
cis-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (S)
Cyclohexane	Resource Conservation Recovery Program (NPW)
Cyclohexane	Resource Conservation Recovery Program (S)
Dibromochloromethane	Resource Conservation Recovery Program (NPW)
Dibromochloromethane	Resource Conservation Recovery Program (S)
Dibromomethane	Resource Conservation Recovery Program (NPW)
Dibromomethane	Resource Conservation Recovery Program (S)
Dichlorodifluoromethane	Resource Conservation Recovery Program (NPW)
Dichlorodifluoromethane	Resource Conservation Recovery Program (S)
Dichloromethane (Methylene chloride)	Resource Conservation Recovery Program (NPW)
Dichloromethane (Methylene chloride)	Resource Conservation Recovery Program (S)
Diethyl ether	Resource Conservation Recovery Program (NPW)
Diethyl ether	Resource Conservation Recovery Program (S)
Diisopropylether (DIPE)	Resource Conservation Recovery Program (NPW)
Diisopropylether (DIPE)	Resource Conservation Recovery Program (S)
Ethyl methacrylate	Resource Conservation Recovery Program (NPW)

Ethyl methacrylate	Resource Conservation Recovery Program (S)
Ethylbenzene	Resource Conservation Recovery Program (NPW)
Ethylbenzene	Resource Conservation Recovery Program (S)
Freon-113 (Trichlorotrifluoroethane)	Resource Conservation Recovery Program (NPW)
Freon-113 (Trichlorotrifluoroethane)	Resource Conservation Recovery Program (S)
Hexachlorobutadiene	Resource Conservation Recovery Program (NPW)
Hexachlorobutadiene	Resource Conservation Recovery Program (S)
Iodomethane (Methyl iodide)	Resource Conservation Recovery Program (NPW)
Iodomethane (Methyl iodide)	Resource Conservation Recovery Program (S)
Isobutyl alcohol	Resource Conservation Recovery Program (NPW)
Isobutyl alcohol	Resource Conservation Recovery Program (S)
Isopropylbenzene	Resource Conservation Recovery Program (NPW)
Isopropylbenzene	Resource Conservation Recovery Program (S)
Methacrylonitrile	Resource Conservation Recovery Program (NPW)
Methacrylonitrile	Resource Conservation Recovery Program (S)
Methyl acetate	Resource Conservation Recovery Program (NPW)
Methyl acetate	Resource Conservation Recovery Program (S)
Methyl chloride (Chloromethane)	Resource Conservation Recovery Program (NPW)
Methyl chloride (Chloromethane)	Resource Conservation Recovery Program (S)
Methyl isobutyl ketone (MIBK)	Resource Conservation Recovery Program (NPW)
Methyl isobutyl ketone (MIBK)	Resource Conservation Recovery Program (S)
Methyl methacrylate	Resource Conservation Recovery Program (NPW)
Methyl methacrylate	Resource Conservation Recovery Program (S)
Methyl tert-butyl ether (MTBE)	Resource Conservation Recovery Program (NPW)
Methyl tert-butyl ether (MTBE)	Resource Conservation Recovery Program (S)
Methylcyclohexane	Resource Conservation Recovery Program (NPW)
Methylcyclohexane	Resource Conservation Recovery Program (S)
m-Xylene	Resource Conservation Recovery Program (NPW)
m-Xylene	Resource Conservation Recovery Program (S)
Naphthalene	Resource Conservation Recovery Program (NPW)
Naphthalene	Resource Conservation Recovery Program (S)
n-Butylbenzene	Resource Conservation Recovery Program (NPW)
n-Butylbenzene	Resource Conservation Recovery Program (S)
n-Propylbenzene	Resource Conservation Recovery Program (NPW)
n-Propylbenzene	Resource Conservation Recovery Program (S)
Pentachloroethane	Resource Conservation Recovery Program (NPW)
Pentachloroethane	Resource Conservation Recovery Program (S)
p-Isopropyltoluene	Resource Conservation Recovery Program (NPW)
p-Isopropyltoluene	Resource Conservation Recovery Program (S)
Propionitrile (Ethyl cyanide)	Resource Conservation Recovery Program (NPW)
Propionitrile (Ethyl cyanide)	Resource Conservation Recovery Program (S)
p-Xylene	Resource Conservation Recovery Program (NPW)
p-Xylene	Resource Conservation Recovery Program (S)
sec-Butylbenzene	Resource Conservation Recovery Program (NPW)
sec-Butylbenzene	Resource Conservation Recovery Program (S)
Styrene	Resource Conservation Recovery Program (NPW)
Styrene	Resource Conservation Recovery Program (S)
tert-Amyl methyl ether (TAME)	Resource Conservation Recovery Program (NPW)
tert-Amyl methyl ether (TAME)	Resource Conservation Recovery Program (S)
tert-Butyl alcohol	Resource Conservation Recovery Program (NPW)
tert-Butyl alcohol	Resource Conservation Recovery Program (S)
tert-Butylbenzene	Resource Conservation Recovery Program (NPW)
tert-Butylbenzene	Resource Conservation Recovery Program (S)
Tetrachloroethylene	Resource Conservation Recovery Program (NPW)
Tetrachloroethylene	Resource Conservation Recovery Program (S)
Tetrahydrofuran (THF)	Resource Conservation Recovery Program (NPW)
Tetrahydrofuran (THF)	Resource Conservation Recovery Program (S)
Toluene	Resource Conservation Recovery Program (NPW)
Toluene	Resource Conservation Recovery Program (S)
trans-1,2-Dicloroethylene	Resource Conservation Recovery Program (NPW)
trans-1,2-Dicloroethylene	Resource Conservation Recovery Program (S)
trans-1,3-Dichloropropylene	Resource Conservation Recovery Program (NPW)
trans-1,3-Dichloropropylene	Resource Conservation Recovery Program (S)
trans-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (NPW)

trans-1,4-Dichloro-2-butene	Resource Conservation Recovery Program (S)
Trichloroethene (Trichloroethylene)	Resource Conservation Recovery Program (NPW)
Trichloroethene (Trichloroethylene)	Resource Conservation Recovery Program (S)
Trichlorofluoromethane	Resource Conservation Recovery Program (NPW)
Trichlorofluoromethane	Resource Conservation Recovery Program (S)
Vinyl acetate	Resource Conservation Recovery Program (NPW)
Vinyl acetate	Resource Conservation Recovery Program (S)
Vinyl chloride	Resource Conservation Recovery Program (NPW)
Vinyl chloride	Resource Conservation Recovery Program (S)
Xylene (total)	Resource Conservation Recovery Program (NPW)
Xylene (total)	Resource Conservation Recovery Program (S)
EPA 8270C	
1,1'-Biphenyl	Resource Conservation Recovery Program (NPW)
1,1'-Biphenyl	Resource Conservation Recovery Program (S)
1,2,4,5-Tetrachlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4,5-Tetrachlorobenzene	Resource Conservation Recovery Program (S)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Diphenylhydrazine	Resource Conservation Recovery Program (NPW)
1,2-Diphenylhydrazine	Resource Conservation Recovery Program (S)
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (NPW)
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (S)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (NPW)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (S)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (NPW)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (S)
1,4-Naphthoquinone	Resource Conservation Recovery Program (NPW)
1,4-Naphthoquinone	Resource Conservation Recovery Program (S)
1-Chloronaphthalene	Resource Conservation Recovery Program (NPW)
1-Chloronaphthalene	Resource Conservation Recovery Program (S)
1-Methylnaphthalene	Resource Conservation Recovery Program (NPW)
1-Methylnaphthalene	Resource Conservation Recovery Program (S)
1-Naphthylamine	Resource Conservation Recovery Program (NPW)
1-Naphthylamine	Resource Conservation Recovery Program (S)
2,2'-Oxybis(1-chloropropane)	Resource Conservation Recovery Program (NPW)
2,2'-Oxybis(1-chloropropane)	Resource Conservation Recovery Program (S)
2,3,4,6-Tetrachlorophenol	Resource Conservation Recovery Program (NPW)
2,3,4,6-Tetrachlorophenol	Resource Conservation Recovery Program (S)
2,4,5-Trichlorophenol	Resource Conservation Recovery Program (NPW)
2,4,5-Trichlorophenol	Resource Conservation Recovery Program (S)
2,4,6-Trichlorophenol	Resource Conservation Recovery Program (NPW)
2,4,6-Trichlorophenol	Resource Conservation Recovery Program (S)
2,4-Dichlorophenol	Resource Conservation Recovery Program (NPW)
2,4-Dichlorophenol	Resource Conservation Recovery Program (S)
2,4-Dimethylphenol	Resource Conservation Recovery Program (NPW)
2,4-Dimethylphenol	Resource Conservation Recovery Program (S)
2,4-Dinitrophenol	Resource Conservation Recovery Program (NPW)
2,4-Dinitrophenol	Resource Conservation Recovery Program (S)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (NPW)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (S)
2,6-Dichlorophenol	Resource Conservation Recovery Program (NPW)
2,6-Dichlorophenol	Resource Conservation Recovery Program (S)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (NPW)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (S)
2-Acetylaminofluorene	Resource Conservation Recovery Program (NPW)
2-Acetylaminofluorene	Resource Conservation Recovery Program (S)
2-Chloronaphthalene	Resource Conservation Recovery Program (NPW)
2-Chloronaphthalene	Resource Conservation Recovery Program (S)

2-Chlorophenol	Resource Conservation Recovery Program (NPW)
2-Chlorophenol	Resource Conservation Recovery Program (S)
2-Methylnaphthalene	Resource Conservation Recovery Program (NPW)
2-Methylnaphthalene	Resource Conservation Recovery Program (S)
2-Methylphenol (o-Cresol)	Resource Conservation Recovery Program (NPW)
2-Methylphenol (o-Cresol)	Resource Conservation Recovery Program (S)
2-Naphthylamine	Resource Conservation Recovery Program (NPW)
2-Naphthylamine	Resource Conservation Recovery Program (S)
2-Nitroaniline	Resource Conservation Recovery Program (NPW)
2-Nitroaniline	Resource Conservation Recovery Program (S)
2-Nitrophenol	Resource Conservation Recovery Program (NPW)
2-Nitrophenol	Resource Conservation Recovery Program (S)
2-Picoline (2-Methylpyridine)	Resource Conservation Recovery Program (NPW)
2-Picoline (2-Methylpyridine)	Resource Conservation Recovery Program (S)
3 & 4 Methylphenol	Resource Conservation Recovery Program (NPW)
3,3'-Dichlorobenzidine	Resource Conservation Recovery Program (NPW)
3,3'-Dichlorobenzidine	Resource Conservation Recovery Program (S)
3,3'-Dimethylbenzidine	Resource Conservation Recovery Program (NPW)
3,3'-Dimethylbenzidine	Resource Conservation Recovery Program (S)
3-Methylcholanthrene	Resource Conservation Recovery Program (NPW)
3-Methylcholanthrene	Resource Conservation Recovery Program (S)
3-Nitroaniline	Resource Conservation Recovery Program (NPW)
3-Nitroaniline	Resource Conservation Recovery Program (S)
4,6-Dinitro-2-methylphenol	Resource Conservation Recovery Program (NPW)
4,6-Dinitro-2-methylphenol	Resource Conservation Recovery Program (S)
4-Aminobiphenyl	Resource Conservation Recovery Program (NPW)
4-Aminobiphenyl	Resource Conservation Recovery Program (S)
4-Bromophenyl phenyl ether	Resource Conservation Recovery Program (NPW)
4-Bromophenyl phenyl ether	Resource Conservation Recovery Program (S)
4-Chloro-3-methylphenol	Resource Conservation Recovery Program (NPW)
4-Chloro-3-methylphenol	Resource Conservation Recovery Program (S)
4-Chloroaniline	Resource Conservation Recovery Program (NPW)
4-Chloroaniline	Resource Conservation Recovery Program (S)
4-Chlorophenyl phenylether	Resource Conservation Recovery Program (NPW)
4-Chlorophenyl phenylether	Resource Conservation Recovery Program (S)
4-Nitroaniline	Resource Conservation Recovery Program (NPW)
4-Nitroaniline	Resource Conservation Recovery Program (S)
4-Nitrophenol	Resource Conservation Recovery Program (NPW)
4-Nitrophenol	Resource Conservation Recovery Program (S)
4-Nitroquinoline 1-oxide	Resource Conservation Recovery Program (NPW)
4-Nitroquinoline 1-oxide	Resource Conservation Recovery Program (S)
5-Nitro-o-toluidine	Resource Conservation Recovery Program (NPW)
5-Nitro-o-toluidine	Resource Conservation Recovery Program (S)
7,12-Dimethylbenz[a]anthracene	Resource Conservation Recovery Program (NPW)
7,12-Dimethylbenz[a]anthracene	Resource Conservation Recovery Program (S)
a-a-Dimethylphenethylamine	Resource Conservation Recovery Program (NPW)
a-a-Dimethylphenethylamine	Resource Conservation Recovery Program (S)
Acenaphthene	Resource Conservation Recovery Program (NPW)
Acenaphthene	Resource Conservation Recovery Program (S)
Acenaphthylene	Resource Conservation Recovery Program (NPW)
Acenaphthylene	Resource Conservation Recovery Program (S)
Acetophenone	Resource Conservation Recovery Program (NPW)
Acetophenone	Resource Conservation Recovery Program (S)
Aniline	Resource Conservation Recovery Program (NPW)
Aniline	Resource Conservation Recovery Program (S)
Anthracene	Resource Conservation Recovery Program (NPW)
Anthracene	Resource Conservation Recovery Program (S)
Aramite	Resource Conservation Recovery Program (NPW)
Aramite	Resource Conservation Recovery Program (S)
Atrazine	Resource Conservation Recovery Program (NPW)
Atrazine	Resource Conservation Recovery Program (S)
Azobenzene	Resource Conservation Recovery Program (NPW)
Azobenzene	Resource Conservation Recovery Program (S)
Benzaldehyde	Resource Conservation Recovery Program (NPW)

Benzaldehyde	Resource Conservation Recovery Program (S)
Benzidine	Resource Conservation Recovery Program (NPW)
Benzidine	Resource Conservation Recovery Program (S)
Benzo[a]anthracene	Resource Conservation Recovery Program (NPW)
Benzo[a]anthracene	Resource Conservation Recovery Program (S)
Benzo[a]pyrene	Resource Conservation Recovery Program (NPW)
Benzo[a]pyrene	Resource Conservation Recovery Program (S)
Benzo[b]fluoranthene	Resource Conservation Recovery Program (NPW)
Benzo[b]fluoranthene	Resource Conservation Recovery Program (S)
Benzo[g,h,i]perylene	Resource Conservation Recovery Program (NPW)
Benzo[g,h,i]perylene	Resource Conservation Recovery Program (S)
Benzo[k]fluoranthene	Resource Conservation Recovery Program (NPW)
Benzo[k]fluoranthene	Resource Conservation Recovery Program (S)
Benzoic acid	Resource Conservation Recovery Program (NPW)
Benzoic acid	Resource Conservation Recovery Program (S)
Benzyl alcohol	Resource Conservation Recovery Program (NPW)
Benzyl alcohol	Resource Conservation Recovery Program (S)
bis(2-Chloroethoxy)methane	Resource Conservation Recovery Program (NPW)
bis(2-Chloroethoxy)methane	Resource Conservation Recovery Program (S)
bis(2-Chloroethyl)ether	Resource Conservation Recovery Program (NPW)
bis(2-Chloroethyl)ether	Resource Conservation Recovery Program (S)
bis(2-Ethylhexyl)adipate	Resource Conservation Recovery Program (NPW)
bis(2-Ethylhexyl)adipate	Resource Conservation Recovery Program (S)
bis(2-Ethylhexyl)phthalate (DEHP)	Resource Conservation Recovery Program (NPW)
bis(2-Ethylhexyl)phthalate (DEHP)	Resource Conservation Recovery Program (S)
Butyl benzyl phthalate	Resource Conservation Recovery Program (NPW)
Butyl benzyl phthalate	Resource Conservation Recovery Program (S)
Caprolactam	Resource Conservation Recovery Program (NPW)
Caprolactam	Resource Conservation Recovery Program (S)
Carbazole	Resource Conservation Recovery Program (NPW)
Carbazole	Resource Conservation Recovery Program (S)
Chlorobenzilate	Resource Conservation Recovery Program (NPW)
Chlorobenzilate	Resource Conservation Recovery Program (S)
Chrysene	Resource Conservation Recovery Program (NPW)
Chrysene	Resource Conservation Recovery Program (S)
Diallate	Resource Conservation Recovery Program (NPW)
Diallate	Resource Conservation Recovery Program (S)
Dibenz[a,h]anthracene	Resource Conservation Recovery Program (NPW)
Dibenz[a,h]anthracene	Resource Conservation Recovery Program (S)
Dibenz[a,j]acridine	Resource Conservation Recovery Program (NPW)
Dibenz[a,j]acridine	Resource Conservation Recovery Program (S)
Dibenzofuran	Resource Conservation Recovery Program (NPW)
Dibenzofuran	Resource Conservation Recovery Program (S)
Diethyl phthalate	Resource Conservation Recovery Program (NPW)
Diethyl phthalate	Resource Conservation Recovery Program (S)
Dimethoate	Resource Conservation Recovery Program (NPW)
Dimethoate	Resource Conservation Recovery Program (S)
Dimethyl phthalate	Resource Conservation Recovery Program (NPW)
Dimethyl phthalate	Resource Conservation Recovery Program (S)
Di-n-butyl phthalate	Resource Conservation Recovery Program (NPW)
Di-n-butyl phthalate	Resource Conservation Recovery Program (S)
Di-n-octyl phthalate	Resource Conservation Recovery Program (NPW)
Di-n-octyl phthalate	Resource Conservation Recovery Program (S)
Dinoseb	Resource Conservation Recovery Program (NPW)
Dinoseb	Resource Conservation Recovery Program (S)
Disulfoton	Resource Conservation Recovery Program (NPW)
Disulfoton	Resource Conservation Recovery Program (S)
Ethyl methanesulfonate	Resource Conservation Recovery Program (NPW)
Ethyl methanesulfonate	Resource Conservation Recovery Program (S)
Famphur	Resource Conservation Recovery Program (NPW)
Famphur	Resource Conservation Recovery Program (S)
Fluoranthene	Resource Conservation Recovery Program (NPW)
Fluoranthene	Resource Conservation Recovery Program (S)
Fluorene	Resource Conservation Recovery Program (NPW)

Fluorene	Resource Conservation Recovery Program (S)
Hexachlorobenzene	Resource Conservation Recovery Program (NPW)
Hexachlorobenzene	Resource Conservation Recovery Program (S)
Hexachlorobutadiene	Resource Conservation Recovery Program (NPW)
Hexachlorobutadiene	Resource Conservation Recovery Program (S)
Hexachlorocyclopentadiene	Resource Conservation Recovery Program (NPW)
Hexachlorocyclopentadiene	Resource Conservation Recovery Program (S)
Hexachloroethane	Resource Conservation Recovery Program (NPW)
Hexachloroethane	Resource Conservation Recovery Program (S)
Hexachlorophene	Resource Conservation Recovery Program (NPW)
Hexachlorophene	Resource Conservation Recovery Program (S)
Hexachloropropene	Resource Conservation Recovery Program (NPW)
Hexachloropropene	Resource Conservation Recovery Program (S)
Indeno[1,2,3-cd]pyrene	Resource Conservation Recovery Program (NPW)
Indeno[1,2,3-cd]pyrene	Resource Conservation Recovery Program (S)
Isodrin	Resource Conservation Recovery Program (NPW)
Isodrin	Resource Conservation Recovery Program (S)
Isophorone	Resource Conservation Recovery Program (NPW)
Isophorone	Resource Conservation Recovery Program (S)
Isosafrole	Resource Conservation Recovery Program (NPW)
Isosafrole	Resource Conservation Recovery Program (S)
Kepone	Resource Conservation Recovery Program (NPW)
Kepone	Resource Conservation Recovery Program (S)
Methapyrilene	Resource Conservation Recovery Program (NPW)
Methapyrilene	Resource Conservation Recovery Program (S)
Methyl methanesulfonate	Resource Conservation Recovery Program (NPW)
Methyl methanesulfonate	Resource Conservation Recovery Program (S)
Methyl parathion	Resource Conservation Recovery Program (NPW)
Methyl parathion	Resource Conservation Recovery Program (S)
Naphthalene	Resource Conservation Recovery Program (NPW)
Naphthalene	Resource Conservation Recovery Program (S)
Nitrobenzene	Resource Conservation Recovery Program (NPW)
Nitrobenzene	Resource Conservation Recovery Program (S)
n-Nitrosodiethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodiethylamine	Resource Conservation Recovery Program (S)
n-Nitrosodimethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodimethylamine	Resource Conservation Recovery Program (S)
n-Nitroso-di-n-butylamine	Resource Conservation Recovery Program (NPW)
n-Nitroso-di-n-butylamine	Resource Conservation Recovery Program (S)
n-Nitroso-di-n-propylamine	Resource Conservation Recovery Program (NPW)
n-Nitroso-di-n-propylamine	Resource Conservation Recovery Program (S)
n-Nitrosodiphenylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodiphenylamine	Resource Conservation Recovery Program (S)
n-Nitrosomethylethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosomethylethylamine	Resource Conservation Recovery Program (S)
n-Nitrosomorpholine	Resource Conservation Recovery Program (NPW)
n-Nitrosomorpholine	Resource Conservation Recovery Program (S)
n-Nitrosopiperidine	Resource Conservation Recovery Program (NPW)
n-Nitrosopiperidine	Resource Conservation Recovery Program (S)
n-Nitrosopyrrolidine	Resource Conservation Recovery Program (NPW)
n-Nitrosopyrrolidine	Resource Conservation Recovery Program (S)
o,o,o-Triethyl phosphorothioate	Resource Conservation Recovery Program (NPW)
o,o,o-Triethyl phosphorothioate	Resource Conservation Recovery Program (S)
o-Toluidine	Resource Conservation Recovery Program (NPW)
o-Toluidine	Resource Conservation Recovery Program (S)
Parathion	Resource Conservation Recovery Program (NPW)
Parathion	Resource Conservation Recovery Program (S)
Pentachlorobenzene	Resource Conservation Recovery Program (NPW)
Pentachlorobenzene	Resource Conservation Recovery Program (S)
Pentachloronitrobenzene	Resource Conservation Recovery Program (NPW)
Pentachloronitrobenzene	Resource Conservation Recovery Program (S)
Pentachlorophenol	Resource Conservation Recovery Program (NPW)
Pentachlorophenol	Resource Conservation Recovery Program (S)
Phenacetin	Resource Conservation Recovery Program (NPW)

Phenacetin	Resource Conservation Recovery Program (S)
Phenanthrene	Resource Conservation Recovery Program (NPW)
Phenanthrene	Resource Conservation Recovery Program (S)
Phenol	Resource Conservation Recovery Program (NPW)
Phenol	Resource Conservation Recovery Program (S)
Phorate	Resource Conservation Recovery Program (NPW)
Phorate	Resource Conservation Recovery Program (S)
p-Phenylenediamine	Resource Conservation Recovery Program (NPW)
p-Phenylenediamine	Resource Conservation Recovery Program (S)
Pronamide (Kerb)	Resource Conservation Recovery Program (NPW)
Pronamide (Kerb)	Resource Conservation Recovery Program (S)
Pyrene	Resource Conservation Recovery Program (NPW)
Pyrene	Resource Conservation Recovery Program (S)
Pyridine	Resource Conservation Recovery Program (NPW)
Pyridine	Resource Conservation Recovery Program (S)
Safrole	Resource Conservation Recovery Program (NPW)
Safrole	Resource Conservation Recovery Program (S)
Sulfotepp	Resource Conservation Recovery Program (NPW)
Sulfotepp	Resource Conservation Recovery Program (S)
EPA 8270D	
1,1'-Biphenyl	Resource Conservation Recovery Program (NPW)
1,1'-Biphenyl	Resource Conservation Recovery Program (S)
1,2,4,5-Tetrachlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4,5-Tetrachlorobenzene	Resource Conservation Recovery Program (S)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2,4-Trichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,2-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,2-Diphenylhydrazine	Resource Conservation Recovery Program (NPW)
1,2-Diphenylhydrazine	Resource Conservation Recovery Program (S)
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (NPW)
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (S)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,3-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (NPW)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (S)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (NPW)
1,4-Dichlorobenzene	Resource Conservation Recovery Program (S)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (NPW)
1,4-Dioxane (1,4- Diethyleneoxide)	Resource Conservation Recovery Program (S)
1,4-Naphthoquinone	Resource Conservation Recovery Program (NPW)
1,4-Naphthoquinone	Resource Conservation Recovery Program (S)
1-Chloronaphthalene	Resource Conservation Recovery Program (NPW)
1-Chloronaphthalene	Resource Conservation Recovery Program (S)
1-Methylnaphthalene	Resource Conservation Recovery Program (NPW)
1-Methylnaphthalene	Resource Conservation Recovery Program (S)
1-Naphthylamine	Resource Conservation Recovery Program (NPW)
1-Naphthylamine	Resource Conservation Recovery Program (S)
2,2'-Oxybis(1-chloropropane)	Resource Conservation Recovery Program (NPW)
2,2'-Oxybis(1-chloropropane)	Resource Conservation Recovery Program (S)
2,3,4,6-Tetrachlorophenol	Resource Conservation Recovery Program (NPW)
2,3,4,6-Tetrachlorophenol	Resource Conservation Recovery Program (S)
2,4,5-Trichlorophenol	Resource Conservation Recovery Program (NPW)
2,4,5-Trichlorophenol	Resource Conservation Recovery Program (S)
2,4,6-Trichlorophenol	Resource Conservation Recovery Program (NPW)
2,4,6-Trichlorophenol	Resource Conservation Recovery Program (S)
2,4-Dichlorophenol	Resource Conservation Recovery Program (NPW)
2,4-Dichlorophenol	Resource Conservation Recovery Program (S)
2,4-Dimethylphenol	Resource Conservation Recovery Program (NPW)
2,4-Dimethylphenol	Resource Conservation Recovery Program (S)
2,4-Dinitrophenol	Resource Conservation Recovery Program (NPW)
2,4-Dinitrophenol	Resource Conservation Recovery Program (S)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (NPW)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (S)

2,6-Dichlorophenol	Resource Conservation Recovery Program (NPW)
2,6-Dichlorophenol	Resource Conservation Recovery Program (S)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (NPW)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (S)
2-Acetylaminofluorene	Resource Conservation Recovery Program (NPW)
2-Acetylaminofluorene	Resource Conservation Recovery Program (S)
2-Chloronaphthalene	Resource Conservation Recovery Program (NPW)
2-Chloronaphthalene	Resource Conservation Recovery Program (S)
2-Chlorophenol	Resource Conservation Recovery Program (NPW)
2-Chlorophenol	Resource Conservation Recovery Program (S)
2-Methylnaphthalene	Resource Conservation Recovery Program (NPW)
2-Methylnaphthalene	Resource Conservation Recovery Program (S)
2-Methylphenol (o-Cresol)	Resource Conservation Recovery Program (NPW)
2-Methylphenol (o-Cresol)	Resource Conservation Recovery Program (S)
2-Naphthylamine	Resource Conservation Recovery Program (NPW)
2-Naphthylamine	Resource Conservation Recovery Program (S)
2-Nitroaniline	Resource Conservation Recovery Program (NPW)
2-Nitroaniline	Resource Conservation Recovery Program (S)
2-Nitrophenol	Resource Conservation Recovery Program (NPW)
2-Nitrophenol	Resource Conservation Recovery Program (S)
2-Picoline (2-Methylpyridine)	Resource Conservation Recovery Program (NPW)
2-Picoline (2-Methylpyridine)	Resource Conservation Recovery Program (S)
3 & 4 Methylphenol	Resource Conservation Recovery Program (NPW)
3,3'-Dichlorobenzidine	Resource Conservation Recovery Program (NPW)
3,3'-Dichlorobenzidine	Resource Conservation Recovery Program (S)
3,3'-Dimethylbenzidine	Resource Conservation Recovery Program (NPW)
3,3'-Dimethylbenzidine	Resource Conservation Recovery Program (S)
3-Methylcholanthrene	Resource Conservation Recovery Program (NPW)
3-Methylcholanthrene	Resource Conservation Recovery Program (S)
3-Nitroaniline	Resource Conservation Recovery Program (NPW)
3-Nitroaniline	Resource Conservation Recovery Program (S)
4,6-Dinitro-2-methylphenol	Resource Conservation Recovery Program (NPW)
4,6-Dinitro-2-methylphenol	Resource Conservation Recovery Program (S)
4-Aminobiphenyl	Resource Conservation Recovery Program (NPW)
4-Aminobiphenyl	Resource Conservation Recovery Program (S)
4-Bromophenyl phenyl ether	Resource Conservation Recovery Program (NPW)
4-Bromophenyl phenyl ether	Resource Conservation Recovery Program (S)
4-Chloro-3-methylphenol	Resource Conservation Recovery Program (NPW)
4-Chloro-3-methylphenol	Resource Conservation Recovery Program (S)
4-Chloroaniline	Resource Conservation Recovery Program (NPW)
4-Chloroaniline	Resource Conservation Recovery Program (S)
4-Chlorophenyl phenylether	Resource Conservation Recovery Program (NPW)
4-Chlorophenyl phenylether	Resource Conservation Recovery Program (S)
4-Nitroaniline	Resource Conservation Recovery Program (NPW)
4-Nitroaniline	Resource Conservation Recovery Program (S)
4-Nitrophenol	Resource Conservation Recovery Program (NPW)
4-Nitrophenol	Resource Conservation Recovery Program (S)
4-Nitroquinoline 1-oxide	Resource Conservation Recovery Program (NPW)
4-Nitroquinoline 1-oxide	Resource Conservation Recovery Program (S)
5-Nitro-o-toluidine	Resource Conservation Recovery Program (NPW)
5-Nitro-o-toluidine	Resource Conservation Recovery Program (S)
7,12-Dimethylbenz[a]anthracene	Resource Conservation Recovery Program (NPW)
7,12-Dimethylbenz[a]anthracene	Resource Conservation Recovery Program (S)
a-a-Dimethylphenethylamine	Resource Conservation Recovery Program (NPW)
a-a-Dimethylphenethylamine	Resource Conservation Recovery Program (S)
Acenaphthene	Resource Conservation Recovery Program (NPW)
Acenaphthene	Resource Conservation Recovery Program (S)
Acenaphthylene	Resource Conservation Recovery Program (NPW)
Acenaphthylene	Resource Conservation Recovery Program (S)
Acetophenone	Resource Conservation Recovery Program (NPW)
Acetophenone	Resource Conservation Recovery Program (S)
Aniline	Resource Conservation Recovery Program (NPW)
Aniline	Resource Conservation Recovery Program (S)
Anthracene	Resource Conservation Recovery Program (NPW)

Anthracene	Resource Conservation Recovery Program (S)
Aramite	Resource Conservation Recovery Program (NPW)
Aramite	Resource Conservation Recovery Program (S)
Atrazine	Resource Conservation Recovery Program (NPW)
Atrazine	Resource Conservation Recovery Program (S)
Azobenzene	Resource Conservation Recovery Program (NPW)
Azobenzene	Resource Conservation Recovery Program (S)
Benzaldehyde	Resource Conservation Recovery Program (NPW)
Benzaldehyde	Resource Conservation Recovery Program (S)
Benzidine	Resource Conservation Recovery Program (NPW)
Benzidine	Resource Conservation Recovery Program (S)
Benzo[a]anthracene	Resource Conservation Recovery Program (NPW)
Benzo[a]anthracene	Resource Conservation Recovery Program (S)
Benzo[a]pyrene	Resource Conservation Recovery Program (NPW)
Benzo[a]pyrene	Resource Conservation Recovery Program (S)
Benzo[b]fluoranthene	Resource Conservation Recovery Program (NPW)
Benzo[b]fluoranthene	Resource Conservation Recovery Program (S)
Benzo[g,h,i]perylene	Resource Conservation Recovery Program (NPW)
Benzo[g,h,i]perylene	Resource Conservation Recovery Program (S)
Benzo[k]fluoranthene	Resource Conservation Recovery Program (NPW)
Benzo[k]fluoranthene	Resource Conservation Recovery Program (S)
Benzoic acid	Resource Conservation Recovery Program (NPW)
Benzoic acid	Resource Conservation Recovery Program (S)
Benzyl alcohol	Resource Conservation Recovery Program (NPW)
Benzyl alcohol	Resource Conservation Recovery Program (S)
bis(2-Chloroethoxy)methane	Resource Conservation Recovery Program (NPW)
bis(2-Chloroethoxy)methane	Resource Conservation Recovery Program (S)
bis(2-Chloroethyl)ether	Resource Conservation Recovery Program (NPW)
bis(2-Chloroethyl)ether	Resource Conservation Recovery Program (S)
bis(2-Ethylhexyl)adipate	Resource Conservation Recovery Program (NPW)
bis(2-Ethylhexyl)adipate	Resource Conservation Recovery Program (S)
bis(2-Ethylhexyl)phthalate (DEHP)	Resource Conservation Recovery Program (NPW)
bis(2-Ethylhexyl)phthalate (DEHP)	Resource Conservation Recovery Program (S)
Butyl benzyl phthalate	Resource Conservation Recovery Program (NPW)
Butyl benzyl phthalate	Resource Conservation Recovery Program (S)
Caprolactam	Resource Conservation Recovery Program (NPW)
Caprolactam	Resource Conservation Recovery Program (S)
Carbazole	Resource Conservation Recovery Program (NPW)
Carbazole	Resource Conservation Recovery Program (S)
Chlorobenzilate	Resource Conservation Recovery Program (NPW)
Chlorobenzilate	Resource Conservation Recovery Program (S)
Chrysene	Resource Conservation Recovery Program (NPW)
Chrysene	Resource Conservation Recovery Program (S)
Diallate	Resource Conservation Recovery Program (NPW)
Diallate	Resource Conservation Recovery Program (S)
Dibenz[a,h]anthracene	Resource Conservation Recovery Program (NPW)
Dibenz[a,h]anthracene	Resource Conservation Recovery Program (S)
Dibenz[a,j]acridine	Resource Conservation Recovery Program (NPW)
Dibenz[a,j]acridine	Resource Conservation Recovery Program (S)
Dibenzofuran	Resource Conservation Recovery Program (NPW)
Dibenzofuran	Resource Conservation Recovery Program (S)
Diethyl phthalate	Resource Conservation Recovery Program (NPW)
Diethyl phthalate	Resource Conservation Recovery Program (S)
Dimethoate	Resource Conservation Recovery Program (NPW)
Dimethoate	Resource Conservation Recovery Program (S)
Dimethyl phthalate	Resource Conservation Recovery Program (NPW)
Dimethyl phthalate	Resource Conservation Recovery Program (S)
Di-n-butyl phthalate	Resource Conservation Recovery Program (NPW)
Di-n-butyl phthalate	Resource Conservation Recovery Program (S)
Di-n-octyl phthalate	Resource Conservation Recovery Program (NPW)
Di-n-octyl phthalate	Resource Conservation Recovery Program (S)
Dinoseb	Resource Conservation Recovery Program (NPW)
Dinoseb	Resource Conservation Recovery Program (S)
Disulfoton	Resource Conservation Recovery Program (NPW)

Disulfoton	Resource Conservation Recovery Program (S)
Ethyl methanesulfonate	Resource Conservation Recovery Program (NPW)
Ethyl methanesulfonate	Resource Conservation Recovery Program (S)
Famphur	Resource Conservation Recovery Program (NPW)
Famphur	Resource Conservation Recovery Program (S)
Fluoranthene	Resource Conservation Recovery Program (NPW)
Fluoranthene	Resource Conservation Recovery Program (S)
Fluorene	Resource Conservation Recovery Program (NPW)
Fluorene	Resource Conservation Recovery Program (S)
Hexachlorobenzene	Resource Conservation Recovery Program (NPW)
Hexachlorobenzene	Resource Conservation Recovery Program (S)
Hexachlorobutadiene	Resource Conservation Recovery Program (NPW)
Hexachlorobutadiene	Resource Conservation Recovery Program (S)
Hexachlorocyclopentadiene	Resource Conservation Recovery Program (NPW)
Hexachlorocyclopentadiene	Resource Conservation Recovery Program (S)
Hexachloroethane	Resource Conservation Recovery Program (NPW)
Hexachloroethane	Resource Conservation Recovery Program (S)
Hexachlorophene	Resource Conservation Recovery Program (NPW)
Hexachlorophene	Resource Conservation Recovery Program (S)
Hexachloropropene	Resource Conservation Recovery Program (NPW)
Hexachloropropene	Resource Conservation Recovery Program (S)
Indeno[1,2,3-cd]pyrene	Resource Conservation Recovery Program (NPW)
Indeno[1,2,3-cd]pyrene	Resource Conservation Recovery Program (S)
Isodrin	Resource Conservation Recovery Program (NPW)
Isodrin	Resource Conservation Recovery Program (S)
Isophorone	Resource Conservation Recovery Program (NPW)
Isophorone	Resource Conservation Recovery Program (S)
Isosafrole	Resource Conservation Recovery Program (NPW)
Isosafrole	Resource Conservation Recovery Program (S)
Kepone	Resource Conservation Recovery Program (NPW)
Kepone	Resource Conservation Recovery Program (S)
Methapyrilene	Resource Conservation Recovery Program (NPW)
Methapyrilene	Resource Conservation Recovery Program (S)
Methyl methanesulfonate	Resource Conservation Recovery Program (NPW)
Methyl methanesulfonate	Resource Conservation Recovery Program (S)
Methyl parathion	Resource Conservation Recovery Program (NPW)
Methyl parathion	Resource Conservation Recovery Program (S)
Naphthalene	Resource Conservation Recovery Program (NPW)
Naphthalene	Resource Conservation Recovery Program (S)
Nitrobenzene	Resource Conservation Recovery Program (NPW)
Nitrobenzene	Resource Conservation Recovery Program (S)
n-Nitrosodiethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodiethylamine	Resource Conservation Recovery Program (S)
n-Nitrosodimethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodimethylamine	Resource Conservation Recovery Program (S)
n-Nitroso-di-n-butylamine	Resource Conservation Recovery Program (NPW)
n-Nitroso-di-n-butylamine	Resource Conservation Recovery Program (S)
n-Nitroso-di-n-propylamine	Resource Conservation Recovery Program (NPW)
n-Nitroso-di-n-propylamine	Resource Conservation Recovery Program (S)
n-Nitrosodiphenylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosodiphenylamine	Resource Conservation Recovery Program (S)
n-Nitrosomethylethylamine	Resource Conservation Recovery Program (NPW)
n-Nitrosomethylethylamine	Resource Conservation Recovery Program (S)
n-Nitrosomorpholine	Resource Conservation Recovery Program (NPW)
n-Nitrosomorpholine	Resource Conservation Recovery Program (S)
n-Nitrosopiperidine	Resource Conservation Recovery Program (NPW)
n-Nitrosopiperidine	Resource Conservation Recovery Program (S)
n-Nitrosopyrrolidine	Resource Conservation Recovery Program (NPW)
n-Nitrosopyrrolidine	Resource Conservation Recovery Program (S)
o,o,o-Triethyl phosphorothioate	Resource Conservation Recovery Program (NPW)
o,o,o-Triethyl phosphorothioate	Resource Conservation Recovery Program (S)
o-Toluidine	Resource Conservation Recovery Program (NPW)
o-Toluidine	Resource Conservation Recovery Program (S)
Parathion	Resource Conservation Recovery Program (NPW)

Parathion	Resource Conservation Recovery Program (S)
Pentachlorobenzene	Resource Conservation Recovery Program (NPW)
Pentachlorobenzene	Resource Conservation Recovery Program (S)
Pentachloronitrobenzene	Resource Conservation Recovery Program (NPW)
Pentachloronitrobenzene	Resource Conservation Recovery Program (S)
Pentachlorophenol	Resource Conservation Recovery Program (NPW)
Pentachlorophenol	Resource Conservation Recovery Program (S)
Phenacetin	Resource Conservation Recovery Program (NPW)
Phenacetin	Resource Conservation Recovery Program (S)
Phenanthrene	Resource Conservation Recovery Program (NPW)
Phenanthrene	Resource Conservation Recovery Program (S)
Phenol	Resource Conservation Recovery Program (NPW)
Phenol	Resource Conservation Recovery Program (S)
Phorate	Resource Conservation Recovery Program (NPW)
Phorate	Resource Conservation Recovery Program (S)
p-Phenylenediamine	Resource Conservation Recovery Program (NPW)
p-Phenylenediamine	Resource Conservation Recovery Program (S)
Pronamide (Kerb)	Resource Conservation Recovery Program (NPW)
Pronamide (Kerb)	Resource Conservation Recovery Program (S)
Pyrene	Resource Conservation Recovery Program (NPW)
Pyrene	Resource Conservation Recovery Program (S)
Pyridine	Resource Conservation Recovery Program (NPW)
Pyridine	Resource Conservation Recovery Program (S)
Safrole	Resource Conservation Recovery Program (NPW)
Safrole	Resource Conservation Recovery Program (S)
Sulfotepp	Resource Conservation Recovery Program (NPW)
Sulfotepp	Resource Conservation Recovery Program (S)
EPA 8330	
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (NPW)
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (S)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (NPW)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (S)
2,4,6-Trinitrotoluene (2,4,6-TNT)	Resource Conservation Recovery Program (NPW)
2,4,6-Trinitrotoluene (2,4,6-TNT)	Resource Conservation Recovery Program (S)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (NPW)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (S)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (NPW)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (S)
2-Amino-4,6-dinitrotoluene (2-am-dnt)	Resource Conservation Recovery Program (NPW)
2-Amino-4,6-dinitrotoluene (2-am-dnt)	Resource Conservation Recovery Program (S)
2-Nitrotoluene	Resource Conservation Recovery Program (NPW)
2-Nitrotoluene	Resource Conservation Recovery Program (S)
3-Nitrotoluene	Resource Conservation Recovery Program (NPW)
3-Nitrotoluene	Resource Conservation Recovery Program (S)
4-Amino-2,6-dinitrotoluene (4-am-dnt)	Resource Conservation Recovery Program (NPW)
4-Amino-2,6-dinitrotoluene (4-am-dnt)	Resource Conservation Recovery Program (S)
4-Nitrotoluene	Resource Conservation Recovery Program (NPW)
4-Nitrotoluene	Resource Conservation Recovery Program (S)
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	Resource Conservation Recovery Program (NPW)
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	Resource Conservation Recovery Program (S)
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	Resource Conservation Recovery Program (NPW)
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	Resource Conservation Recovery Program (S)
Nitrobenzene	Resource Conservation Recovery Program (NPW)
Nitrobenzene	Resource Conservation Recovery Program (S)
Nitroglycerin	Resource Conservation Recovery Program (NPW)
Nitroglycerin	Resource Conservation Recovery Program (S)
Pentaerythritoltetranitrate	Resource Conservation Recovery Program (NPW)
Pentaerythritoltetranitrate	Resource Conservation Recovery Program (S)
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	Resource Conservation Recovery Program (NPW)
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	Resource Conservation Recovery Program (S)
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	Resource Conservation Recovery Program (NPW)
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	Resource Conservation Recovery Program (S)
EPA 8330A	
1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (NPW)

1,3,5-Trinitrobenzene (1,3,5-TNB)	Resource Conservation Recovery Program (S)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (NPW)
1,3-Dinitrobenzene (1,3-DNB)	Resource Conservation Recovery Program (S)
2,4,6-Trinitrotoluene (2,4,6-TNT)	Resource Conservation Recovery Program (NPW)
2,4,6-Trinitrotoluene (2,4,6-TNT)	Resource Conservation Recovery Program (S)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (NPW)
2,4-Dinitrotoluene (2,4-DNT)	Resource Conservation Recovery Program (S)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (NPW)
2,6-Dinitrotoluene (2,6-DNT)	Resource Conservation Recovery Program (S)
2-Amino-4,6-dinitrotoluene (2-am-dnt)	Resource Conservation Recovery Program (NPW)
2-Amino-4,6-dinitrotoluene (2-am-dnt)	Resource Conservation Recovery Program (S)
2-Nitrotoluene	Resource Conservation Recovery Program (NPW)
2-Nitrotoluene	Resource Conservation Recovery Program (S)
3-Nitrotoluene	Resource Conservation Recovery Program (NPW)
3-Nitrotoluene	Resource Conservation Recovery Program (S)
4-Amino-2,6-dinitrotoluene (4-am-dnt)	Resource Conservation Recovery Program (NPW)
4-Amino-2,6-dinitrotoluene (4-am-dnt)	Resource Conservation Recovery Program (S)
4-Nitrotoluene	Resource Conservation Recovery Program (NPW)
4-Nitrotoluene	Resource Conservation Recovery Program (S)
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	Resource Conservation Recovery Program (NPW)
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	Resource Conservation Recovery Program (S)
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	Resource Conservation Recovery Program (NPW)
Methyl-2,4,6-trinitrophenylnitramine (tetryl)	Resource Conservation Recovery Program (S)
Nitrobenzene	Resource Conservation Recovery Program (NPW)
Nitrobenzene	Resource Conservation Recovery Program (S)
Nitroglycerin	Resource Conservation Recovery Program (NPW)
Nitroglycerin	Resource Conservation Recovery Program (S)
Pentaerythritoltetranitrate	Resource Conservation Recovery Program (NPW)
Pentaerythritoltetranitrate	Resource Conservation Recovery Program (S)
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	Resource Conservation Recovery Program (NPW)
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	Resource Conservation Recovery Program (S)
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	Resource Conservation Recovery Program (NPW)
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	Resource Conservation Recovery Program (S)
EPA 9012A	
Total Cyanide	Resource Conservation Recovery Program (NPW)
Total Cyanide	Resource Conservation Recovery Program (S)
EPA 9040C	
pH	Resource Conservation Recovery Program (S)
EPA 9045D	
pH	Resource Conservation Recovery Program (S)
EPA 9056 0	
Bromide	Resource Conservation Recovery Program (NPW)
Bromide	Resource Conservation Recovery Program (S)
Chloride	Resource Conservation Recovery Program (NPW)
Chloride	Resource Conservation Recovery Program (S)
Nitrate as N	Resource Conservation Recovery Program (NPW)
Nitrate as N	Resource Conservation Recovery Program (S)
Nitrite as N	Resource Conservation Recovery Program (NPW)
Nitrite as N	Resource Conservation Recovery Program (S)
Orthophosphate as P	Resource Conservation Recovery Program (NPW)
Orthophosphate as P	Resource Conservation Recovery Program (S)
Sulfate	Resource Conservation Recovery Program (NPW)
Sulfate	Resource Conservation Recovery Program (S)
EPA 9060A	
Total Organic Carbon	Resource Conservation Recovery Program (S)
EPA 9071B	
Oil & Grease	Resource Conservation Recovery Program (S)
MA EPH	
2-Methylnaphthalene	Leaking Underground Storage Tank Program (NPW)
2-Methylnaphthalene	Leaking Underground Storage Tank Program (S)
Acenaphthene	Leaking Underground Storage Tank Program (NPW)
Acenaphthene	Leaking Underground Storage Tank Program (S)
Acenaphthylene	Leaking Underground Storage Tank Program (NPW)

Acenaphthylene	Leaking Underground Storage Tank Program (S)
Anthracene	Leaking Underground Storage Tank Program (NPW)
Anthracene	Leaking Underground Storage Tank Program (S)
Benzo[a]anthracene	Leaking Underground Storage Tank Program (NPW)
Benzo[a]anthracene	Leaking Underground Storage Tank Program (S)
Benzo[a]pyrene	Leaking Underground Storage Tank Program (NPW)
Benzo[a]pyrene	Leaking Underground Storage Tank Program (S)
Benzo[b]fluoranthene	Leaking Underground Storage Tank Program (NPW)
Benzo[b]fluoranthene	Leaking Underground Storage Tank Program (S)
Benzo[g,h,i]perylene	Leaking Underground Storage Tank Program (NPW)
Benzo[g,h,i]perylene	Leaking Underground Storage Tank Program (S)
Benzo[k]fluoranthene	Leaking Underground Storage Tank Program (NPW)
Benzo[k]fluoranthene	Leaking Underground Storage Tank Program (S)
Chrysene	Leaking Underground Storage Tank Program (NPW)
Chrysene	Leaking Underground Storage Tank Program (S)
Dibenz[a,h]anthracene	Leaking Underground Storage Tank Program (NPW)
Dibenz[a,h]anthracene	Leaking Underground Storage Tank Program (S)
EPH Aliphatic C19-C36	Leaking Underground Storage Tank Program (NPW)
EPH Aliphatic C19-C36	Leaking Underground Storage Tank Program (S)
EPH Aliphatic C9-C18	Leaking Underground Storage Tank Program (NPW)
EPH Aliphatic C9-C18	Leaking Underground Storage Tank Program (S)
EPH Aromatic C11-C22	Leaking Underground Storage Tank Program (NPW)
EPH Aromatic C11-C22	Leaking Underground Storage Tank Program (S)
Fluoranthene	Leaking Underground Storage Tank Program (NPW)
Fluoranthene	Leaking Underground Storage Tank Program (S)
Fluorene	Leaking Underground Storage Tank Program (NPW)
Fluorene	Leaking Underground Storage Tank Program (S)
Indeno[1,2,3-cd]pyrene	Leaking Underground Storage Tank Program (NPW)
Indeno[1,2,3-cd]pyrene	Leaking Underground Storage Tank Program (S)
Naphthalene	Leaking Underground Storage Tank Program (NPW)
Naphthalene	Leaking Underground Storage Tank Program (S)
Phenanthrene	Leaking Underground Storage Tank Program (NPW)
Phenanthrene	Leaking Underground Storage Tank Program (S)
Pyrene	Leaking Underground Storage Tank Program (NPW)
Pyrene	Leaking Underground Storage Tank Program (S)
MA VPH	
Benzene	Leaking Underground Storage Tank Program (NPW)
Benzene	Leaking Underground Storage Tank Program (S)
Ethylbenzene	Leaking Underground Storage Tank Program (NPW)
Ethylbenzene	Leaking Underground Storage Tank Program (S)
Methyl tert-butyl ether (MTBE)	Leaking Underground Storage Tank Program (NPW)
Methyl tert-butyl ether (MTBE)	Leaking Underground Storage Tank Program (S)
Naphthalene	Leaking Underground Storage Tank Program (NPW)
Naphthalene	Leaking Underground Storage Tank Program (S)
Toluene	Leaking Underground Storage Tank Program (NPW)
Toluene	Leaking Underground Storage Tank Program (S)
VPH Aliphatic C5-C8	Leaking Underground Storage Tank Program (NPW)
VPH Aliphatic C5-C8	Leaking Underground Storage Tank Program (S)
VPH Aliphatic C9-C12	Leaking Underground Storage Tank Program (NPW)
VPH Aliphatic C9-C12	Leaking Underground Storage Tank Program (S)
VPH Aromatic C9-C10	Leaking Underground Storage Tank Program (NPW)
VPH Aromatic C9-C10	Leaking Underground Storage Tank Program (S)
Xylene (total)	Leaking Underground Storage Tank Program (NPW)
Xylene (total)	Leaking Underground Storage Tank Program (S)
ME HETL 4.1.25	
Diesel range organics (DRO)	Leaking Underground Storage Tank Program (NPW)
Diesel range organics (DRO)	Leaking Underground Storage Tank Program (S)
ME HETL 4.2.17	
Gasoline range organics (GRO)	Leaking Underground Storage Tank Program (NPW)
Gasoline range organics (GRO)	Leaking Underground Storage Tank Program (S)
SimPlate®	
Heterotrophic plate count	Safe Drinking Water Program (DW)
SM 2120 B 21st ED	

Color	Clean Water Program (NPW)
SM 2130 B 21st ED	
Turbidity	Clean Water Program (NPW)
SM 2310 B 21st ED	
Acidity, as CaCO3	Clean Water Program (NPW)
SM 2320 B 20th ED	
Alkalinity as CaCO3	Clean Water Program (NPW)
SM 2320 B 21st ED	
Alkalinity as CaCO3	Clean Water Program (NPW)
SM 2340 B 21st ED	
Hardness	Clean Water Program (NPW)
SM 2540 B 21st ED	
Residue-total (TS)	Clean Water Program (NPW)
SM 2540 C 21st ED	
Residue-filterable (TDS)	Clean Water Program (NPW)
SM 2540 D 21st ED	
Residue-nonfilterable (TSS)	Clean Water Program (NPW)
SM 2540 F 21st ED	
Residue-settleable	Clean Water Program (NPW)
SM 3500-Cr D 19th ED	
Chromium VI	Clean Water Program (NPW)
SM 3500-Fe D 19th ED	
Iron	Clean Water Program (NPW)
SM 4500-Cl G 20th ED	
Chlorine	Clean Water Program (NPW)
SM 4500-Cl^- E 21st ED	
Chloride	Clean Water Program (NPW)
SM 4500-CN G 20th ED	
Amenable cyanide	Clean Water Program (NPW)
SM 4500-F^- B 21st ED	
Fluoride	Safe Drinking Water Program (DW)
SM 4500-F^- C 21st ED	
Fluoride	Clean Water Program (NPW)
SM 4500-H+ B 21st ED	
pH	Clean Water Program (NPW)
SM 4500-NH3 H 21st ED	
Ammonia as N	Clean Water Program (NPW)
SM 4500-P E 20th ED	
Orthophosphate as P	Clean Water Program (NPW)
SM 4500-$S2^-$ F 21st ED	
Sulfide	Clean Water Program (NPW)
SM 4500-$SO3^-$ B 21st ED	
Sulfite	Clean Water Program (NPW)
SM 5210 B 21st ED	
Biochemical oxygen demand	Clean Water Program (NPW)
Carbonaceous BOD, CBOD	Clean Water Program (NPW)
SM 5310 B 21st ED	
Total Organic Carbon	Clean Water Program (NPW)
SM 5540 C 20th ED	
Surfactants - MBAS	Clean Water Program (NPW)
SM 9222 D (m-FC) 21st ED	
Fecal coliforms	Clean Water Program (NPW)
Fecal coliforms	Safe Drinking Water Program (DW)
SM 9223 B (Colilert® Quanti-Tray®) 21st ED	
Total coliforms	Safe Drinking Water Program (DW)
SM 9223 B (Colilert®) 21st ED	
Escherichia coli	Safe Drinking Water Program (DW)
SM 9223 B (Colilert®-18 Quanti-Tray®) 21st ED	
Escherichia coli	Clean Water Program (NPW)
SM 9223 B (Colisure® Quanti-Tray®) 21st ED	

APPENDIX F

RESPONSE TO REGULATORY AGENCY COMMENTS

Response to MEDEP Comments dated November 16, 2011
Draft Tier II Sampling and Analysis Plan, Remedial Investigation of Soil Munitions Response Program Site, Skeet Range dated October 2011
Naval Air Station, Brunswick, Maine

Claudia Sait
Project Manager-Federal Facilities
Bureau of Remediation & Waste Management

General Comments

1. **Comment:** Please provide MEDEP with at least two weeks notice of implementation of the workplan, so that staff can be on site if our schedules allow. Also please send 3 hard copies of the final workplan prior to starting field work.

   Response: Agree. Provided that comments are resolved and the SAP finalized in time, the tentative field work start date is now December 14, 2011 and MEDEP will be provided with 3 hard copies of the final work plan.

2. **Comment:** As usual, please provide MEDEP with an Electronic Data Display (EDD) of the data from this investigation.

   Response: Agree. MEDEP will be provided with an EDD of the data from this investigation.

3. **Comment:** MEDEP finds it difficult to read the numbers in Table A-1 which are highlighted in red. If it is not too much effort, please use yellow highlighting in the final version.

   Response: Agree. Table A-1 will be revised so that the highlighting is yellow instead of red.

4. **Comment:** MEDEP appreciates that all the detections are shown on the tag maps but it would be helpful to highlight (in yellow) the detections exceeding their screening criteria.

   Response: Detections exceeding screening criteria are presented in Table A-1. No change to the tag maps will be made for the SAP, although for the associated future report, tag maps will identify area(s) of concern based on risk assessment results.

5. **Comment:** MEDEP is in the process of revising its background levels for Polycyclic Aromatic Hydrocarbons (PAHs), so the Navy may want to wait until that is done as the levels are expected to rise. Also if the Background Study for soils is finalized the Navy already has site specific background levels, so the Navy needs to discuss how and when these numbers will be used in relationship to the current background concentrations. Also the proposed site specific background study warrants a

justification and rationale for the number and location of the proposed sampling. MEDEP suggests that the stakeholders discuss these issues prior to proceeding with the background study for lead and PAHs.

Response: The Navy appreciates MEDEP giving advance notice that MEDEP is revising its background levels for PAHs and will consider MEDEP background values for PAHs as a line of evidence when evaluating Skeet Range PAH data. All proposed site-specific background sampling will be removed from the SAP at this time. If the Navy decides to pursue collection of site-specific background data, then a work plan addendum with sample location and data evaluation procedures will be created. Site data will be evaluated against background using lines-of-evidence such as the pending MEDEP background PAH values. The SAP will recognize that MEDEP background levels will be used, if available at the time of conducting the risk assessment, and that site-specific background samples will be collected in the future, if warranted.

6. **Comment:** Decision Units should be broken up into 9 units corresponding to skeet range fans. The fans are made up of the 1940's to early 1950's skeet range in the western most portion; the fan that overlaps the early and later skeet range, in the center, and the southern most fan which is part of the mid and post 1950's skeet range. Within each of the three fans there are 3 areas: the shooting station, likely shot fall zone, and the outer or maximum shot fall zone.

   Response: As decided during the stakeholder conference call on November 17, 2011, decision unit definitions will be removed from the SAP and decision units will instead be determined by project stakeholders after evaluating the data collected for this investigation.

7. **Comment:** MEDEP cannot agree with the exposure unit of 0 to 12 inches. Based on the Conceptual Site Model, it is expected that the lead pellets would not penetrate the soil but remain on the soil surface if undisturbed and the principle exposure for most receptors would be in the top 3 inches not 0-12 inches below ground surface (bgs). The data collected so far strongly indicate that the concentrations in the upper three inches are much higher than those in the 3-12 inch depth range. This is consistent with the findings at other skeet ranges.

   Response: Agree. The draft SAP defaulted to standard risk assessment soil intervals. However, the MEDEP comment is justified considering the conceptual site model for undisturbed areas at this particular site, where contamination is largely present only in the shallow surface soil. Therefore, as agreed upon during the November 17, 2011 stakeholder conference call, exposure units for undisturbed areas will be 0 to 3 inches and 3 to 12 inches, whereas, the surface soil exposure unit for disturbed areas will be 0 to 12 inches.

8. **Comment:** The Navy uses "Data Gap Investigation and Risk Assessment Report for Site 9, Neptune Drive Disposal Site (Tetra Tech 2011) as a building block to design this remedial investigation, however MEDEP has never seen this report,

therefore it cannot be used to support this investigation. (Also see comment 19 below.)

Response: All references to the "Data Gap Investigation and Risk Assessment Report for Site 9, Neptune Drive Disposal Site (Tetra Tech 2011) will be removed from the SAP. The fact that an investigation was conducted will be retained with a note that the report is pending.

9. **Comment:** The "Site Inspection Report for Munitions Response Program Sites, Machine Gun Boresight Range and Skeet Range" (August 2011) report should be finalized as soon as possible to support this investigation.

   Response: Comment noted.

10. **Comment:** To aid discussion of the two skeet ranges and the decision units within the ranges it might be advantageous to give each section a letter and each decision unit within the section a number. For example the western most section of the 1940-early 1950's could be Area A; the overlapping area could be Area B and so on. Then each DU within Area A could be 1, 2, as needed.

    Response: Decision unit definitions are being removed from the SAP per response to MEDEP Comment 6 and per the stakeholder conference call on November 17, 2011; therefore, no change to the SAP will be made as a result of this comment.

11. **Comment:** Unless MEDEP misunderstands the Navy's intent the samples should be taken in undisturbed areas when possible (i.e., wooded areas or near trees).

    Response: As discussed during the November 17, 2011 conference call, the MEDEP misunderstood the Navy's intent for this investigation, which is to define the extent of impacted soil from the Skeet Range activities and evaluate risks to human health and the environment as stated in the problem definition (Section 5.1). Skeet range activities may have impacted soils in disturbed areas (i.e., areas where construction occurred); therefore, it is appropriate to also collect samples in those locations. However, a change is warranted concerning this comment as per MEDEP's request during a December 12, 2011 phone call: Sample locations SB34, SB74, and SB80 will be redefined as undisturbed, rather than disturbed, soil sampling locations and text, figures, and tables will be changed accordingly.

Specific Comments:

12. **Comment:** Worksheet (WS) 1.0, Project Organizational Chart, and WS 2.0, Communications Pathways: Please check the telephone number for Mr. Bober and correct as necessary.

    Response: Mr. Bober's telephone number on WS 1.0 and WS 2.0 will be revised to read: (215) 897-4911.

13. **Comment:** WS 1.0, Project Organizational Chart:

a.) Please check the spelling of Brian Geringer's name.

b.) Kelly Perkins in no longer the Katahdin Project Manager. Please update the organizational chart.

Response:
a.) The spelling of Brian Geringer's name will be corrected.

b .) Kelly Perkins will be replaced by Jenifer Obrin in the organization chart.

14. **Comment:** WS 2.0, Communications Pathways, SAP Amendments: "The Tetra Tech PM will send scope changes to the Project Team via email ..."

It is unclear if regulators will be notified as the project team is not identified. Please provide the mechanism for notifying MEDEP and EPA of changes in the Sampling and Analysis Plan (SAP). (The notification of regulators also needs to be addressed in the "Field Issues that require changes in scope..." and "Stop work recommendations...")

Response: The project team, including the MEDEP and EPA RPMs, is identified on WS 1.0. The notification of regulators will be included in the "Field Issues that require changes in scope..." and "Stop work recommendations" communication drivers in WS 2.0.

15. **Comment:** Section 3, Project Planning Session Participants Sheet, Comments/Consensus Decision: MEDEP is not going to comment on the summary of decisions made by the Navy in its discussion with its contractor but, as written, they indicate a false sense of participation among the stakeholders which is not the case. MEDEP suggests that they be removed or at the very least identified as Navy/Tetra Tech meeting notes not consensus decisions.

Response: Additional text will be added to Section 3 clarifying that all Stakeholders did not provide input on the consensus decisions.

16. **Comment:** Section 4.1, Historical Information: Please provide information on how long the post 1950's range was used and provide the construction dates of the various buildings and structures on the ranges.

Response: Available requested information will be included.

17. **Comment:** Section 4.2, Geology: This section needs to describe the ponds and the significant portion of the shotfall zone that overlays the slopes that drop to the pond. The south and southwest facing slopes are more likely to have accumulated shotfall,

and the drainage to the pond is influencing shallow groundwater flow and surface runoff at the site.

Response: The requested information will be included. A discussion of site topography, surface water drainage, and likely pond influence on shallow groundwater flow will be added.

18. Comment: Section 4.3, Current Land Use and Anticipated Future Land Use:

a.) This section should be checked for accuracy or revised to be more specific as to the timeframes being discussed and include a discussion of current land use.

b.) "Prior to 1950 the SKT was in a highly developed part of the base and included several buildings."

It is unclear what the basis is for this statement. A review of the 1952 figure of the Base, there were a few buildings to the west and some to the north including the incinerator, ash landfill and some storage buildings where site 9 is currently but MEDEP would not call it a "highly developed part of the base". Please review and correct.

c.) After 1950, the SKT was undeveloped except for the northernmost portion, which contains a baseball field (Site 6 on Figure 1)..."

Unless this statement pertains to only the later skeet range (post 1950's) it is inaccurate. Please be more specific or recheck aerial photos for development on the range such as the barracks, the galley, the gymnasium, housing, etc. To MEDEP's knowledge there was no baseball field on either Site 9 or Site 6 but there were baseball fields where the new housing is now to the east of Site 9. Please revise/clarify as necessary.

d.) "In the future, most of the SKT will be slated for business and technology industries use, while the ..."

This statement overlooks the current residential use in the northeast portion of the site and that the reuse allows for community mixed use north of Neptune Drive. Please revise.

Response:
a.) Comment noted. The section will be checked for accuracy and revised accordingly to discuss more specific timeframes and current land use.

b.) The description of the Skeet Range will be changed to read "partially developed part of the base" instead of "highly developed part of the base".

c.) The sentence: "The SKT was undeveloped except for the northernmost portion, which contains a baseball field (Site 6 on Figure 1)..." will be revised to state "After 1950, the SKT was undeveloped except for the northernmost portion, which contains residential housing (Figure 1), and the central portion, which reportedly contains a baseball field (Site 6 on Figure 1)."

d.) The statement will be revised to account for residential and community mixed use.

19. **Comment:** Section 4.4, Nature and Extent of Contamination, para 4, 7 & 8: "The Site 9 soil samples which will be used as a part of this RI are outside of the Ash Excavation Area."

    The Site 9 soil samples were collected based on visible ash and were not collected at 0-3 inches and 3-12 inch intervals, but at 0-1 foot, 1-5 feet, and 5-10 bgs. It is unlikely that these previously collected samples can be used as part of this investigation. MEDEP suggests that stakeholders discuss this further. (Also see comment 8 above.)

    Response: Per the conference call on November 17, 2011, Site 9 soil samples will not be included in this SAP.

20. **Comment:** Nature and Extent of Contamination, para 6: The lack of elevated lead at depths below 3 inches does not preclude migration to groundwater if the conditions prevent re-adsorption or precipitation of the lead. Groundwater pH at the Boresight Range was less than 6 in some wells, and the relative abundance of organic carbon and iron/manganese oxides may control lead migration. The cadmium issues at Site 7 are one example for having low metal concentrations in soil at shallow depths contributing to a groundwater plume. However, the highest lead concentrations are in the area north of the ponds, where groundwater likely would discharge to the ponds, and the limited extent of the potential source vertically limit any impact it may have on groundwater at the site. The rationale for omitting groundwater needs to be expanded in the text. However once the data from this investigation has been issued stakeholders may need to determine whether it is necessary to include groundwater in the investigation.

    Response: As suggested, once the data from this investigation are collected stakeholders will determine whether it is necessary to include groundwater in the investigation. A significant number of sample locations are planned to further refine the site conceptual model. However, due to the straightforward nature of the site (i.e., the lack of complexity), it is anticipated that the data from sampled collected will fit the current site conceptual model, and that the site conceptual model will not change significantly. The additional measure the Navy agreed to during the November 17, 2011 conference call to evaluate for risk assessment samples from the 0 to 3 inch interval, where contamination is most evident, will ensure that contamination migration potential to groundwater is not overlooked.

21. **Comment:** Section 4.5, Source Media Potential Migration Routes, and Potential Receptors:

    a.) Para 4: Planned future uses include Community Mixed Use which includes residential use in addition to Recreation Use, and Business and Technology Use.

There is housing on the site currently, therefore potential receptors must also include residents. Please revise.

b.) Para 4: As there are already residences within the site, please revise the following statement: "Residential use of the site is not currently planned;...

c.) Para 4: The first paragraph states "[d]ue to the complexity of potential sources of contaminants in sediment and surface water in the Impoundment Ponds, these media and potential migration routes will be addressed through investigation under a separate cover." It is not clear what "under separate cover" means. Will there be a completely separate investigation and human health/ ecological risk assessments for these impoundment ponds or a concurrent investigation/ assessment that will eventually unite with this one to provide comprehensive assessments? While being sympathetic to the potential difficulties in separating out influence of the skeet range and other sources in these ponds, it must be recognized that the human health and ecological assessments are assessments of receptors, not media. Since it is certainly plausible that a single human or ecological receptor can be exposed to both soil and surface water/sediment, it is inappropriate to separate these exposures in different risk assessments.

d.) Para 5: "Five metals (antimony, arsenic, cobalt, lead and manganese)..." This is only the list of metals that exceeded both the Maine Remedial Action Guidelines and EPA's Regional Screening Levels. Please add the full list of metals that exceeded either the RAGs or the RSLs.

Response:

a.) Will revise accordingly.

b.) Will revise accordingly.

c.) As discussed during the November 17, 2011 conference call, sediment and surface water will be addressed through a separate investigation at a later date due to current Navy priorities to first address/remediate soils in support of property transfer. The Navy acknowledges that only evaluating soil risks will initially underestimate cumulative site risks to receptors also exposed to surface water and sediment. However, it is anticipated that a soil remedial action will occur to be protective of human health and the environment at the Skeet Range and the Navy would like to mitigate those soil risks prior to conducting a comprehensive risk assessment of all site media. It is anticipated that overall site-wide risks following soil remediation will be nominal, and that any soil-to-sediment and soil-to-surface water pathway will be removed. Upon completion of the sediment and surface water investigations all site data (i.e., relevant soil, sediment, and surface water) will be evaluated collectively to determine site risks to those receptors potentially exposed to all three media. Text to this effect will be added to the section.

d.) Several changes are warranted:

- The sentence will be revised to list metals that exceeded PALs to be consistent with the remainder of the paragraph.
- Moreover, the use of the terms PALs and RSLs will be reviewed throughout the entire document to ensure appropriate use in context.

- Earlier in the section, with the paragraph beginning "Groundwater is assumed to not have been impacted...", the following clarification will be added: "; however, after RI data are available the potential risk to groundwater will be discussed with the stakeholders."

22. **Comment:** Section 5.2, Identify Information Inputs, Soil Lithology Data: The objective for sampling areas clearly reworked needs to be clarified. MEDEP is curious as to why 4 feet below ground surface (bgs) was selected to identify native soil; why just the 2 foot interval above the native soil was selected for sampling and analyses; and why 1 to 3 foot interval was selected for sampling analyses if native soil was not identified within 4 feet?

    Response: As discussed during the November 17, 2011 conference call, the objective of sampling reworked areas is to determine what impact, if any, skeet range activities had on these soils at depth since the original potentially contaminated soil may have been buried when the soil was reworked. Shallow subsurface soil is expected to be most contaminated. As agreed upon during the conference call, if native soil is detected within 4 ft bgs in reworked sample location areas, then a soil sample will be collected over a two foot depth interval that included approximately 1 foot of native material and 1 foot of reworked material. If native soil is not encountered at 4 ft bgs then a sample will be collected from 1 to 3 ft bgs. Section 5.2 text will be revised to clarify.

23. **Comment:** Section 5.2, Identify Information Inputs, Laboratory-Analyzed Chemical Data: "Sediment and surface water were analyzed in the SI for TAL metals; no additional RI analyses are planned for these media."

    Sediment and surface water will have to be investigated sometime as noted in Section 4.5, so please add "at this time".

    Response: Agreed. The requested revision will be made.

24. **Comment:** Section 5.2, Identify Information Inputs, Background Data: See comment 5 above.

    Response: Agree. See response to Comment 5. Item 4. Background Data in Section 5.2 will be revised to explain that site data will be compared to background using lines-of-evidence such as the pending MEDEP background PAH values.

25. **Comment:** Section 5.2, Identify Information Inputs, Spatial Location Data: If there are other potential sources then they should be discussed as part of the conceptual site model. How does the Navy propose to distinguish between the different point sources? Also please check the last sentence for a typographical error.

    Response: Any potential point sources will be added to the site conceptual model text and figures. The data will be evaluated in the RI, and any discernable patterns, especially near other potential point sources, will be flagged for further evaluation in

the RI. If any data gaps exist in proximity to other potential point sources, those will be identified, then addressed in the uncertainty analysis.

26. **Comment:** Section 5.3, Delineation of Study Boundary, bullet 3:

a.) See comments 6 and 7 above. The proposed depth of 0-12 inches bgs is inconsistent with the data collected to date and with the Topsham Annex Skeet Range proposals. Other skeet range studies have clearly shown that concentrations decline significantly below 6 inches. The exposure units need to reflect the more likely exposure to the most contaminated shallow surface soils.

b.) Decision Unit 1 should be broken up into three units corresponding to the outer arc of EU 2, 3 and 4.

Response:
a.) Please see response to Comment 7.

b.) Please see response to Comment 6.

27. **Comment:** Section 5.4, Decision Rules, A: Probable exposure units were tentatively defined based on existing data and are subject to change based on the contaminant distribution, presumable from newly acquired data. Please provide additional information on how additional data may change exposure units (e.g., only in size or also in number?) and how new boundaries will be determined. Will this be an intuitive judgment or based on some numeric criteria?

Response: Please see response to Comment 6. Exposure units will be defined and agreed to upon by the project stakeholders after evaluation of data and based upon intuitive judgment driven primarily by upon contaminant distribution and potential future land use.

28. **Comment:** Section 5.4, Decision Rules, B: As presented, addressing ecological risk comes only after the human health assessment is completed and only if the human health risks are below maximum acceptable risk levels. It is presumed that this sequence is a simplification of the decision rules. It is expected that potential ecological risk will be assessed concurrently with human health risks and not be dependent on the human health risk outcome. Please clarify.

Response: Ecological risks will be concurrently assessed with human health risk. The ecological risk assessment is not dependent upon the human health risk assessment outcome. To clarify, the following text will be added at the end of the first sentence of Decision Rule B:

"...then conclude that human health risks associated with exposure to surface soil are acceptable."

29. **Comment:** Section 5.4, Decision Rule B & D: (also in human health and ecological risk assessment methodology sections). This rule indicates that human health and ecological risks will first be evaluated using soil data collected from 0-12 inches and, if that risk exceeds maximum acceptable levels, then additional assessments will be performed segregating the soil data into intervals of 0 to 3 inches and 3 to 12 inches. This is neither logical nor protective. It is conceivable that the 0- to 3-inch interval could result in unacceptable risks, but these risks would be masked by including data from the 3- to 12-inch (and generally less contaminated, based on existing data) interval. Therefore, the initial risk assessment using the 0- to 12-inch interval would fail to identify these risks. It is recommended that the 0- to 3-inch and 3- to 12-inch intervals be assessed individually and the 0- to 12-inch interval be added as an optional evaluation. See comment 7 above. Decision Rule D was deleted.

Response: Agree. Please see response to Comment 7.

30. **Comment:** Section 6.0, Measurement Performance Criteria (MPC) Table: The MPC for field duplicates is unacceptable. Values greater than the Limit of Quantitation (LOQ) should be able to meet ≤ 30% Relative Percent Difference (RPD) for metals.

Response: The MPC for field duplicates is acceptable when compared to the Region 1, EPA – New England Data Validation Functional Guidelines for Evaluating Environmental Analyses, Part IV – Inorganic Data Functional Guidelines, November 2008, which states the following in Section X. Field Duplicates:

B. Criteria
  2.b Non-Aqueous Field Duplicates
    i. For all analytes detected at concentrations greater than or equal to five times the sample quantitation limit in both field duplicate samples of non-aqueous matrices, the RPD must be less than or equal to 50 percent.

31. **Comment:** Section 7.0, Sampling Design and Rationale, para 5: The objective of the background soil sample locations is to represent areas that have had no impact from activities associated with the skeet range. However most of the locations shown on Figure 6 are in developed areas (albeit not defined "sites") that may have contaminants from unrelated activities such as traffic (especially in older areas that may have been active during leaded gasoline days). Since the bulk of the skeet range is undeveloped, it is reasonable for the bulk of the background soil samples to also be from undeveloped areas. (Also see comment 5.)

Response: Please see response to Comment 5.

32. **Comment:** Section 9.0, Reference Limits and Evaluations Tables:
a.) In this table, and in similar tables in the human health and ecological risk sections, selected screening levels are presented and referenced. Because all

possible screening levels from the selected sources are not presented, the reviewer has to either trust that the correct value was selected or independently go back to each source and re-compile the table. All candidate screening levels should be presented and referenced, with the selected screening level identified. This also gives the reviewer an idea of the range of screening levels for the constituent.

b.) Footnote1: In case where the Maine Remedial Action Guidelines (RAGs), Appendix 2 are more conservative than EPA's Residential Screening Levels (RSLs) for human health the RAGs must be used. Please correct as necessary.

Response:
a.) A reference screening value table will be added as an appendix to the report which lists those values considered for screening purposes.

b.) Section II.F. of the Final 2010 Maine RAGs Guidance clearly states that RAGs values are not applicable to selection of COPCs for a full assessment. Since a full risk assessment is being conducted no change is necessary.

33. **Comment:** Section 12.1, Validation Summary: The stated validation level is EPA Region I tier III; however, the data verification and validation steps listed in section 12.0 include only tier II review. Will all raw data and calculations be reviewed for 100% samples as called for in EPA Region I tier III validation?

Response: Yes. All raw data and calculations will be reviewed for 100% of samples as called for in EPA Region 1 tier III validation. Section 12.0 will be updated accordingly.

34. **Comment:** Figures: Please double check the figures as the boundaries for Site 6 and Site 9 on some of them have shifted southward. Also please revise Neptune Street to Neptune Drive.

Response: Agreed. The figures will be updated as requested.

35. **Comment:** Figure 2, SI Soil Positive Detections Metals, Table 1 and Table A-1: Based on the data in Table A-1, locations SS-04 and SS-12 (sampled December 2009) have associated lead values of 173 ppm and 179 ppm, respectively. Also, please correct the notes for locations SS-23 and SS-16, which were NOT non-detect. Table 1 indicates they had values too far over the calibrated range to calculate a result.

Response: Figure 2 will be re-evaluated and updated as necessary.

36. **Comment:** Figure 4, Conceptual Site Model:

a.) Please add residential site use as there are currently homes on the site and adjacent to the former Skeet Range.

b.) Please show Site 6 and Site 11 (currently the infiltration gallery) as areas of disturbed soil.

Response:
a.) Residential use will be added to the CSM.

b.) Sites 6 and 11 will be indicated as areas of disturbed soil on the CSM.

37. **Comment:** Figure 5, SI Sample Location and Proposed RI Sample Locations: MEDEP reviewed the proposed sampling locations and has the following concerns regarding the proposed locations listed below. MEDEP has included a revised figure showing its suggested relocations of the some of the sample locations.

Some of the proposed sampling locations designations are not shown (SB-53, SB-54, SB-66, SB-99, SB-102), perhaps they are hidden behind other locators. Please correct.

SB71 and SB70 are too close and appear to be in an area that would have been disturbed when building 81 was constructed and might be impacted from the historic use of leaded gasoline.

Point (unnumbered) but near XRF-SB05 appears to be in a developed area and should be shifted slightly.

SB74 is proposed in a parking lot and SB72 in the galley parking lot median strip.

SB48 and SB47 appear to be outside the boundary of the skeet range.

SB57 and SB59 are within the boundary of Site 6.

SB84 also seems to be in the weir for the lower impoundment pond.

SB60 and SB88 are too close together. One of them should be moved.

SB105 is located in the former Site 11 site which was excavated and restored.

Response: The responses below are grouped by action to be taken:

Missing sample location ID tags: Sample locations (SB-53, SB-66, SB-99, SB-102) are now identified on Figure 5 (attached). SB-54 is located north of the lower pond south of samples XRF-SS06 and XRFSS-17 and was on the original figure provided.

Relocated sample locations as per MEDEP request: Sample locations SB70, SB71, SB74, SB47, SB48, SB84, SB88, and SB105 were relocated as suggested by MEDEP on their figure provided via email on Wednesday, November 16, 2011.

Retained sample locations:

- Sample locations XRF-SB05 and SB72 will not be relocated, as discussed during the November 17, 2011 stakeholder conference call, because the

intent of those sample locations is to vertical extent of contamination from SKT activities in areas where construction may have moved soil which was a the surface during SKT activities.

- Sample locations SB57 and SB59 were relocated so that those samples are not located within the boundary of Site 6. The site boundary was slightly shifted in the figure; therefore, the site boundary will also be corrected.

38. **Comment:** Figure 6, Proposed Background Sample Locations: Some of the proposed sampling locations are close to know point sources such as the Fire Training Area, the Test Cell, the Power Plant, and the incinerator at Site 9. (See comment 5 above.)

    Response: Please see response to Comment 5.

39. **Comment:** Appendix D, Tetra Tech Standard Operating Procedures, Soil Sampling: This SOP is different from the one used in the Site Investigation. That one used an area of 1 foot by 1 foot. This one appears to be just a point sample. (The current on has an effective date of 2008 compared with the earlier one which had an effective date of 2003.) This inconsistency must the addressed.

    Response: The SOPs from 2003 and 2008 are generally the same. In the 2003 SOP, Sections 5.3 and 5.4 are Surface and Near-Surface Soil sampling, respectively. In the 2008 SOP, Sections 6.3 and 6.4 are Surface and Near-Surface Soil sampling, respectively. The 2008 SOP provided will be revised with additions and strikeouts as necessary to make the SOP site specific (and in accordance with the SAP). Also, SOP GH-1.3 Soil and Rock Drilling Methods will be deleted as the limited applicable portions are better addressed in the revised soil sampling SOP.

    In summary, the SOP changes will reflect the Navy's intent to collect 0-3 inch interval shallow surface soil samples over an area of 1 foot by 1 foot. Other surface soil sample intervals with a deeper termination depth (0-12 inch and 3-12 inch) and subsurface soil samples will be collected with a hand corer (or hand auger if the hand corer cannot reach the desired depth).

40. **Comment:** Appendix D, Tetra Tech Standard Operating Procedures, Soil Sampling, Section 6.3:

    a.) Note: The surface soil sampling interval should be 0-3 inches not 0-6 inches and near surface should be 3-12 inches not 6-18 inches. Please correct.

    b.) #3: Why is an Encore ® being used since volatile organic compounds are not contaminants of concern. Please review this SOP and correct or replace as necessary.

    Response: The SOPs have been revised to make them site specific rather than the generic information provided in the SOP. Therefore;

    (a) The SOP will be revised to reflect the depths listed within the SAP.

(b) No volatile organic compound analysis is planned; therefore, #3 from this procedure will be struck out in this SOP.

41. **Comment:** Appendix D, Tetra Tech Standard Operating Procedures, Soil Sampling, Section 6.4, para 1: See comment 40.a above.

Please provide an SOP for collecting and sampling subsurface soils

Response: See the response to Comment 39.

Appendix B, Human Health Risk Assessment Methodology: Please also see relevant comments presented under "Main Document."

Response: Noted. The relevant comments presented under "Main Document" were reviewed and responded to above.

42. **Comment:** Section 1.1.1, Toxicity screen: This section discusses use of groundwater screening levels; however, no groundwater samples are planned for collection. It is unclear here (and in Section 1.2.1) whether the human health risk assessment intends to include leaching calculations or other ways of estimating and evaluating potential soil leaching. Please clarify.

Response: Section 1.1.1 states that "groundwater soil screening levels (SSLs)" will be used as part of the toxicity screen. This will be changed to "groundwater protection soil screening levels (SSLs)" to clearly indicate that these are not groundwater screening criteria. A paragraph similar to the paragraphs previously included for the direct contact pathway evaluation and the vapor intrusion pathway evaluation will be added to Section 1.1.1 to indicate how the groundwater protection SSLs will be used. This paragraph will note that groundwater protection risk-based SSLs will be compared to maximum detected site concentrations for the selection of COPCs. If COPCs are selected for the migration to groundwater pathway, a qualitative evaluation will be used to further evaluate the COPCs. The qualitative evaluation may include consideration of magnitudes of COPC concentrations, frequency of criteria exceedances, and whether COPC concentrations exceed groundwater protection SSLs based on a dilution attenuation factor (DAF) of 20 or Maximum Contaminant Level (MCL-based) SSLs.

43. **Comment:** Section 1.1.1, Vapor intrusion pathway.: Please indicate what chemicals already detected or planned for analysis would be considered to pose a potential vapor intrusion concern.

Response: Agree. Chemicals to be analyzed during this investigation will be evaluated to determine which are sufficiently volatile and toxic to be evaluated for the vapor intrusion pathway and those chemicals will be listed in Section 1.1.1.

44. **Comment:** Section 1.1.3 Selection of COPCs: It is not clear why tentatively identified compounds (TICs) are discussed here, since it does not appear that TIC reporting is being requested.

Response: Agree. TIC reporting is not being requested in the SAP. Therefore, the last two sentences of Step 1 in Section 1.1.3 will be revised to remove references to TICs as follows: "Additionally, essential nutrients (i.e., calcium, magnesium, potassium, and sodium) are not selected as COPCs."

45. **Comment:** Section 1.1.3, Selection of COPCs: Please identify which chemicals already detected or planned for analysis do not have risk-based screening levels and which surrogate chemicals are proposed for use.

Response: Agree. The statement following Step 2 in Section 1.1.3 will be revised as follows: "Because of the lack of toxicity criteria, risk-based COPC screening levels are not available for some chemicals (i.e., acenaphthylene, benzo(g.h.i)perylene, and phenanthrene). For these constituents, surrogate chemicals (which have toxicity criteria) will be used for screening purposes. Acenaphthylene will be used as a surrogate for acenaphthylene, and pyrene will be used as a surrogate for benzo(g,h,i)perylene and phenanthrene."

46. **Comment:** Section 1.2.1, Land use and potential exposure: The exposure pathways proposed to be assessed do not include the consumption of homegrown produce pathway for residential receptors. This pathway is recommended in *Guidance for Human Health Risk Assessments for Hazardous Substance Sites in Maine* (MEDEP 2009, draft). This pathways needs to be included for residential receptors. There is ample guidance from EPA on the methodology and input values to assess this pathway. (Also see comment 18 above.)

Response: After collection and evaluation of site data the project stakeholders will decide whether it is necessary to assess the consumption of homegrown produce pathway for residential receptors.

47. **Comment:** Section 1.2.2, Human Health Receptors:

a.) This section discusses the assessment of "hypothetical" future residential use, but residential use already exists on the northern portion of the range and is allowed within the Community Mixed Use Zones. Therefore, residential use must be considered. For the Business and Technology Zone, although residential use is not currently planned, it must be considered a plausible (not hypothetical) future use unless a Restrictive Covenant or other type of activity and use restriction is placed on that portion of the site prohibiting such use.

b.) The type of recreational receptors being assessed is not clear. This section should provide more specific information on the type of recreation planned, either passive use (e.g., walking pathways) or active use (e.g., development of sports fields), and whether it will involve the surface water bodies (e.g., will swimming or fishing be allowed?). The type of recreational use will have a bearing on the

exposure scenarios and exposure factors applied. As it is now, there is insufficient information to evaluate the proposed exposure scenario for recreational use.

Response: a.) Agree. Residential use will be evaluated in the HHRA. The second sentence of Section 1.2.2 will be revised as follows: "Expanded Residential use of the site is not currently planned; however, future residential use is evaluated as a risk scenario that could occur if the sites were developed for residential use. Additionally, residential use is evaluated because residential land use already exists on the northern portion of the range and is an allowable land use scenario in the Community Mixed Use Zones."

b.) Both passive (e.g., walking) and active (e.g., playing sports) recreational uses are considered as potential future uses of the site. The recreational user will be evaluated for exposures to soil only. Exposures to surface water or sediment from the surface water bodies will not be addressed in this HHRA. Exposures to surface water and sediment from the surface water bodies will be assessed under a separate cover. The following will be added to the beginning of the recreational user description in Section 1.2.2: "an onsite receptor under current and future land use who may spend time outdoors recreating (e.g., walking, playing sports)."

48. Comment: Section 1.2.3, Calculation of Exposure Point Concentrations.

a.) This section indicates that the soil EPC for a constituent will be the lesser of the upper confidence limit (of the mean, it is presumed) or the maximum detected concentration, except for lead, for which a sample mean concentration will be applied. This is not acceptable. There is no technical or programmatic justification for using different EPC criteria for lead. The soil EPC for lead should be derived in the same manner as all other constituents.

b.) Para 5: Also see Comment 7 above.

Response:
a.) Average lead concentrations are used to estimate blood lead levels from exposure to lead, in accordance with USEPA's Integrated Exposure Uptake Biokinetic Model (IEUBK) Model (USEPA, 1994, 2009c) and their Technical Review Workgroup (TRW) Adult Lead Model (USEPA, 2003a). This is because the first step in the model calculations is to develop a central estimate of blood lead concentrations, which requires an "appropriate average concentration" for an individual. This methodology reflects the current USEPA guidance regarding the calculation of the EPC for input into the IEUBK and TRW models.

b.) Please see response to Comment 7.

49. Comment: Section 1.2.4; Chemical and Intake Estimation: This section first indicates that EPA's *Exposure Factors Handbook*, EPA's *Supplemental Guidance for Dermal Risk Assessment*, and MEDEP's *Guidance for Human Health Risk Assessments for Hazardous Substances Sites in Maine* will be used (to provide values) to estimate intakes. Two sentences later, it is stated that the equations and

exposure parameters used to quantify intakes and intake parameters are from EPA's *Risk Assessment Guidance for Superfund, Part D*, Table 4s. Please correct or clarify.

This section discusses the use of EPA's *Integrated Exposure Uptake Biokinetic* (IEUBK) model for child exposure to lead and EPA's *Adult Lead Model (ALM)* for adult exposure to/fetal impacts from lead. However, there is no presentation of the proposed input values for this model as there is for the conventional risk model. The human health risk assessment methodology should specify the non-soil concentration-related input parameters for the IEUBK model, such as maternal blood concentration and air concentration, etc., and the pathways and exposure factors in the *ALM*, that are proposed for use. It should also be noted that the *ALM* (referred to as the TRW model in the methodology) is residential and non-residential adult exposures.

Response: The RAGS Part D Table 4s summarize the equations and exposure parameters that were obtained from USEPA and MEDEP guidance. The last sentence of the first paragraph of Section 1.2.4 will be edited as follows: "The equations and exposure parameters obtained from USEPA and MEDEP guidance documents that will be used to quantify intakes and intake parameters are summarized in the RAGS Part D Table 4s, provided in Attachment B."

Except for the arithmetic mean soil lead concentration, the other input parameters for the IEUBK model will be USEPA default values. If the IEUBK model is run for lead, the model output files, which include the default input parameters, will be included in an appendix to the HHRA. These statements will be added to the end of Section 1.2.4.

It will be noted in the text that the TRW model is also referred to as the ALM. Non-default input parameters to the ALM are the arithmetic mean soil lead concentration and receptor-specific ingestion rates and exposure frequencies, which are based on Central Tendency Exposure (CTE) exposure assumptions. The receptors evaluated by the ALM are non-residents. In this HHRA, the ALM would be used to evaluate lead exposures for construction workers, industrial workers, and adult recreational users if necessary. If the ALM is run, the receptor-specific input parameters will be in the model output files, which will be included in an appendix to the HHRA, and the receptor-specific input parameters will also be discussed in the text. These statements will be added to the end of Section 1.2.4.

50. Comment: Section 1.4.2, Interpretation of Risk Assessment Results: This section needs to include a discussion on how the results of the IEUBK and ALM will be integrated (or not) with the risk assessment results for conventional chemicals.

Response: As Section 1.4.2 states, "Current USEPA policy regarding lead exposures is to limit the childhood risk of exceeding a 10 microgram per deciliter (µg/dL) blood-lead level to 5 percent." The following statements will be added to the end of Section 1.4.2: "Lead is evaluated separately from other chemicals. The results of the IEUBK model and ALM model will be compared to the USEPA limit of 5 percent of children having a blood-lead concentration exceeding µg/dL. If a model output indicates that more than 5 percent of children are expected to have blood-

lead concentrations exceeding 10 µg/dL, the risk is typically considered unacceptable."

51. **Comment:** Attachment B Tables - Values Used for Daily Intake Calculations:

a.) For the construction worker inhalation pathway, the proposed particle emission factor (PEF) is indicated to assume 140 days of precipitation of the 250 days of exposure. Please provide a reference for this and justify its use.

b.) For residential and recreational receptors, a footnote to these tables indicates "for chemicals that act via the mutagenic mode of action, residential children were evaluated as two age groups: 0-2 years and 2-6 years, in accordance with USEPA's *Supplemental Guidance (for) Assessing Susceptibility from Early-Life Exposure to Carcinogens* (USEPA 2005). A similar footnote is presented for "adults" between the ages of 7-16 and 16-30. This was not discussed in the text. This EPA guidance recommends use of an age-dependent adjustment factor for assessing exposure of children under the age of 16 to certain mutagens; however, use of these adjustment factors is not discussed in either table or text. Please indicate for which chemicals already detected or planned for analysis this approach is proposed, and clarify how the age-dependent adjustment factors will be used.

c.) While it is not indicated as such on these tables, it is conventional to add the excess lifetime cancer risk for children and adults to derive a total 30-year exposure. Please revise tables and text to include this.

Response:
a.) Exhibit E-4 of USEPA's *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (December 2002) indicates that the mean number of days with 0.01 inch or more of annual precipitation is 140 days for the NAS Brunswick area. The 250 days of exposure is equal to the 250 days per year exposure frequency used for the construction worker, which was obtained from MEDEP (2009) guidance.

b.) The following text discussing the use of age-dependent adjustment factors will be added to Section 1.2.4:

USEPA's Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens (2005b) recommends adjusting the toxicity of carcinogenic chemicals that act via the mutagenic mode of action when evaluating early-life exposures to contaminants. The guidance recommends using age-dependent adjustment factors (ADAFs) in concert with age-specific exposure estimates when assessing cancer risks. Absent chemical-specific data, the supplemental guidance recommends the following default adjustments, which reflect that cancer risks are generally higher from early-life exposures than from similar exposures later in life:

- For exposures before two years of age (i.e., spanning a two-year interval from the first day of birth until a child's second birthday), a 10-fold adjustment.

- For exposures between two and less than 16 years of age (i.e., spanning a 14-year time interval from a child's second birthday until a child's sixteenth birthday), a three-fold adjustment.

- For exposures after reaching 16 years of age, no adjustment.

These adjustments were applied using the same method as that used by USEPA to develop the RSLs. Children will be evaluated in two age groups, ages 0–2 and 2–6 years old. Adults will be evaluated as two age groups (6-16 and 16–30 years old). Using this approach, the intakes for child and adult recreational users and residents were calculated for the RME scenario as follows:

$$\text{Intake}_{\text{Child}} = \text{Intake}_{(\text{ages 0 to 2 years})} \times 10 + \text{Intake}_{(\text{ages 2 to 6 years})} \times 3$$
$$\text{Intake}_{\text{Adult}} = \text{Intake}_{(\text{age 6 to 16 years})} \times 3 + \text{Intake}_{(\text{ages 16 to 30 years})} \times 1$$

This approach was used only for chemicals identified as mutagenic in the USEPA RSL table (e.g., hexavalent chromium, benzo(a)anthracene, benzo(a)pyrene, benzob)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene). Sample calculations showing how this approach was applied will be included in an appendix to the HHRA.

c.) The following text will be added to Section 1.2.4 immediately after the text added in the response to Part B: "In addition, risks to lifelong recreational users and lifelong resident receptors will be evaluated. Risks to these receptors are sums of the cancer risks calculated for individual children and adult receptors. Therefore, lifelong cancer risks from chemicals that act via the mutagenic pathway are assessed through the lifelong recreational user and lifelong resident receptor scenarios."

Appendix C, Ecological Risk Assessment Methodology: Please also see relevant comments presented under "Main Document."

Response: Noted. The relevant comments presented under "Main Document" were reviewed and responded to above.

52. **Comment**: Introduction: It is noted in this section that "sediment and surface water will not be included in this ERA; they will be evaluated under separate cover." Please discuss the ramification of separating these media in the ecological risk assessment and the possible underestimation of ecological risks for receptors that may be exposed to soil, sediment, and surface water (such as terrestrial organisms that drink water or consume aquatic insects).

    Response: Please see response to Comment 21c.

53. **Comment**: Section 2.2, Exposure Characterization: Please fix the equation to be readable.

    Response: Agreed. The equation will be corrected so it is legible.

Orient, Jeff

From: Daly.Mike@epamail.epa.gov
Sent: Thursday, November 03, 2011 4:40 PM
To: todd.bober@navy.mil
Cc: paul.burgio@navy.mil; Claudia.B.Sait@maine.gov; Miller, Ralinda; Orient, Jeff
Subject: NAS Brunswick: Draft Tier II SAP for Brunswick

Good afternoon Todd,

I've completed a quick review of the subject SAP. The spatial extent of the sampling and resultant number of samples required by this plan is extensive and builds on previous characterization efforts completed by the Navy. Included in the plan is the collection of reference soil samples to compare against SKT sample results. I have no substantive comments that would significantly change the Navy's field sampling plan objectives and design. EPA requests that prior to the development of any risk assessment for the site, the Navy provide the lab results and supporting figures to EPA & MEDEP for review. Once the regulators have the opportunity to review the results, EPA suggests that a conference call be convened to discuss the results and determine the best approach for assessing site risk and/or completing any cleanup actions that may be warranted at the site.

Please give me a call with any questions.

Thanks,

Mike