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Final

U.S. Army Corps of Engineers
Kansas City District

Former Nebraska Ordnance Plant
Operable Unit-3 Supplemental Remedial Investigation
Work Plan
Mead, Nebraska

Prepared for
U.S. Army Corps of Engineers
Kansas City District
Contract No. W912DQ-10-D-3012
Delivery Order 0001

Prepared by
GEO Consultants, LLC
325 Kentucky Avenue
Kevil, Kentucky 42053

August 2010

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Notice is hereby given that an independent technical review (ITR) was conducted that is appropriate to the level of risk and complexity inherent in the project. During the ITR, compliance with established policy principles and procedures was verified. This included review of procedures to be used to create a product that meets the customer's needs consistent with law and existing U.S. Army Corps of Engineers policy.

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6/11/10
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Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from the independent technical review of the project have been considered.

Todd Buchanan
Project Manager, GEO Consultants, LLC

6-11-10
Date

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BR-ME-004r12_7471
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BR-ME-011r10_3050
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ATTACHMENT

Attachment – Site Specific Health Plan/Accident Prevention Plan

ACRONYMS and ABBREVIATIONS

ADR	automated data review
amsl	above mean sea level
APP	Accident Prevention Plan
ARDC	Agricultural Research and Development Center
ART	artesian
bgs	below ground surface
BLRA	Baseline Risk Assessment
CAS	Chemical Abstracts Service
CENWK	U.S. Army Corps of Engineers, Kansas City District
cm	centimeter(s)
COCs	contaminants of concern
COPCs	contaminants of potential concern
CSEM	conceptual site exposure model
DCE	dichloroethene
DMP	Data Management Plan
DoD	Department of Defense
DT	drain tile
ECC	Environmental Chemical Corporation
EM	electromagnetics
F	Fahrenheit
FCR	Field Change Request
FOM	Field Operations Manager
FSP	Field Sampling Plan
ft	foot or feet
GEO	GEO Consultants, LLC
GP	direct push sample
gpm	gallons per minute
Hg	mercury
HI	hazard index
HQ	hazard quotient
IDW	investigation-derived waste
ILCR	incremental lifetime cancer risk
ITRC	Interstate Technical and Regulatory Council
in.	inche(s)
kg	kilogram
L	liter
LL	Load Line
MDC	maximum detected concentration
MEC	munitions and explosives of concern
mg	milligram(s)
mL	milliliter
MW	monitoring well
NA	not available
NCP	National Contingency Plan
ND	non-detect
NDEQ	Nebraska Department of Environmental Quality
NE	northeast
NL	Not Listed

NOP	Nebraska Ordnance Plant
NRD	Natural Resources District
OD	outer diameter
OU	Operable Unit
Pb	lead
PETG	polyethylene terephthalate glycol
PM	Project Manager
PMP	Project Management Plan
ppbv	parts per billion by volume
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
QCP	Quality Control Plan
RAGS	Risk Assessment Guidance for Superfund
RDA	recommended daily allowance
RDI	recommended daily intake
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RfD	reference dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SAP	Sampling and Analysis Plan
Sb	antimony
Se	selenium
SE	southeast
SOP	Standard Operating Procedure
SP	seep
SSHP	Site-Specific Safety and Health Plan
SVOC	semi-volatile organic compounds
SW	surface water sampling location
TAGA	Trace Atmospheric Gas Analyzer
TCE	trichloroethene
TCT	Twin City Testing Corporation
Tl	thallium
UCL	upper confidence limit
UNL	University of Nebraska—Lincoln
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
W	west
WP	Work Plan
WSW	water supply well
yd	yard(s)
µg	micrograms

SYMBOLS

ABS	chemical-specific dermal absorption factor
AF	soil-to-skin adherence factor
AT	averaging time for carcinogens or non-carcinogens (days)
B	chemical specific constant reflecting the partitioning properties
BW	body weight (kg)
C_S	chemical concentration in soil (mg/kg)
C_W	chemical concentration in water (mg/L)
CF	conversion factor (10^{-3} L/cm^3)
CSF	cancer slop factor (mg/kg-day)$^{-1}$
CSF_{dermal}	dermal cancer slope factor (mg/kg-day)$^{-1}$
CSF_{oral}	oral cancer slop factor (mg/kg-day)$^{-1}$
DA_{event}	absorbed dose per event in water (mg/cm^2-event)
DAD	dermal absorbed dose (mg/kg-day)
EC	exposure concentration (mg/m^3)
ED	exposure duration (years)
EF	exposure frequency (days/year)
ET	exposure time (hours)
EV	event frequency (events/day)
FA	fraction absorbed in water (chemical-specific)
FI	fraction ingested
HQi	hazard quotient for the ith COPC
I	chronic daily intake or DAD (mg/kg-day)
$ILCR_i$	incremental lifetime cancer risk for the ith COPC
$ILCR_{total}$	total probability of cancer incidence associated with all carcinogenic COPCs
IR_a	inhalation rate (m^3/day)
IR_{fish}	ingestion rate of fish (kg/day)
IR_S	ingestion rate of soil (kg/day)
IR_W	ingestion rate of water (L/day)
IUR	inhalation unit risk (mg/m^3)$^{-1}$
K_{oc}	soil organic carbon water partitioning coefficient
K_{ow}	octanol/water coefficient
K_p	chemical specific dermal permeability coefficient (cm/hr)
MF	modeling factor to convert surface water to fish tissue concentration (L/kg)
PEF	particulate emission factor (m^3/kg)
RfD_{dermal}	dermal reference dose (mg/kg-day)
RfD_{oral}	oral reference dose (mg/kg-day)
SA	surface area of exposed skin (cm^2)
t*	chemical-specific time to reach steady-state (hr)
t_{event}	duration of event (hr/event)
VF	chemical specific volatilization factor (m^3/kg)
W_M	molecular weight
τ_{event}	chemical specific lag time per event (hr/event)

EXECUTIVE SUMMARY

The Operable Unit (OU)-3 Supplemental Remedial Investigation (RI) activities proposed in this Work Plan (WP) are part of a continuing effort to assess the potential risk from contaminated media at the former Nebraska Ordnance Plant (NOP) site. This WP for a Supplemental RI was prepared by GEO Consultants, LLC.

The former NOP site consists of approximately 17,250 acres located approximately 0.5 miles south of the town of Mead and 30 miles west of Omaha in Saunders County, Nebraska. From 1942 until 1945, the plant was used for the assembly of bombs, shells, and rockets during World War II. Several buildings were decontaminated between 1945 and 1949 and were used primarily for storage. The plant was temporarily reactivated during the Korean Conflict in 1950 and later put on standby status in 1956. In 1959, the site was transferred to the General Services Administration as surplus. The Army National Guard and Army Reserve retained approximately 1000 acres. The Nike Missile Maintenance Area (12 acres) was retained by the U.S. Army. The U.S. Air Force retained 2000 acres for the Offutt Air Force Base Missile Site (Atlas Missile Area) and 40 acres were transferred to the Department of Commerce. The University of Nebraska—Lincoln (UNL) purchased approximately 9600 acres of the former NOP in 1962 and an additional 600 acres in 1964. The remaining 5250 acres were purchased by private individuals or organizations.

The former NOP was placed on the U.S. Environmental Protection Agency (USEPA) National Priorities List of Superfund sites in August 1990 because contamination identified in groundwater exceeded the final target groundwater cleanup goals determined by the U.S. Army Corps of Engineers, Kansas City District, USEPA, and Nebraska Department of Environmental Quality [Environmental Chemical Corporation (ECC) 2009a]. Response actions conducted by the U.S. Department of the Army at the former NOP have been organized into the following Operational Units [OUs (USEPA et al. 1991, ECC 2009a)]:

- OU-1 encompasses the upper 4 feet of soil contaminated with explosive compounds.
- OU-2 includes contaminated groundwater, and explosive-contaminated soil not remediated as part of OU-1 which could potentially impact groundwater with explosive contaminants of concern and soil with volatile organic compounds (VOCs).
- OU-3 includes a former on-site landfill and all other waste disposal areas not previously identified.

The OU-3 RI was conducted by Woodward-Clyde/URS between 1995 and 1999 (Woodward-Clyde 1997, URS 2000a). No further action was recommended for many of the investigation areas based on analytical data being below screening values (Woodward-Clyde 1997) and the results of a Baseline Risk Assessment [(BLRA) URS 2000b]. The BLRA showed that risks from exposure to environmental media at the OU-3 investigation areas are below threshold values with the exception of non-carcinogenic risks associated with antimony-contaminated soil at three investigation areas [Load Line (LL) 1 Paint Operations Area, LL4 Paint Operations Area, and the Potential Landfill Area]. The antimony-contaminated soils at these three investigation areas were excavated and taken to an off-site disposal site during a non-time-critical removal action conducted in 2007 to 2008 (Kingston 2008).

The following investigation areas were identified as requiring additional assessment to be conducted as part of the Supplemental RI:

- The burn layer found during removal actions by UNL at the former North Burning Grounds (MACTEC 2009) located within the former NOP, as well as ash buried in the Potential Landfill Area;
- Johnson Creek, Clear Creek, and Silver Creek, where surface water samples were collected between 2004 and 2009 after completion of the OU-3 RI (Woodward-Clyde 1997, URS 2000a). The OU-3 BLRA (URS 2000b) needs to be revised to incorporate these more recent sampling results; and
- Buildings located above the trichloroethene (TCE) groundwater plumes that may be impacted by vapor intrusion. Vapor intrusion into buildings was investigated in 2007 by Lockheed Martin on behalf of USEPA. Additional data are needed to supplement the Lockheed Martin/USEPA study to definitively assess concerns regarding vapor intrusion at the site.

This supplemental RI WP will: 1) summarize previous contamination assessment activities, 2) propose additional sampling to be used as input data for a Supplemental BLRA on the remaining investigation areas, and 3) describe methods that will be used to perform the Supplemental BLRA.

Surface and subsurface soil sampling is proposed to determine the depth, lateral extent, and metals content of the burn layer and ash found at the former North Burning Grounds and Potential Landfill Area. In respect to the burn layer/ash, the primary target analytes are metals.

Surface water sampling has been ongoing since the completion of the previous BLRA (URS 2000b). This larger data set will be used in the Supplemental BLRA. No additional sampling will be necessary to complete this activity. The primary target analytes for surface water are explosives and VOCs.

The Lockheed Martin Vapor Intrusion study did not contain sufficient indoor air concentration data to complete a BLRA. Additional indoor air monitoring in locations not previously sampled will be required. The target analytes for vapor intrusion are TCE, cis-1,2-dichloroethene (DCE), trans-1,2-DCE, and vinyl chloride.

1. INTRODUCTION

The former Nebraska Ordnance Plant (NOP) is located in Saunders County, Nebraska, and is 0.5 miles south of Mead, Nebraska. The former NOP investigation has been divided into separate Operable Units (OUs) under the January 30, 1992 Interagency Agreement between the U.S. Department of the Army and the U.S. Environmental Protection Agency (USEPA) and the Nebraska Department of Environmental Quality (NDEQ). OU-1 consists of the upper 4 feet (ft) of explosives-contaminated soil. OU-2 consists of groundwater and soils that could potentially impact groundwater with explosive contaminants and soil with volatile organic compounds (VOCs). OU-3 consists of a former on-site landfill and areas of waste not previously identified [Environmental Chemical Corporation (ECC) 2009a; Interagency Agreement, USEPA et al. 1991]. The regulatory agencies involved in this project are the USEPA Region VII and the NDEQ. The U.S. Army Corps of Engineers (USACE), Kansas City District (CENWK) is the executing agency for this project. This supplemental Remedial Investigation (RI) Work Plan (WP) for OU-3 is for the former NOP in Mead, Nebraska (Contract No. W912DQ-10-D-3012, Delivery Order 0001).

1.1 PROJECT OBJECTIVES

The overall objective of this Supplemental RI is to complete an additional assessment on OU-3 and conduct a Baseline Risk Assessment (BLRA) for investigation areas where potential concerns were identified after completion of the previous OU-3 RI activities (Woodward-Clyde 1997, URS 2000a) as well as to address the potential for vapor intrusion at the former NOP and the potential burn layer identified in the North Proving Grounds. The supplemental RI focuses on the following OU-3 investigation areas:

- The burn layer found during removal actions by the University of Nebraska—Lincoln (UNL) at the former North Burning Grounds (MACTEC 2009), which is located within the former NOP. UNL removal actions at the former North Burning Grounds and other areas within the former NOP were directed towards locating and removing waste that UNL had buried. The Potential Landfill Area adjacent to the former North Burning Grounds also contains potential buried ash.
- Johnson Creek, Clear Creek, and Silver Creek, where surface water samples were collected between 2004 and 2009. The OU-3 BLRA (URS 2000b) needs to be revised to incorporate these more recent sampling results.
- Buildings located above the trichloroethene (TCE) groundwater plumes that may be impacted by vapor intrusion. In 2007, Lockheed Martin, on behalf of USEPA, investigated vapor intrusion utilizing indoor air and sub-slab soil gas monitoring in several buildings at locations that overlie the TCE groundwater plumes (Lockheed Martin 2007). Additional data are needed to supplement the Lockheed Martin/USEPA study to definitively assess the concerns regarding vapor intrusion in these buildings.

This Supplemental RI WP summarizes previous contamination assessment activities, proposes additional sampling to be used as input data for a Supplemental BLRA on the Investigation Areas listed above, and describes methods that will be used to perform the Supplemental BLRA.

1.2 REPORT ORGANIZATION

The WP is organized as follows:

- *Section 1: Introduction* – An overview of project objectives and report organization is presented.
- *Section 2: Site Background* – The history and characteristics of the former NOP site, as well as results of previous environmental investigations related to OU-3, are summarized.
- *Section 3: Task Descriptions* – An overview of project plans, field activities, handling of samples, investigation-derived waste (IDW), chemical quality control, and sample analysis.
- *Section 4: Baseline Risk Assessment Methods* – The supplemental BLRA including data evaluation, exposure assessment, toxicity assessment, risk characterization, and uncertainty analysis are discussed.
- *Section 5: General Requirements* – The general requirements, such as information security, environmental laws and regulations, the project information repository, and lines of communication are discussed.
- *Section 6: References* – A list of all documents referenced in this document.
- Tables and Figures are found at the end of this report.
- The six Appendices contain the *Quality Assurance Project Plan* (QAPP), Field Documents, GEO Consultants, LLC (GEO) Field Standard Operating Procedures (SOPs), TestAmerica SOPs, vapor intrusion SOPs, and the laboratory certification for TestAmerica.

Other planning documents associated with this document include the following:

- A Quality Control Plan [QCP (GEO 2010a)] that describes the overall project organization and scheduling;
- A Project Management Plan [PMP (GEO 2010b)] that describes the overall project management procedures for the supplemental RI WP, Sampling and Analysis Plan (SAP), and Site-Specific Safety and Health Plan/Accident Prevention Plan (SSHP/APP);
- A QAPP (Appendix A) that consists of a series of Uniform Federal Policy-QAPP worksheets.
- A SSHP/APP (GEO 2010d) that describes the procedures for protecting both workers and the environment during all field work (Attachment to this WP).

2. SITE BACKGROUND

2.1 SITE LOCATION AND HISTORY

The former NOP occupies approximately 17,250 acres and is located approximately 0.5 miles south of the town of Mead and 30 miles west of Omaha in Saunders County, Nebraska (Figure 2-1).

During World War II and the Korean Conflict, bombs, shells, and rockets were assembled at the site. Ordnance production was terminated in 1945 and the facility was placed on inactive status. Between 1945 and 1949, the buildings were decontaminated and used primarily for storage and disposal of bulk explosives and munitions. In addition, ammonium nitrate was produced for use as fertilizer. Finished munitions, bulk explosives, and related ordnance materials and components were stored and demilitarized at the site. Following building decontamination, wastewater and residual explosives were removed from sumps, settling basins, pipelines, and drainage ditches and were reportedly taken to the Burning/Proving Grounds for disposal (ECC 2009a).

In 1950, the plant was temporarily reactivated and produced an assortment of weapons for use in the Korean Conflict. The plant was placed on standby status in 1956. In 1959, the former NOP site was determined to be surplus and was transferred to the General Services Administration for disposal. Approximately 1000 acres were retained by the U.S. Army for National Guard and Army Reserve training. Twelve acres were retained by the Army for use as a Nike Missile Maintenance Area, 2000 acres were transferred to the U.S. Air Force to build the Offutt Air Force Base Atlas Missile Site (Atlas Missile Area), and 40 acres were transferred to the Department of Commerce.

From 1959 to 1960, the Atlas Missile Area was built north of Load Line (LL) 4 (Figure 2-2). TCE was used during construction to degrease and clean pipelines used to carry liquid oxygen fuel for missiles. Historical information suggests that TCE was released as ground spills and/or discharged into surface drainage features during these construction activities. The missile facilities were deactivated in 1964 and the Atlas Missile Area and the Nike Missile Maintenance Area were transferred to the Nebraska National Guard.

In 1962, approximately 9600 acres of the site were purchased by UNL for use as an agricultural research farm and an additional 600 acres were obtained by UNL in 1964. The remaining 5250 acres were eventually purchased by private individuals and corporations. Currently, most of the site is owned by UNL for the operation of the Agricultural Research and Development Center [ARDC (Figure 2-1)]. Other portions are owned by the Nebraska Army National Guard, the U.S. Air Force, the U.S. Army Reserves, and the U.S. Department of Commerce. Private pastures and crop fields also exist on the site, with some private light industry located near the northern end of the site. Adjacent land use is primarily agricultural, except for the town of Mead, which is located north of the site (ECC 2009a).

The former NOP site was placed on the USEPA National Priorities List of Superfund sites in August 1990 because contamination identified in the groundwater exceeded the final target groundwater cleanup goals determined by CENWK, USEPA, and the NDEQ (ECC 2009a). Response actions conducted by the U.S. Army at the former NOP were organized into the following OUs (USEPA et al. 1991, ECC 2009a):

- OU-1 encompasses the upper 4 ft of soil contaminated with explosive compounds.
- OU-2 includes contaminated groundwater, and explosive-contaminated soil not remediated as part of OU-1, which can potentially impact groundwater with explosive contaminants of concern (COCs) and soil with VOCs.
- OU-3 includes a former on-site landfill and areas of waste not previously identified.

2.2 SITE PHYSICAL CHARACTERISTICS

The geology, hydrogeology, surface water, soils, topography, climate/meteorology, and land use are discussed in this section. A general site map of the former NOP is shown in Figure 2-2 with a close up of the Natural Resources District (NRD) Reservoir Area in Figure 2-3.

2.2.1 Geology

The former NOP site is located in the Todd Valley, an abandoned alluvial valley of the ancestral Platte River (ECC 2009a). The unconsolidated sand and gravel deposits in the Todd Valley at the former NOP site ranges in thickness from approximately 81 ft to 157 ft, and is overlain by 4 ft to 23 ft of fine-grained Peoria Loess (URS 2008, ECC 2009a).

Todd Valley is bounded on the southwest by Wahoo Valley Alluvium, on the southeast by the Platte Valley Alluvium, and northeast by the Till Uplands (URS 2008). Both the Platte and Wahoo Valley alluvial deposits consist of sands and gravels overlain by fine-grained overbank deposits (URS 2008). The Till Uplands consist of silts and clays covered by Peoria Loess.

The uppermost bedrock unit is the Omadi Shale in the northwest and the Omadi Sandstone in the southeast portions of the former NOP site (ECC 2009a).

2.2.2 Hydrogeology

Three major aquifers are present at and in the vicinity the former NOP site: the Todd Valley aquifer, the Platte River alluvial aquifer, and the Omadi Sandstone aquifer (ECC 2009a). Within the northwestern portion of the former NOP site, the Omadi Shale acts as an aquitard between the Todd Valley aquifer and the Omadi Sandstone aquifer (URS 2008). Where the Omadi Shale is absent (i.e., in the southeastern portion of the former NOP site), the Todd Valley aquifer and the Platte River alluvial aquifer are hydraulically connected with the Omadi Sandstone (ECC 2009a).

The water-bearing portions of the unconsolidated material in the Todd Valley Aquifer are divided into two units (ECC 2009a), an upper fine sand unit (12 ft to 77 ft thick) and a lower sand and gravel unit (17.5 ft to 72 ft thick). As mentioned previously, the Todd Valley alluvial deposits are overlain by 4 ft to 23 ft of Peoria Loess. The potentiometric surface in the Todd Valley Aquifer slopes towards the south/southeast. Depths to groundwater range from 6.6 ft to 58.0 ft below ground surface [bgs (ECC 2009a)].

The unconsolidated material in the Platte River Valley Aquifer (located east of the former NOP site) ranges in thickness from 39 ft to 49 ft, and is overlain by silts and clays ranging from 10 ft to 17 ft thick (ECC 2009a). The potentiometric surface of the Platte River alluvial aquifer slopes to the south paralleling the Platte River Valley. Depths to groundwater range from 0 to 10.2 ft bgs.

2.2.3 Surface Water

A number of streams are located within and near the former NOP site (Figure 2-4). The three largest streams are Johnson Creek, Clear Creek, and Silver Creek. Johnson Creek, which includes the NRD Reservoir (Figure 2-4), merges with Clear Creek southeast of the site and continues downstream as Clear Creek.

Silver Creek is located on the southwest corner of the site and drains into Wahoo Creek (Figure 2-4). Historically, Silver Creek flowed into Memphis Lake and the outlet stream that drains Memphis Lake was the original channel of Silver Creek (URS 2009b). A diversion channel was built to redirect the

upper portion of Silver Creek such that it flows into Wahoo Creek. The stream that drains Memphis Lake is called "Lower Silver Creek" (URS 2009b). Wahoo Creek drains into Salt Creek, which drains into the Platte River near the southeastern corner of Saunders County.

The majority of surface runoff from the former NOP flows into Johnson Creek. Sources of surface runoff include the former Raw Products Igloo Storage Area, the former Atlas Missile Area, the former Ammonium Nitrate Plant, LL2 through LL4, and the Burning/Proving Grounds (Woodward-Clyde 1997). Surface run-off from the western portion of the former NOP site, including run-off from LL1, the former Administration Area, and the Bomb Booster Assembly Area, drains southward and eventually enters Silver Creek (Woodward-Clyde 1997).

Currently, the OU-2 groundwater treatment plants discharge into both Clear and Wahoo Creeks with flows of 400 gallons per minute (gpm) and 1800 gpm, respectively (URS 2009a).

The Todd Valley aquifer discharges to Johnson Creek and Clear Creek southeast of the site as seen in Figure 2-5 Part A, and to Silver and Wahoo Creeks south of the site as seen in Figure 2-5 Part B (URS 2009a).

2.2.4 Topography

On-site elevations range from 1210 ft above mean sea level (amsl) in the northeastern portion of the site to 1105 ft amsl in the southwestern corner near Silver Creek [Twin City Testing Corporation (TCT) 1991].

2.2.5 Climate/Meteorology (Saunders County, Nebraska)

Saunders County, Nebraska is subjected to cold northerly winds in the winters and hot southerly winds in the summer. April and September are the wettest months, with annual precipitation at averaging 28 inches (in.) per year. An average snowfall of 31 in. occurs annually, with January exhibiting the coldest temperatures [average low temperature of 13° Fahrenheit (F)]. An average high temperature of 88°F occurs in July (Woodward-Clyde 1997).

2.2.6 Land Use

The majority of the former NOP site is currently owned by the UNL-ARDC (approximately 9536 acres, Figure 2-1). Approximately 2176 acres are owned by the U.S. government and used by the Nebraska National Guard, the U.S. Air Force, and the Army Reserves. Privately-owned crop and pasture land makes up the majority of the rest of the area with The Mead Cattle Company occupying approximately 2240 acres. Most of the adjacent land is used for agriculture with the exception of the town of Mead (Woodward-Clyde 1997, URS 2009a).

2.3 SUMMARY AND ASSESSMENT OF PREVIOUS INVESTIGATIONS

The following is a summary of investigations and studies that have been performed as part of OU-3. All OU-3 investigation areas are shown in Figures 2-2 and 2-3

2.3.1 Envirodyne Engineers, Inc./Twin City Testing Corp. St. Louis – Preliminary Assessment of Ordnance Contamination

2.3.1.1 Summary

In 1991, a preliminary assessment was conducted to identify potential sources of explosives contamination and unexploded ordnance (UXO) caused by former Department of Defense (DoD)-related

activities at the former NOP. TCT utilized an archives search, personnel interviews, a walk-over survey, geophysical surveys, and soil and wipe sampling and analysis at the following sites (shown in Figure 2-2 and 2-3).

- LL1 through LL4
- Culvert Area (also designated as the Demolition Grounds, Figure 2-2)
- Turnout Area (also designated as the Detonation Craters Area, Figure 2-2)
- South Burning Ground
- Proving Ground
- North Burning Ground (see Figure 2-6)

2.3.1.2 Assessment

Note that all of the areas listed above were subsequently investigated during the OU-3 RI by Woodward-Clyde/URS (Section 2.3.2). The findings at the North Burning Grounds are of interest for the OU-3 Supplemental RI. Trenching in areas that approximately corresponded to the burn ramparts (Figure 2-3) revealed "ash like material" at a depth of approximately 6 in. to a reported depth of 3 ft (TCT 1991). This finding is consistent with the "burn layer" that was found during UNL removal actions in the same area (Section 2.3.6).

2.3.2 Woodward-Clyde/URS – OU-3 Remedial Investigation and Baseline Risk Assessment

2.3.2.1 Summary

From 1995 to 1999, field activities for the OU-3 RI were conducted in three phases (Figure 2-2 and 2-3 for investigation areas). Phases I and II were conducted between 1995 and 1996, and a summary report was published in 1997 (Woodward-Clyde 1997). Phase III focused on the collection of additional data at selected investigation areas based on the results of the Phase I/II investigations as well as discussions with USEPA. The Phase III field work was completed in 1999 and a report summarizing the findings of the Phase III investigations was published in 2000 (URS 2000a).

Field activities during the OU-3 RI included shallow and deep soil sampling, trenching, wipe sampling of buildings (most of which have been demolished), groundwater sampling, geophysical surveys, and surface water, sediment, and fish sampling. Table 2-1a summarizes the geophysical, soil sampling, and trenching results. Table 2-1b presents results of the surface water and sediment sampling. Groundwater sampling results from the OU-3 RI are not summarized here because groundwater is within the scope of a different OU (i.e., OU-2). The OU-3 investigation areas, as well as the chemicals selected for sample analysis, were based on principal operations for each area, as documented in historical records (ESE 1993) and on earlier investigations (e.g., TCT 1991). The samples collected were analyzed for the following chemical groups: explosives, metals, semi-volatile organic compounds (SVOCs), VOCs, polychlorinated biphenyls (PCBs), and total recoverable petroleum hydrocarbons (TRPH). The specific analyte groups for each investigation area are shown in Tables 2-1a and 2-1b.

To evaluate if further action was needed at each of the investigation areas, screening levels were developed based on OU-1 Remediation Goals (RUST 1994) for explosives and published risk-based criteria that were current at the time [i.e., 1995 USEPA Region IX Preliminary Remediation Goals (PRGs) and 1996 USEPA Region III Risk-Based Criteria]. In addition, to evaluate metals, soil samples were collected from background locations during Phase I/II of the OU-3 RI (Woodward-Clyde 1997), and twice the average value for a given metal in the background data set was used as the background comparison value. Based on a comparison of data against screening levels, Woodward-Clyde (1997)

recommended no further action for the following investigation areas (Figure 2-2 for area locations, Tables 2-1a and 2-1b for summary of investigations and screening results).

- Bermed Area southwest of LL1
- Demolition Ground
- Detonation Craters
- Former Ammonium Nitrate Plant
- Former Igloo Storage
- Former Tetryl Pelleting Area
- Geophysical Anomaly at LL3
- North Burning Ground
- Proving Grounds
- Potential Waste Disposal Area north of the former Nike Maintenance Area
- Potential Waste Disposal Area southeast of the former Bomb Booster Area
- Potential Waste Disposal Area north of the former Atlas Missile Area
- South Burning Ground

Data collected from the investigation areas that involved underground storage tanks [USTs (listed at the end of Table 2-1a)] were below screening levels. However, further action for USTs is currently handled under a separate program. Surface water and sediment data collected from Johnson Creek, Clear Creek, Silver Creek, and the NRD Reservoir were not compared against screening levels (URS 2000b) because all surface waters were included in the OU-3 BLRA (URS 2000b). Investigation areas where screening levels were exceeded were also included in the BLRA (URS 2000b). These areas were:

- LL1 through LL4, Bomb Production Buildings
- LL1 through LL4, Paint Operations Areas
- Northeast Boundary Area
- Proving Grounds
- Potential Landfill Area

At the load lines, only surface soils, defined as soil above 2 ft bgs, were included in the BLRA because the screening level exceedences were limited to samples from depth intervals shallower than 2 ft. Separate risk assessments were conducted for surface soil at depth ranges of 0 to 0.5 ft and 0 to 2 ft bgs. Both surface and subsurface soil (depths greater than 2 ft bgs) were considered for the Northeast Boundary Area, Proving Grounds, and Potential Landfill Area. The chemicals included in the BLRA for each investigation area consisted of all analytes that were detected in the environmental samples. Chemicals were excluded from the BLRA for an investigation area based on:

- Maximum detected concentration being less than the USEPA Region IX PRGs and USEPA Region III Risk-Based Criteria,
- Being identified as an essential nutrient,
- Being present at background concentrations, or
- Being detected in less than 5% of the samples collected from the investigation area.

The environmental media and chemicals included in the BLRA for each investigation area are listed in Table 2-2a. Tables 2-2b and 2-2c show the incremental lifetime cancer risk (ILCR) and hazard indices (HIs), respectively, of site receptors from exposure to soils at each of the investigation areas from the BLRA (URS 2000b). ILCR is the increase in the probability of an individual developing cancer from a lifetime exposure to carcinogens, while the HI is a measure of the combined hazard from non-carcinogens. The ILCRs for all site receptors from exposure to soils at the investigation areas included in the BLRA (URS 2000b) and reproduced in Table 2-2b, are within or below the National Contingency Plan (NCP) risk range of 10^{-6} to 10^{-4} (1 in 1,000,000 to 1 in 10,000). The HIs (Table 2-2c) are below the target hazard goal of one at all investigation areas included in the BLRA with the exception of surface soil at LL2 Paint Storage Buildings, LL4 Paint Storage Buildings, and the Potential Landfill Area. Antimony (Sb) was the primary contributor to the HI at these investigation areas. Note that the HIs were greater than 1 only for the "hypothetical" child resident.

Table 2-2d shows the ILCRs and HIs from exposure to chemicals in sediment and surface water at Johnson Creek, Clear Creek, Silver Creek, and the NRD Reservoir. The cancer risks are within the NCP risk range of 10^{-6} and 10^{-4} for all three surface water bodies, while the HIs are below 1 for Silver Creek. The HI for the child recreational fisherman receptor from exposure to chemicals in the NRD Reservoir is greater than 1 due primarily to ingestion of fish with selenium (Se). Note that the HI is the sum of the HIs for all chemicals without regard for the target organs affected by each chemical. If the target organs are considered and only the HIs for the same target organ are added, the resulting HIs are all below one (URS 2000b).

Ecological risk assessments have also been conducted at the site. The initial site wide ecological risk assessment was implemented during OU-1 investigations and focused on the site soils (RUST 1993). The OU-1 BLRA concluded that the site soils did not pose a hazard to the environment (RUST 1993). A second ecological BLRA focused on the aquatic habitats in OU-3 (URS 2000b). It was concluded that VOCs, explosives, most metals and most SVOCs in surface water and sediment samples were unlikely to result in adverse ecological health effects (URS 2000b). Three sediment chemicals of potential ecological concern (Se, silver, 4-methylphenol) were not eliminated. However, these were analyzed with qualitative weight-of-evidence and a semi-quantitative ecological risk assessment. None of the chemicals of potential ecological concern were found to be a hazard to aquatic and terrestrial receptors at the site (URS 2000b).

2.3.2.2 Assessment

The OU-3 BLRA (URS 2000b) indicates that there are no unacceptable risks and hazards to site receptors, with the exception of hazards for the "hypothetical" child resident from exposure to surface soil at LL2 Paint Storage Area, LL4 Paint Storage Area, and the Potential Landfill Area. These hazards were addressed during removal actions in 2007 to 2008 (Kingston 2008, summarized in Section 2.3.6 below).

The HIs for the adult and child recreational fisherman receptors are greater than one for Johnson Creek and Clear Creek, primarily from ingestion of fish with mercury (Hg) and thallium (Tl). Note that the fish tissue concentrations for Johnson Creek and Clear Creek used in the risk assessment were estimated from surface water concentrations of Hg and Tl using a conservative bioconcentration model (URS 2000b). However, Hg and Tl were not detected in fish samples collected from the NRD Reservoir. Thus, it is unlikely that these metals are truly present in fish at Johnson Creek and Clear Creek at levels that pose unacceptable risks to fishermen (URS 2000b).

2.3.3 Environmental Chemical Corporation (ECC) – Surface Water Sampling

2.3.3.1 Summary

Beginning in December 2004 through 2009, surface water samples were collected quarterly from sampling locations along Johnson Creek, Clear Creek, and Silver Creek (Figure 2-7) as part of the OU-2 Groundwater Monitoring Program (ECC 2006). The purpose of the surface water sampling was to monitor the impact of TCE and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) groundwater plumes on these creeks. At Silver Creek, the sampling locations were selected to intercept any impact on the creek from the underlying TCE plume (Figure 2-7 for plume configuration based on 2008 groundwater data).

The surface water samples collected in 2004 through 2009 were analyzed for explosives and VOCs. TCE was the most frequently detected VOC in the surface water samples, while RDX was the most frequently detected explosive. Figures 2-8 and 2-9 summarize the TCE and RDX results, respectively, in surface water samples collected in 2004 through 2009 from Johnson Creek. Figure 2-8 plot A shows TCE is first detected in Johnson Creek at surface water sampling location SW-05, then the concentration increases to a maximum at SW-08 and decreases to less than 2 micrograms (μg) per liter (L) at sampling location SW-13. A similar pattern is observed with the RDX data, as shown in Figure 2-9 plot A. TCE concentration versus time for SW-08 (Figure 2-8 plot B) show the highest concentration of 59.6 μg/L, was measured in November 2005. Since then, concentrations have fluctuated between approximately 5 μg/L and 40 μg/L. During the OU-3 RI (Woodward-Clyde 1997), two surface water samples collected in May and July 1996 from approximately the same location as SW-08 contained TCE at 6.9 and 3.8 μg/L. The apparent increase in TCE concentrations at SW-08 from the levels measured in 1996 to the concentrations measured in 2004 may be due to the influence of the groundwater pump and treat system that first became operational in 1998 (URS 2009a). TCE concentrations at SW-10 located downstream of SW-08 ranged between 5 μg/L and 20 μg/L since 2004. Sampling at SW-16, located between SW-08 and SW-10 on Johnson Creek, began in late 2006; concentrations at this location have also ranged between 5 μg/L and 20 μg/L. At SW-13, the most downstream sampling location (Figure 2-8 for sample location), TCE consistently stayed below 2 μg/L from 2004 through 2009. RDX versus time plots in Figure 2-9 show concentrations that have generally been below 2 μg/L, with occasional spikes in concentration that nevertheless remained below 10 μg/L. With the exception of a single spike of 9 μg/L in a sample from June 2008, RDX at SW-13 has remained below 0.5 μg/L.

TCE or RDX have not been detected in any of the surface water samples from Clear Creek, upstream of the confluence with Johnson Creek (SW-07, SW-09, SW-11, Figure 2-7). TCE has not been detected in any surface water samples from Silver Creek. RDX was detected, but only in 3% of the samples collected between 2004 and 2009. No other explosives were detected.

2.3.3.2 Assessment

The surface water sampling data collected from 2004 through 2009 consistently shows the reach of Johnson Creek, from SW-05 to SW-10, as being the most impacted by TCE and RDX. The source of the TCE impacting this reach of Johnson Creek is also fairly well understood based on an investigation conducted by URS in 2007 to 2008 and summarized in Section 2.3.4 below. The surface water data collected from 2004 through 2009 need to be incorporated into a revised BLRA for Johnson Creek, Clear Creek, and Silver Creek, especially since TCE concentrations have increased at some locations since the OU-3 RI sampling was performed in 1996. The 2004 to 2009 surface water data are of adequate quality and spatial and temporal extent so that no additional surface water sampling is being proposed in the OU-3 Supplemental RI.

It is also of interest to note that the maximum TCE concentration measured in the surface water samples from the site (59.6 μg/L at SW-08 in Johnson Creek) is less than 10% of 810 μg/L, NDEQ's

water quality standard for TCE (NDEQ 2009). This water quality standard is a human health criterion at a 10^{-5} carcinogenic risk level, based on the consumption of fish and other aquatic organisms.

2.3.4 URS – Groundwater Modeling, OU- 2

2.3.4.1 Summary

From 2007 to 2008, as part of an effort to better understand the source of TCE in Johnson Creek and improve the conceptual model for groundwater/surface water interactions at the site (URS 2009b), drain tiles (DTs) and seeps (SPs) were identified near the reach of Johnson Creek that had highest concentrations of TCE in surface water samples. Twenty-one drain tiles were identified along the banks of Johnson Creek and extending downstream of the Johnson Creek and Clear Creek confluence. Five seeps were also identified along Johnson Creek. A field of sustained seeps was identified on the property located northwest of where County Road G crosses Johnson Creek [the artesian (ART) property (Figure 2-10)]. It was discovered that the ponds on this property do not freeze during the winter months, which suggests that the ponds are within an area of groundwater discharge (URS 2009b). Water from the seeps flows into a drainage ditch on the south side of the ART property, then discharges to Johnson Creek at DT-15 (Figure 2-10 for drain tile locations). DT-15 is one of the three drain tiles with the highest measured flow rates. The two other drain tiles with the highest measured flow rates are DT-02 and DT-06 (Figure 2-10). DT-02 empties the drainage ditch on the south side of a property northwest of County Road F and Johnson Creek, while DT-06 drains a holding pond approximately halfway between DT-15 and DT-02. The drain tile/seep study indicated that interaction between the streams and contaminated aquifers appears to be the result of discharging drain tiles, wetlands, and seeps, in addition to groundwater discharging into the streams through the streambed (URS 2009b). Drain tile and seep samples were collected quarterly from December 2007 until November 2008 and were analyzed for VOCs. A few samples were analyzed for explosives. The highest concentration of TCE in the seep samples from the ART property was 210 μg/L, while the maximum concentration of TCE in the drain tile samples was 82 μg/L measured at DT-15. During the same time period, the TCE in Johnson Creek at SW-08, a sampling point near DT-15 (Figure 2-10), ranged from 30 to 40 μg/L (surface water data presented in Section 2.3.3).

2.3.4.2 Assessment

The ECC drain tile/seep study provided evidence that upwelling groundwater in seeps and flowing through drain tiles is the source of TCE at Johnson Creek (URS 2009b). Thus, the surface water data from 2004 to 2009 (Section 2.3.3) and the drain tile/seep study summarized here have provided enough information for delineating the nature and extent of surface water contamination at Johnson Creek. The study suggests that TCE is attenuated, likely through volatilization and dilution, as groundwater upwells in the seep area on the ART property and flows into the drain tiles before discharging into Johnson Creek. Furthermore, discharge from DT-15 appears to be a source of TCE for Johnson Creek.

2.3.5 Lockheed Martin – Vapor Intrusion Assessment

2.3.5.1 Summary

Lockheed Martin (2007) conducted a vapor intrusion assessment on behalf of USEPA at 12 buildings that overlie the former NOP LL1 and Atlas Missile Area TCE groundwater plumes. The buildings sampled are listed below, and are shown in Figures 2-11 (LL1 Plume) and 2-12 (Atlas Missile Area Plume). Building characteristics are listed in Table 2-3:

- Unit 001 – Building 103 – UNL-ARDC Dairy Farm Manager Residence (LL1 plume)

- Unit 002 – Building 105 – UNL-ARDC Swine Farm Manager Residence (LL1 plume)
- Unit 003 – UNL-ARDC Feed Mill , 970 County Road-10 (LL1 plume)
- Unit 004 – Building 104 – UNL Entomology Building, 1033 County Road-H (LL1 plume)
- Unit 005 – Building 102 – UNL-ARDC Dairy Science, 1159 CR-10 (LL1 plume)
- Unit 006 – Building 101 – UNL-ARDC storage and maintenance (LL1 plume)
- Unit 007 – Building 403 – UNL-ARDC, Agronomy Building 650 County Road-H (Atlas Missile Area plume)
- Unit 008 – Building 406 – Four Winds Winery (privately owned), 1033 County Road-5 (Atlas Missile Area plume)
- Unit 009 – Building 405 – Residence, 1041 County Road-5 (Atlas Missile Area plume)
- Unit 010 – Building 404 – Residence, 1061 County Road-5 (Atlas Missile Area plume)
- Unit 011 – Building 401 – AFE Fire Shop (Atlas Missile Area plume)
- Unit 012 – Building 402 – UNL Building (Atlas Missile Area plume)

These buildings were selected for inclusion in the study because these were within 100 ft laterally of the LL1 and Atlas Missile Area TCE plumes with concentrations greater than or equal to 5 µg/L (Table 2-3). Depth to groundwater, shown in Table 2-4, ranges from approximately 10 ft at Unit 008 to approximately 55 ft at Unit 012 (Figure 2-11 for unit locations). Average TCE concentrations in the groundwater in monitoring wells near the buildings ranged from 1.1 to 972.2 µg/L, with a maximum concentration of 4900 µg/L (Table 2-4). TCE concentrations measured in direct-push groundwater samples were as high as 16,000 µg/L [e.g., at direct-push sample (GP)-21 near Unit 011 (Lockheed Martin 2007)]. Boring logs from monitoring well (MW)-24B and MW-40A indicate that a clay layer exists above the groundwater plumes. The fine-grained layer observed in the boring logs corresponds to the regional presence of Peoria loess overlying the sand and gravel deposits in the Todd Valley, and to the overbank deposits that overly the Platte and Wahoo Valley alluvium (Section 2.2.1).

At each of the 12 buildings, at least one of the following air sampling methods were performed (Table 2-5):

- Real-time air monitoring of TCE, cis-1,2- DCE, trans-1,2-DCE, and vinyl chloride using the Trace Atmospheric Gas Analyzer (TAGA) system.
- Collection of 24 hour indoor air and/or sub-slab soil gas samples in SUMMA® canisters which were analyzed for TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, and vinyl chloride.

The most frequently detected compound was TCE, with only occasional detections of the other target compounds. TCE concentrations in air samples collected from each of the buildings (Table 2-5) were compared against the USEPA Regional Screening Levels for residential indoor air [0.22 parts per billion by volume (ppbv)] and industrial indoor air (1.14 ppbv) to screen out buildings where vapor intrusion is not a concern. Based on the results in Table 2-5, vapor intrusion does not appear to be a concern in the following buildings:

- Unit 002 (UNL Swine Farm Manager). TCE was not detected during TAGA monitoring of indoor air and sub-slab soil gas samples.
- Unit 004 (UNL Entomology Building). TCE was not detected during TAGA monitoring of indoor air. An indoor air sample was not collected from this building. However, a sub-slab soil gas sample was collected and contained TCE at 0.018 ppbv. Using 0.1 as an attenuation

factor (USEPA 2002b), the estimated indoor air TCE concentration is 0.0018 ppbv, which is much less than the residential criterion for residential air.

- Unit 005 (UNL Dairy Science Building). TCE was not detected during TAGA monitoring of indoor air. Indoor air samples were not collected. However, sub-slab soil gas samples were collected and TCE was not detected in these samples.
- Unit 007 (UNL Agronomy Building) TCE was not detected during TAGA monitoring of indoor air. An indoor air sample was not collected; however, a sub-slab soil gas sample was collected and contained TCE at 0.072 ppbv. Using 0.1 as an attenuation factor (USEPA 2002b), the estimated indoor air TCE concentration is 0.0072 ppbv, which is much less than the residential criterion for residential air.
- Unit 008 (Four Winds Winery), Unit 009 (private residence), and Unit 010 (private residence). TCE was either not detected or detected below residential screening levels (0.22 ppbv) in indoor air samples (Lockheed Martin 2007).
- Unit 012 (UNL Building). TCE was not detected during TAGA monitoring of indoor air. Indoor air samples were not collected. However, sub-slab soil gas samples were collected and TCE was not detected in these samples.

2.3.5.2 Assessment

Although TCE is present in groundwater beneath the buildings listed above (Table 2-3), the Lockheed Martin (2007) assessment results indicate that TCE is not diffusing into the buildings at levels of concern. As mentioned previously, fine-grained deposits overlying the water-bearing sand and gravel deposits of the aquifers are regionally present at the site and may be acting as a barrier to upward migration of TCE from the groundwater.

The results of the vapor intrusion study are less conclusive for the following buildings:

- Unit 001 (UNL Dairy Farm Manager residence). TCE was detected during TAGA monitoring of indoor air at a concentration of 0.27 ppbv, which slightly exceeds the residential screening level of 0.22 ppbv. However, TCE concentrations in the indoor air samples (0.12 and 0.13 ppbv) and the estimated indoor air concentration from the sub-slab soil gas sample (0.0024 ppbv) are below the screening level. Because conflicting results were found among the TAGA results, the indoor air results, and the sub-slab soil gas results, it is recommended that another set of indoor air samples (with simultaneous sub-slab soil gas sampling in accordance with recent guidance) [Interstate Technology and Regulatory Cooperation (ITRC) 2007 and DoD 2009)] be collected from this building.
- Unit 003 (UNL Feed Mill). TCE was not detected in the sub-slab soil gas sample. However, there are no indoor air sampling results (TAGA or SUMMA® canister) from this building location. Indoor air samples [with simultaneous sub-slab soil gas sampling in accordance with recent guidance (ITRC 2007)] are needed to confirm results of the sub-slab soil gas sampling during the Lockheed Martin (2007) study.
- Unit 006 (UNL Farm Equipment Storage). TCE was detected during TAGA monitoring of indoor air at a concentration of 0.54 ppbv, which exceeds the residential screening level (0.22 ppbv), but is below the industrial screening level (1.14 ppbv). There were no indoor air samples collected from this building. Using 0.1 as an attenuation factor (USEPA 2002b), the estimated indoor air concentration based on the sub-slab soil gas sample (190 ppbv) is 19 ppbv, which exceeds the industrial screening level. Note, however, that this building is generally not occupied because it is currently used as a storage area and, as such, exposure duration will be less than in a typical industrial scenario. It is recommended that indoor air

samples [with simultaneous sub-slab soil gas sampling in accordance with recent guidance (ITRC 2007)] be collected from this building and a quantitative risk assessment be conducted using exposure factors that are representative of the building's use as a storage area.

- Unit 011 (AFE Fire Shop). TCE was detected in the sub-slab soil gas sample at 0.54 ppbv. Using an attenuation factor of 0.1 (USEPA 2002b), the estimated indoor air concentration is 0.054 ppbv which is below the industrial and residential screening level. However, there are no indoor air samples from this location. It is recommended that indoor air samples [with simultaneous sub-slab soil gas sampling in accordance with recent guidance (ITRC 2007)] be collected from this building to confirm the results of the sub-slab soil gas sample collected during the Lockheed Martin vapor intrusion assessment (2007).

TAGA monitoring also took place during crop irrigation. TCE was detected at a maximum concentration of 0.021 ppbv when the TAGA system was downwind of irrigation sprinklers (Lockheed Martin/REAC 2007). The measured TCE concentration is less than the residential screening level (0.22 ppbv), which suggests that exposure to TCE volatilizing from the irrigation system is not a concern.

2.3.6 Kingston Environmental Services, Inc. – Non-Time-Critical Removal Action for OU-3

2.3.6.1 Summary

In 2008, contaminated soils from LL2 and LL4 Paint Operations Area and the Potential Landfill Area were excavated during a removal action conducted by Kingston Environmental Services, Inc (Kingston). Soil with Sb levels above a clean-up goal of 31 milligrams (mg) per kilograms (kg) were removed. A seam of debris ran through the excavation area in the Potential Landfill Area in a northeast to southwest direction and was thought to be a former disposal trench. Much of the debris appeared to have been burned. A pocket of asbestos-containing transite tiles was encountered and removed under the supervision of a certified Nebraska Asbestos Inspector. The confirmation soil sampling results from the west wall of the excavation indicated Sb above the removal goal of 31 mg/kg. A thin seam of ash was observed to be present on this west wall. An additional 1 ft of soil was removed from the west wall and another confirmation sample was collected, analyzed, and found to meet the clean-up goal. The approximate total volume of soil removed from the Potential Landfill Area was 575 cubic yards and an approximate area of 430 square yards. The excavation was backfilled with soil from the Butler County Landfill borrow area (Kingston 2008).

2.3.6.2 Assessment

The presence of ash at the Potential Landfill Area is consistent with the observation of buried ash found during the OU-3 RI field activities at this investigation area (Section 2.3.2).

2.3.7 MACTEC – UNL Removal Action Report –OU-5

2.3.7.1 Summary

In 2009, the removal actions conducted by UNL at the site were directed towards finding and excavating former UNL disposal trenches at LL1 and LL2, in the vicinity of the former NOP Landfill ("Burial Site D") and at the North Burning Grounds ("Burial Site A"). UNL records indicate that these trenches were used for waste disposal over a period of two years between 1962 and 1979. A series of test pits were dug while trying to find the exact location of Burial Site A at the North Burning Grounds. During the excavation of test pit Number 5, a burn layer was identified between 1 ft to 2 ft bgs and thought to be related to historical military burning activities in the area. A sample of the burn layer was

collected and analyzed. The sample contained Sb at 258 mg/kg, lead (Pb) at 709 mg/kg, and manganese at 805 mg/kg (MACTEC 2009).

2.3.7.2 Assessment

Note that during the OU-3 RI (Section 2.3.2), screening of the soil sampling results indicated that no further action was needed in the North Burning Ground (Table 2-1). This assessment needs to be re-evaluated based on the level of Sb in the burn layer, which exceeds the screening level for this metal (31 mg/kg) during the OU-3 RI (Woodward-Clyde 1997, URS 2007a).

2.3.8 GEO Consultants, LLC (GEO)

2.3.8.1 Assessment

In 2010, a review of OU-3 related documents was conducted to consolidate all previous OU-3 activities. The purpose of this review was to determine any potential data gaps in the data and determine if any additional assessment or characterization was required.

The OU-3 BLRA (URS 2000b) is based on data collected between 1995 and 1999 during the field sampling and analysis events at the OU-3 investigation areas (Woodward-Clyde 1997, URS 2000a). However, recent developments and data collection activities at the site indicate the need to revise the OU-3 BLRA for the following investigation areas:

- *Johnson Creek, Clear Creek, and Silver Creek*. Surface water data collected between 2004 and 2009 (Section 2.3.3) needs to be incorporated into the BLRA. Higher concentrations of TCE and RDX were measured in the recent data (maximum of 59.6 μg/L and 6.8 μg/L, respectively) when compared to concentrations used in the 2000 BLRA (maximum of 6.9 μg/L and 1.8 μg/L for TCE and RDX, respectively).

- *The former North Burning Ground*. A burn layer was encountered during UNL removal actions (MACTEC 2009, summarized in Section 2.3.7). A sample of the burn layer contained Sb and Pb concentrations that exceeded screening levels used during the OU-3 RI. The North Burning ground (Figure 2-3, also shown in Figure 2-6) was historically used for burning powder boxes, combustibles, old powder, and similar materials (Woodward-Clyde 1997).

- *The Potential Landfill Area*. Located beside the former North Burning Ground (Figure 2-3, also shown in Figure 2-6) and identified from historical aerial photographs, the Potential Landfill Area consisted of approximately 10 acres (USEPA 1987). Ash was reported in several trenches at the Potential Landfill excavated during OU-3 field activities (URS 2000b). However, no samples for metals analysis were collected at the time. Given the Sb and Pb content in the burn layer sample from the North Burning Ground (MACTEC 2009), it is possible that the ash at the Potential Landfill Area contains similar levels of metals.

The OU-3 Supplemental RI sampling proposed in this WP will include characterizing the areal extent, depth, and metals composition of this burn layer and any other ash present at the North Burning Ground and the Potential Landfill Area (Section 3.2). The results of the Supplemental RI will be used in a quantitative risk assessment (Section 4) to determine whether the burn layer/ash materials are resulting in unacceptable risks and/or hazards to site receptors.

The revised BLRA for Johnson Creek, Clear Creek, and Silver Creek, which will incorporate the recent surface water data from 2004 through 2009, will be conducted as part of the OU-3 Supplemental RI (Section 4 for risk assessment methods). At this time, no revision to the surface water section of

previous ecological risk assessment is recommended. The 2004 through 2009 surface water Contaminants of Potential Concern (COPCs) was compared to NDEQ Chronic Criteria for the protection of aquatic life and their uses, and no exceedances of the criteria were found for any surface water.

The OU-3 Supplemental RI will also include field sampling at the former North Burning Ground and Potential Landfill Area to characterize the burn layer/ash present in these investigation areas (Section 3.2.3). The data will be used to evaluate exposure potential and quantify risks for land users that may come in contact with these burn layer/ash materials.

Finally, the OU-3 RI did not include assessments of vapor intrusion, which was recognized as an important exposure pathway only after the OU-3 RI field activities and BLRA were completed. A vapor intrusion assessment was conducted by Lockheed on behalf of USEPA (Lockheed 2007; summarized in Section 2.3.5) in selected buildings overlying the TCE groundwater plumes. The field activities proposed in this WP (Section 3.2 4) will supplement the data collected during the Lockheed/USEPA vapor intrusion study to determine if further action is needed to address concerns in these buildings.

2.4 INVESTIGATION AREAS TO BE INCLUDED IN THE SUPPLEMENTAL OU-3 REMEDIAL INVESTIGATION

After a review of previous RIs and BLRAs summarized in Section 2.3, the following remaining areas of potential concern will be addressed in the supplemental RI WP:

- Burn layer and other ash materials present at the North Burning Ground and Potential Landfill;
- Johnson Creek, Clear Creek, and Silver Creek where surface water data collected in 2004 to 2009 needs to be incorporated into a revised BLRA; and
- Buildings overlying the LL1 and Atlas Missile Area TCE groundwater plumes to evaluate vapor intrusion.

2.4.1 Burn Layer

As mentioned in Section 2.3.7, a burn layer was identified in the North Burning Grounds during UNL removal actions. Furthermore, visual descriptions of trenches during the OU-3 RI field activities (Section 2.3.2) and removal action (Section 2.3.6) imply that ash may also be present in the Potential Landfill Area. Sampling and analysis is proposed as part of the OU-3 Supplemental RI to characterize the areal extent, burial depth, and metal content of the burn layer and any other ash buried at the North Burning Ground and Potential Landfill Areas. Sampling details and justification for sampling locations can be found in Section 3.2.3. Data collected during the Supplemental RI will be combined with previous soil data from the OU-3 RI (Woodward-Clyde 1997, URS 2000a) and the combined data set will be used for a revised BLRA of these investigation areas (Section 4 for risk assessment methods). The results of the revised BLRA will determine the need for further action to address the risks and hazards to site receptors, if any, posed by the burn layer and buried ash. A deed restriction exists for the North Burning Grounds that prohibits usage of the area in the following ways:

- The use of the property in any manner that would interfere with or adversely affect the implementation, integrity, or protectiveness of any response actions that have been, or may be preformed is prohibited.

- The use of the property for other than wildlife habitat is prohibited except for the maintenance of the remedy and further cleanup and other related land stewardship activities.

- The use of groundwater contaminated with any of the constituents listed in Appendix D of the Consent Decree for human consumption is prohibited unless it has been treated before use to standards acceptable to the USEPA and Nebraska Health and Human Services System consistent with the Safe Drinking Water Act and applicable Nebraska law (Permanent Deed Notation, U.S. 2005b).

No deed restrictions have been found for the Potential Landfill Area.

2.4.2 Surface Water

No additional sampling is being proposed for surface water. As summarized in Section 2.3.3 and 2.3.4, sufficient characterization data are available for a revised BLRA of Johnson Creek, Clear Creek, and Silver Creek.

2.4.3 Vapor Intrusion

Indoor air and sub-slab soil gas sampling is proposed for four buildings to supplement the findings of the Lockheed Martin (2007) study summarized in Section 2.3.5. Sampling details and justification for sampling locations can be found in Section 3.2.4.

2.5 TARGET ANALYTES

The target analytes are listed below for the burn layer and Vapor Intrusion. A review of the results of the target analytes will be used to form a list of COPCs for each investigation area for the BLRA.

The target analytes for the burn layer include the following metals:

- Aluminum
- Sb*
- Arsenic
- Barium
- Beryllium
- Cadmium*
- Chromium
- Cobalt*
- Copper
- Iron
- Pb*
- Magnesium
- Manganese
- Hg
- Nickel
- Potassium
- Se

- Silver*
- Sodium
- Tl*
- Zinc

The Potential Landfill Area was analyzed in the previous BLRA for the following metals: Sb, cadmium, cobalt, Pb, silver, and Tl (marked with a * above, URS 2000a). The North Burning Ground was not included in the previous BLRA (Woodward-Clyde 1997). The target analytes were chosen to match the previous investigation for vapor intrusion (Lockheed Martin 2007) and include the following VOCs:

- ccis-1,2-DCE
- trans-1,2-DCE
- TCE
- vinyl chloride

A review of the results of the target analytes will be compared to the list of COPCs from the previous BLRA and utilized to update the previous list of COPCs for each investigation area for the supplemental BLRA.

3. TASK DESCRIPTIONS

3.1 PROJECT PLANS

3.1.1 Quality Control Plan

The QCP (GEO 2010a) was submitted under a separate cover for OU-3 activities and addresses the statement of purpose and scope of the investigation; the project organization and schedule including the project team, points of contact, and teaming partners; quality assurance/quality control procedures including project management, compliance with federal, state, and local regulations, field sampling and analytical data, independent technical review of document deliverables, CENWK and regulatory agency document review, and management review; records and data management; and provisions for feedback and lessons learned.

3.1.2 Project Management Plan

The PMP (GEO 2010b) was submitted under a separate cover for OU-3 activities. The purpose of the PMP is to be the primary tool for managing the project; to outline the methods and procedures to maintain control over the project schedule; meet project milestones; provide project status and progress reports; and present financial reporting procedures. The PMP also provides subcontractor oversight protocols, risk mitigation procedures, definition of communication channels, and procedures for response to changes in the project scope and/or schedule. The PMP defines the approach, schedule, and resources required for planning, executing, and completing the contract objectives.

3.1.3 Work Plan

This WP is developed to help manage available resources and to inform the stakeholders of the type (description) and timeframe (schedule) of the activities that will take place at the site. The WP discusses the personnel, equipment, and contracted services requirements of the project, as well as property restoration upon completion of the project's field activities. The Site-Wide WP (ECC 2009a) will be utilized as much as possible.

3.1.4 Site-Specific Safety and Health Plan/Accident Prevention Plan

The SSHP/APP (GEO 2010d) describes and addresses the full range of safety precautions to be implemented and observed during field investigation activities. It also addresses the required personal protective equipment and potential hazards. The SSHP/APP is prepared in accordance with USACE *Appendix C, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste Activities*, ER 385-1-92, July 2007 and USACE *Safety and Health Requirements Manual*, Engineering Manual 385-1-1. The SSHP/APP will specify safety and health training, safety audit/inspection procedures, accident/hazard investigations, and accident reporting and investigation procedures and is an Attachment to this WP.

3.1.5 Sampling and Analysis Plan

The Site-Wide SAP (ECC 2009d) and Site-Wide WP (ECC 2009a) will be referenced as much as possible and details soil sampling activities, analytical requirements, and may be used as an audit guide for field and laboratory work.

3.1.6 Quality Assurance Project Plan

The QAPP (GEO 2010c) describes the policy, organization, functional activities, data quality objectives, and measures necessary to achieve suitable data for use in selecting the appropriate remedy. It is prepared in accordance with USEPA-505-B-04-900A *Uniform Federal Policy for Quality Assurance Project Plans*. The QAPP can be found in Appendix A.

3.1.7 Data Management Plan

The *Site-Wide Data Management Plan* [DMP (ECC 2009b)] will be followed for:

- data collection;
- data verification and validation;
- data entry, loading, and management; and
- data reporting.

3.1.8 Project Database

A centralized non-proprietary Structured Query Language Database will be utilized to manage chemical, geological, hydrogeological, geospatial, and well construction data. It will also contain both historical data and data from ongoing investigations. The Project Database (http://portal.synectics.net) will include web-based applications designed to load, review, and approve data within the database. The database is structured to support Staged Electronic Data Deliverable submittals and Quality Control Summary Report documentation (ECC 2009a). All data created from field activities will be uploaded into the Project Database and subjected to an automated data review (ADR) using built-in ADR tools, as required by the DMP (ECC 2009b).

3.2 FIELD ACTIVITIES

Field activities will include utility clearance, a munitions and explosives of concern (MEC) probability assessment for the North Burning Ground, UXO Hazards Evaluation, surface and subsurface soil sampling, vapor intrusion sampling, sample handling requirements, and waste management. SOPs are located in Appendices C, D, and E.

3.2.1 Utility Clearance Activities

Utility clearance activities will follow Section 2.1 of the Field Sampling Plan (FSP) from the Site-Wide SAP (ECC 2009d).

The former North Burning Ground and Potential Landfill Area are located in property owned by UNL. At least one month before the field sampling event, the GEO Project Manager (PM) will request permission from the CENWK PM and CENWK Project Engineer to contact UNL regarding underground utilities in these areas. Once permission is granted by CENWK, the GEO Field Operations Manager (FOM) will contact UNL property management to identify utilities in close proximity to where soil cores may be collected. The following clearance activities will be performed:

- The FOM will review the site history and any as-built drawings available to identify the potential for underground utilities. After permission is granted by CENWK, UNL property

management personnel will be contacted and interviewed for information concerning utility facilities and locations.

- Borehole locations will be identified with a stake and brightly colored paint or flagging.
- The Digger's Hotline of Nebraska system will be contacted at least three business days prior to the drilling activity for a utility locate.
- The Locate Request "ticket number" and expiration date will be recorded. This will verify compliance with state laws governing utility protection and will be critical in the event of an incident.
- The Digger's Hotline administrator should provide responses from the utility owners, or refer them directly to the GEO FOM.
- If the local utility company cannot provide the location, then a private locator service will be engaged to locate utilities through field testing. In these situations, as-built drawings cannot be relied upon for utility marking.
- Prior to utility marking, the FOM will meet with the private locator service to review the WP, and the services and limitations of the locator.
- Utilities will be marked using standard colors, as described in Section 4.4 of the SSHP/APP. The FOM or designee will photograph all utility locate markings prior to the drilling activity.
- The FOM will verify the drilling location and utility markings just prior to starting the drilling activity. Evidence of any unmarked utilities, such as risers, pedestals, meters, and obvious trench lines, will be explored and documented, if discovered. If unmarked utilities are suspected, Digger's Hotline or a private locator service will be contacted for assistance.
- All information derived from utility locate efforts will be communicated to the drilling crews at the daily tailgate meeting prior to the drilling activity. In addition, the requirements of this procedure will be discussed. This training will be documented on the Daily Tailgate Meeting attendance sheet (in Appendix B).

If a utility is not found where it was marked, or if an unmarked utility is found, the FOM or designee will call the utility owner and the Diggers Hotline of Nebraska to report the discrepancy. Photos or videos will be taken and an Incident Report will be logged. If an unmarked utility is found by contact with drilling equipment, and the equipment or utility is damaged, work will stop, the CENWK PM, CENWK Project Engineer, and GEO PM will be contacted, and an incident report will be prepared in accordance with the SSHP/APP (GEO 2010b).

The FOM will call the Diggers Hotline of Nebraska or UNL property manager to update the locate ticket three business days before its expiration date, if it will expire before completion of the activity.

3.2.2 UXO Hazards Evaluation/MEC Probability Assessment

According to the OU-3 MEC Probability Assessment memo dated March 2008, the Potential Landfill at the former NOP has had a MEC Probability Assessment; this area was found to have a "Low" probability of encountering MECs during construction activities (Anderson 2008). The memo also states that the Potential Landfill should have two qualified UXO personnel on site during construction activities (Anderson 2008).

A MEC Assessment has not been conducted on the North Burning Ground. Chapter 12 of the DoD 6055.9-STD, C12.2.1.2 (DoD 2008a) states that all areas of known or suspected explosive or chemical hazards must be identified for sites in the Military Munitions Response Program, which includes the

former NOP (DoD 2008b). The MEC Probability Assessment is included. The probability of encountering MECs in the North Burning Ground and UXO personnel requirements will be determined by the MEC probability assessment.

Although regulations only require that two qualified personnel be "on call" at the Potential Landfill Area, due to the logistical difficulties, GEO plans to have two qualified UXO personnel on-site to monitor all intrusive activities and to provide MEC avoidance services at both the Potential Landfill Area and the North Burning Grounds. All site personnel will have an initial ordnance identification/safety class and attend daily awareness briefs during the morning meetings.

3.2.2.1 General UXO Information

- The cardinal principle to be observed involving UXO is to limit the exposure of a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- The age or condition of ordnance does not decrease its effectiveness. Ordnance that has been exposed to the elements for extended periods becomes more sensitive to shock, movement, and friction due to the possibility of the stabilizing agent in the explosives being degraded.
- The North Burning Ground was surveyed for UXOs by TCT in 1991. A visual and geophysical survey was conducted. No ordnance debris was found in the North Burning Ground (TCT 1991).
- The Potential Landfill Area was surveyed in March 1995 for ordnance explosive avoidance and the ground was found to be saturated with metallic contacts. Twelve locations were cleared for sampling (Woodward-Clyde 1997).
- All planned soil sampling locations will be screened by qualified UXO personnel prior to drilling or sampling.
- All sampling in the Potential Landfill Area will have two on-site UXO personnel for all construction activities.
- The MEC Probability Assessment on the North Burning Ground area will determine if additional UXO personnel are required during construction activities in this area.

3.2.2.2 Site-Specific UXO Rules

- All on-site workers will be trained to recognize the types of ordnance that may be present.
- All individuals (including visitors) will receive a safety briefing and must sign a visitor's log prior to entering the exclusion zone.
- Daily "tailgate" safety briefings will reiterate the hazards and controls, as they pertain to UXO avoidance at this site.
- Workers will not handle, move, or otherwise disturb unexploded ordnance or any items that cannot be identified as not being unexploded ordnance.
- Consider ordnance that has been exposed to fire as extremely hazardous. Chemical and physical changes may have occurred to the contents, which render them more sensitive than they were in their original state.
- Always assume that ordnance contains a live charge until it can be ascertained otherwise.
- Employ the "buddy system" at all times.

- No personnel will be allowed into non-surveyed UXO areas. All investigation areas have been previously surveyed.
- First aid equipment and fire extinguishers will be available on-site during UXO avoidance activities.
- Intrusive anomaly activities are not authorized during anomaly avoidance activities.
- DO NOT be misled by markings on the ordnance stating "practice bomb," "dummy," or "inert." Even practice bombs contain explosive charges that are used to mark/spot the point of impact. The item(s) may also be mismarked.
- DO NOT rely on color codes for positive identification of ordnance item(s) or their contents.
- DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- DO NOT use radios or cellular phones in the vicinity of suspected ordnance.
- DO NOT walk across an area where the ground cannot be seen. If dead vegetation or animals are observed, leave the area immediately because of potential contamination by chemical agents.
- DO NOT drive vehicles into a suspected UXO area; use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters, or other flame or spark-producing devices into UXO areas of the site.

3.2.2.3 Encountering UXO

- If UXO is encountered during field activities, project personnel will immediately cease all activity.
- Personnel will proceed to a safe evacuation distance from the UXO and will avoid that area.
- Immediately notify the appropriate site personnel (on-site UXO personnel) of the location of the UXO.
- DO NOT touch or move any ordnance regardless of the markings or apparent condition.
- When anomalies or surface UXO are encountered, they will be marked using pin flags. The area surveyed will be clearly marked with pin flags of a different color than used for encountered UXO.

3.2.3 Soil Sampling

Soil sampling will occur within the North Burning Grounds and the Potential Landfill Area to locate and determine the depth of the burn layer/ash, characterize the metals content, and to evaluate the lateral extent/distribution of the burn layer/ash. As these areas are congruent, they will both be covered in this section. The North Proving Ground/Potential Landfill Area will be sampled in 20 locations (Figure 3-1). The locations shown are approximate and are subject to change based on the UXO clearance. Table 3-1 contains justification for each sampling location. Continuous soil cores to 8 ft will be collected at each location shown in Figure 3-1 (noting the occurrence of ash in the soil cores). From the soil core, a sample will be collected from each of the following depth intervals: 0 to 0.5 ft, 0.5 ft to 4 ft, and 4 ft to 8 ft for metals analysis. Rationale for these increments is listed below.

- 0 to 0.5 ft section represents surface soil, the layer of soil to which all receptors are likely to be exposed without intentionally disturbing the soil.

- 0.5 to 4 ft and 4 to 8 ft sections will provide data to examine the change in concentration with depth for target analytes.
- 8 ft is the maximum depth to which it is assumed a construction worker will be exposed during intrusive activities.

Detailed information on soil sampling procedures can be found in Section 2.10 of the FSP in the Site-Wide SAP (ECC 2009d). A summary of surface and subsurface soil sample collection is located in Table 3-2.

A direct push drill rig will be used to obtain soil cores. Specifically, a dual tube sampling system will be used to advance a 2.25 in. outer diameter (OD) probe rod as an outer casing and an inner rod string that will advance a cutting shoe to collect a 1.125 in. OD soil core inside a clear polyethylene terephthalate glycol (PETG) liner and facilitate retrieving of the core. The function of the outer casing is to prevent hole collapse between collection of the two soil cores at each sampling location. Soil cores will be collected at each sampling site in two, 48 in. PETG liners, to a total depth of 8 ft bgs. New PETG liners will be used for each 48 in. length of soil core. Decontamination procedures will follow the Site-Wide SAP (Sections 2.3 and 3.3 of the FSP, ECC 2009d).

Soil cores will be photographed to provide a visual record of the core at each sampling location and facilitate identification and depth of any ash layer that may exist at the location. In addition, each core will be logged to produce a continuous soil log to a depth of 8 ft bgs (see Appendix B for drilling log). The top 0.5 ft. of the core representing the 0 to 4 ft bgs interval at each site will be designated as a surface soil sample. It will be homogenized and sub-sampled with a pre-cleaned polyethylene scoop in an amount sufficient to fill the sample container. The remainder of the upper soil core (0.5 to 4 ft bgs) will be homogenized, sub-sampled with a pre-cleaned polyethylene scoop, and transferred to a sample container as the second soil sample for the site. The third soil sample will come from the lower soil core (4 to 8 ft bgs) and will be homogenized and sub-sampled, as described above. Excess soil will be returned to the sample area.

Prior to intrusive work, each sampling site will be cleared for underground utilities and UXO, as described in Section 3.2.1. Since the sampling areas included in this project (Figure 2-1) may include suspected landfill sites, it is possible that construction debris may be encountered during subsurface sampling. This construction debris may prevent soil coring to a total depth of 8 ft. If this occurs, the coring system will be moved to offset the sampling location by several ft from the original coring site and a second attempt made to collect soil cores. If refusal is encountered again, coring will terminate at that site and up to three soil samples will be collected from the available core in the manner previously described in this section. The core from the borehole with the deepest penetration will be selected for sampling. If the refusal occurred at less than 4 ft, then samples will be taken from the 0 to 0.5 ft interval and another sample from the remaining core. If refusal occurred between 4 ft and 8 ft, the 0 to 0.5 ft interval, 0.5 to 4 ft interval, and the remaining core will be sampled. The refusal depth will be noted in the boring log.

3.2.4 Vapor Intrusion

To supplement the findings of the Lockheed Martin (2007) vapor intrusion assessment, four buildings will be evaluated as part of the OU-3 Supplemental RI (Section 2.3.5).

- Unit 001 – Building 103 – Diary Farm Manager Residence (LL1 plume)
- Unit 003 – Feed Mill (LL1 plume)
- Unit 006 – Building 101 – UNL-ARDC Storage Building (LL1 plume)

- Unit 011 – Building 401 –AFE Fire Shop (Atlas Missile Area plume)

The rationale for sampling these four locations is located in Table 3-3. The rationale for not sampling the remaining locations can be found in Table 3-4.

All sub-slab soil gas and air samples will be collected in 6 liter SUMMA® canisters during a 24 hour sampling period. Each canister will be fitted with a critical orifice flow controller set at approximately 3.4 milliliters (mL)/minute to collect 4 to 5 liters of the sample in accordance with the method used in the Lockheed Martin/USEPA study (2007).

An initial building survey will be conducted to verify use and occupancy information as well as potential indoor VOC sources. An inventory of chemicals within each building will be completed and Material Safely Data Sheets, if available, will be obtained for all products identified (chemical inventory and location of potential sources found within the Building Questionnaire and Indoor Air Quality Building Survey in Appendix B). The existence of sampling ports will be verified during this initial building survey and any structural changes to the buildings since 2007 will be noted. A Building Questionnaire form will be utilized in the initial building survey (Appendix B).

Each of the four buildings to undergo sub-slab soil gas sampling had an access sampling port, installed during the previous vapor intrusion study, which penetrates the concrete floor. It is assumed that the sample access systems in each building are intact and serviceable, but will require testing to verify. Each of the sub-slab soil gas access ports will be leak tested by placing a small enclosure over the port location, filling the enclosure with helium, withdrawing a sample of soil gas, and checking the helium concentration with a portable field analyzer. The leak rate will be considered acceptable if the helium concentration in the sample is ≤10% of the concentration in the enclosure. If the sampling ports cannot be located or fail the leak test, a new sub-slab soil vapor sampling port will be installed using guidance from the USEPA's *Draft Standard Operating Procedure for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations* (undated, Appendix E).

Prior to connecting the SUMMA® canister to the port, the sample transfer line attached to the canister will be vacuum-tested. A leak rate <5% over five minutes will be considered acceptable. The Field Data Air Sampling Form is located in Appendix B. The final step before connecting the canister to the sampling port involves purging the line between the port connection and sub-slab soil gas probe (approximately three purge volumes) by using a purge canister under vacuum. In each of the buildings, locations of indoor air sampling stations will be established based on the building floor plan and the use of the space. In general, sampling sites will be located in the living room and basement of the residential building (Unit 001) and near the center of the industrial buildings (Units 003, 006, and 011). Air samples will be collected from the breathing zone (approximately 5 ft above the floor) either by locating the SUMMA® canister at this height or by placing the canister on the floor and connecting it to a sampling tube with the air sampling port placed in the breathing zone.

A summary of vapor intrusion sample collection is in Table 3-5. During vapor intrusion sampling, the barometric pressure will be noted as changes in atmospheric pressure may influence vapor intrusion. Sampling will also be avoided if measureable precipitation or irrigation nearby occurred in the previous five days as increased soil moisture can affect vapor intrusion.

3.2.4.1 Sub-slab sampling procedure (USEPA undated, Appendix E)

During sub-slab soil gas sampling, dedicated stainless-steel fittings and Teflon™ tubing will be connected to the each existing sub-slab port, the tubing will then be connected to a second piece of Teflon™ tubing using a ball valve and Swagelock™ fittings. This second piece of tubing will then be attached to the purge pump and a purge container under vacuum. The sub-slab port will be purged

approximately three purge volumes. Clean Nitrile gloves should be worn when connecting the stainless-steel fitting and Teflon™ tubing to the sub-slab port. The second piece of tubing will then be connected to the evacuated, certified Summa® canister (the vacuum in the canisters should be checked prior to sampling) The samples will be collect over 24 hours at a flow rate of approximately 3.4 mL/minute using a flow controller. Near the end of the 24 hours, the vacuum gauge should be periodically monitored. If the vacuum gauge indictes 5 in. of Hg of vacuum remaining before the 24 hours have expired, the valve should be closed and the time noted.

3.2.4.2 SUMMA® canister instructions (Columbia Analytical Services, Inc. 2004, Appendix E)

Ensure that the valve is fully closed (green knob should be completely clockwise). The brass cap should be removed from the valve on the top of the canister using a 9/16 in. wrench; the flow controller should then be attached to the valve by hand, and then tightened gently with a wrench. To open the valve, turn the green knob until there is no resistance, approximately 1¼ turns, then turn back clockwise slightly until resistance is felt. After the required sampling period (24 hours), close the valve by turning the green knob clockwise, do not overtighten. Remove the flow controller from the valve and wrap securely in bubble wrap. Replace the brass cap on the canister valve and tighten with the wrench. Follow all requirements listed in Sections 3.2.8, 3.2.9, 3.3.2, and 3.3.3.

3.2.4.3 Indoor and Background Sampling Procedure

The procedures listed in sub-slab sampling procedure will be used with the following exceptions:

- Canisters will be placed in the breathing zone. Indoor samples will be placed away from windows, ventilation registers, or areas of high heat and/or humidity.
- Indoor sample canisters will be centrally located within a room while minimizing disruption to occupants (indoor samples only).
- Background canisters will be place upwind of the buildings being tested.

3.2.5 Changes in Field Program

During the field investigation, all changes to the survey and/or sampling program must be documented on a Field Change Request (FCR) form. FCRs shall be numbered serially, starting with 01. Copies of the FCR must be maintained by the field team and by the PM in the project management files. FCR forms shall include an explanation of the problem and a proposed solution. Each FCR must be approved by the necessary personnel (e.g., GEO PM, USACE, NDEQ, USEPA) before implementation of the change occurs. At a minimum, copies of the approved FCR form will be distributed to USACE, NDEQ, USEPA, and the following GEO personnel: the PM and the Project Quality Program Manager, other field staff as applicable, and the project files. The PM shall be responsible for controlling, tracking, implementing, and distributing of all identified changes/FCR forms.

3.2.6 Sample Labeling and Custody Procedures

A summary of sample containers required, preservation methods and holding times is located in Table 3-6.

3.2.6.1 Soil sampling labeling

A sample numbering system shall be used to identify each soil sample collected and submitted for analysis to assist in the tracking of samples and to facilitate retrieval of analytical results. The sample identification numbers for each sampling effort shall be used on sample labels, chain-of-custody forms, field logbooks, field sheets and all other applicable documentation. A listing of all sample identification

numbers shall be recorded in the field logbook. Quality control (QC) samples shall be disguised using the same numbering system selected for the field samples. This sample label is modified from Section 5.2.5 of the FSP in the Site Wide SAP (ECC 2009d).

The sample number shall consist of six distinct fields:

NBG/PLA ## tt nn XX MMYY

Where:

NBG/PLA	=	site location designation (representing either North Burning Ground or Potential Landfill Area)
##	=	unique two digit sample number that is specific to the sampling location.

The following prefixes will be used followed by the sampling location number designation.

tt	=	sample type ("SS" for surface soil from 0 to 0.5 ft, "SB" for subsurface soil from >0.5 ft depth):
nn	=	subsurface sample depth interval (where applicable)
XX	=	01-primary sample; 02-duplicate sample
MMYY	=	month/year (e.g. 0410)

Each sample collected shall be assigned a unique sample number. Sample numbers shall change when the location changes.

3.2.6.2 Vapor intrusion sampling

Each vapor intrusion sample will be given a unique sample designation for identification purposes. The field sample identification designation will be printed on all sample labels and will be referenced on the sample collection field sheet and in the field logbook. All vapor intrusion samples will be identified with a 22 character sample identification number in the following format which has been modified from the Site-Wide SAP (Section 5.2.6 of the FSP, ECC 2009d).

XXXX-MYY-AIR-aaa-XX–ZZ

Where:

XXXX	=	the site location designation (building designation): e.g., U001 for Unit 001 (see QAPP for Unit designations, Appendix A)
MMYY	=	the month and year the sample was collected
AIR	=	indicates that this is a vapor intrusion sample
aaa	=	the sequential sampling event number (for MS or MSD samples, either MS or MSD is added after the sampling event number
XX	=	01, primary sample; 02, duplicate sample
ZZ	=	indicates whether the sample is an indoor air (IA) or sub-slab soil gas (SG) sample

3.2.7 Sample Labels

Sample labels will follow the Site-Wide SAP (Section 5.3 of the FSP, ECC 2009d).

3.2.8 Custody Seals

Custody seals will follow the Site-Wide SAP (Section 5.4 of the FSP, ECC 2009d).

3.2.9 Chain-of-Custody Records

Chain-of-Custody records will follow the Site-Wide SAP (Section 5.5 of the FSP, ECC 2009d).

3.2.10 Corrections to Field Documents

Correction to field documents will follow the Site-Wide SAP (Section 5.6 of the FSP, ECC 2009d).

3.3 PACKAGING, SHIPPING, AND LABELING OF SAMPLE CONTAINERS

Packaging, shipping and labeling of sample containers will follow the Site-Wide SAP (Section 6.0 of the FSP, ECC 2009d) for all soil samples. Vapor intrusion sample procedures can be found in Section 3.3.1 below.

3.3.1 Vapor intrusion samples

- Summa® canisters will be shipped back with the original custom shipping materials designed to prevent damage to the equipment.
- The Chain-of-Custody Record will be placed in a self-sealing polyethylene bag and taped to the inside lid of the cooler.
- The shipping container will be closed and taped shut with duct tape or strapping tape and the drain of the cooler will be shut and sealed with duct tape.
- Custody seals will be placed over the seam at the front and rear of the cooler lid and covered with clear tape.
- The completed shipping label and any other labels (i.e., “Fragile”, “This Side Up”) will be placed on the top of the cooler.
- If appropriate, the shipper’s hazardous certification form will be completed prior to shipping.

3.3.2 Shipping Containers for Samples

Shipping containers for samples will meet the requirements listed in the Site-Wide SAP (Section 6.2 of the FSP, ECC 2009d).

3.3.3 Marking and Labeling of Shipping Containers

Marking and labeling of shipping containers will follow requirements listed in the Site-Wide SAP (Section 6.3 of the FSP, ECC 2009d). The names, addresses, and phone numbers of the analytical laboratories are presented in Worksheet #6 of the QAPP (Appendix A).

3.4 INVESTIGATION-DERIVED WASTE

IDW will be addressed according to the Site-Wide SAP (Section 2.11 of the FSP, ECC 2009d).

3.5 CHEMICAL QUALITY CONTROL

Chemical QC consists of three phases (preparatory, initial, and follow-up) of control that will be performed for the sampling activities. The procedures shall follow the Site-Wide SAP (Section 8.0 of the FSP, ECC 2009d).

3.6 CORRECTIVE ACTIONS

Corrective actions will be address according the Site-Wide SAP (Section 9.0 of the FSP, ECC 2009d).

3.7 SAMPLE ANALYSIS

Detailed information on sampling can be found in Section 3.2. Analytical requirements, sample containers, and preservation requirements will comply with Section 3.0 of the FSP in the Site-Wide SAP (ECC 2009d). The requirements for Field Quality Assurance and Quality Control Samples can be found in the Site-Wide SAP (Section 4.0 of the FSP, ECC 2009c). Requirements for documentation can also be found in the Site-Wide SAP (Section 5.0 of the FSP, ECC 2009c).

3.7.1 Data Management

All soil and SUMMA® samples collected will be submitted to Test America Burlington (address and phone number listed below). Test America Burlington is expected to be Environmental Laboratory Accreditation Program compliant by August 2010 with the most recently published versions of the *DoD Quality System Manual* and approved by the Nationally Accredited Environmental Laboratory for all appropriate fields of testing. Analytical data will be provided in electronic format compatible with Automatic Data Review and will meet the requirements of the Site-Wide DMP (ECC 2009b) and the Project Database. The Site-Wide DMP details the following processes: database management, project organization, responsibilities of key personnel, database standards, data collection, data loading and data entry into the Project Database, data management, data reporting and data security (ECC 2009a).

Test America
30 Community Drive, Suite 11
South Burlington, VT 05403
802-660-1990

Laboratories will upload the data in a compatible format to the online Project Database as required by the Site-Wide DMP (ECC 2009b). Data will be uploaded and updated as new data is collected. The system is designed to support Staged Electronic Data Deliverable submittals and Quality Control Summary Report documentation directly from the analyzing laboratories (ECC 2009a).

3.7.2 Data Verification

Analytical data will be verified 100% in accordance with the project-specific QAPP (Appendix A), the Site-Wide WP (Section 4.2, ECC 2009a), and the *Site-Wide DMP (*Section 6.0, ECC 2009b).

3.7.3 Data Validation

Analytical data will be validated in accordance to the procedures prescribed in the project-specific QAPP (Appendix A), Data validation will also follow all requirements of the Site-Wide DMP (Section 6.0, ECC 2009b).

3.8 SUPPLEMENTAL BASELINE RISK ASSESSMENT AND SUPPLEMENTAL RI REPORT

This task consists of reviewing data and presenting the results and conclusions with regards to revising the BLRA for former NOP OU-3 (Section 4 of this WP).

4. BASELINE RISK ASSESSMENT METHODS

4.1 INTRODUCTION

A BLRA will be performed as part of the OU-3 Supplemental RI to document the potential for human health risks from exposure to the following environmental media:

- The burn layer/ash and surrounding soil at the North Burning Ground/Potential Landfill Area,
- Surface water and sediment in Johnson Creek, Clear Creek, and Silver Creek, and
- Indoor air in selected buildings that overlie the TCE groundwater plumes. The risk assessment will only be conducted at locations in which sufficient data is not available for the BLRA.

This assessment will present the risks for the "no-action" alternative. The methodology used in the Supplemental BLRA will be based on USEPA guidance documents and will consist of the following steps detailed in the following sections:

- Section 4.2. Data evaluation of target analytes including the screening process to identify COPCs to be included in the risk assessment.
- Section 4.3. Exposure assessment, including identification of exposure pathways and potential intake estimates for each of the receptors and pathways.
- Section 4.4. Toxicity assessment including the potential for adverse health effects of COPCs in exposed individuals.
- Section 4.5. Risk characterization where human health COPCs are identified if risks exceed acceptable values for carcinogenic and non-carcinogenic risks.
- Section 4.6. Assessment of uncertainties associated with the BLRA.

4.2 DATA EVALUATION

The data evaluation will identify COPCs for each environmental medium being evaluated in the OU-3 Supplemental RI and will eliminate chemicals for which no further risk evaluation is needed. For the purpose of risk evaluation, it will be assumed that the burn layer/ash at the North Burning Ground/Potential Landfill is part of the soil. Surface soil will be defined as soil from 0 to 0.5 ft bgs and subsurface soil will be defined as soil 0.5 ft to 8 ft. The data evaluation to identify COPCs for each investigation area will consist of four steps: (1) a data quality assessment, (2) screening of essential human nutrients (applies to the burn layer), (3) risk-based screening, and (4) background screening (applies to the burn layer).

4.2.1 Data Quality Assessment

The data set will be organized so that only one result will be used for each sample location and depth sampled on a given date. Sample splits, duplicates, re-analysis, and dilutions will not be included in the determination of COPCs in the risk assessment. Samples rejected by the validation process will not be included in the risk assessment.

4.2.2 Essential Nutrients

Chemicals that are considered essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) are an integral part of the human food supply and are often added to foods as supplements. Recommended daily allowance (RDA) and recommended daily intake (RDI) values are available for these metals and will be used as a point of comparison.

Based on these RDA/RDI values, a receptor ingesting 100 mg of soil per day would receive less than the RDA/RDI of calcium, magnesium, phosphorous, potassium, and sodium, even if the soil consisted of the pure mineral (i.e., soil concentrations > 1,000,000 mg/kg). Receptors ingesting 100 mg of soil per day would require soil concentrations of 100,000 to 180,000 mg/kg of iron to meet their RDA/RDI for these metals. Concentrations of essential nutrients will be evaluated to determine if these levels are exceeded. If these levels are not exceeded in soil, these constituents will not be considered as COPCs in this BLRA.

4.2.3 Risk-Based Screen

The objective of this evaluation is to identify COPCs that may pose a potentially significant risk to human health. The risk-based screening values used in this process will be the Regional Screening Levels published by USEPA (2010). The maximum detected concentration (MDC) of each chemical in each environmental medium will be compared against the appropriate medium-specific and chemical-specific risk-based screening value. Chemicals detected below these concentrations will be eliminated from the COPC list for that environment. Detected chemicals without risk-based screening values will not be eliminated from the COPC list based on this screening step. Screening levels for soil and air quality are shown in Tables 4-1 and 4-2.

4.2.4 Background Screen of Metals

A background screen of surface and subsurface soils from the North Burning Ground/Potential Landfill will consist of comparing MDC of each COPC with the background levels. Metals where the MDC is less than two times the mean background concentration will be eliminated from the COPC list. Background soil statistics, based on data collected during the OU-3 RI (Woodward-Clyde 1997), are shown in Table 4-3.

4.2.5 Summary of Chemicals of Potential Concern Screening Approach

The data set used to determine the COPCs will be determined for surface soil, subsurface soil, surface water, sediment, and air separately. The following assumptions will be used in the development of COPCs for the BLRA:

- Chemicals not detected in the medium will be eliminated from the COPC list (with the exception of constituents having reporting limits greater than twice the screening criteria).
- Essential nutrients detected at levels below their RDA/RDI (for soils) will be eliminated from the COPC list.
- Chemicals detected at levels below their respective risk-based screening levels will be eliminated from the COPC list (with the exception of constituents that were not detected, but had reporting limits greater than twice the risk-based screening levels).
- Results of previous background screening for soils will be used to eliminate COPCs that are not found in concentrations greater than twice the mean background level.

The COPC screening process and results will be summarized in separate tables for each medium. These tables will include:

- Summary statistics, including frequency of detection, range of detected concentrations, arithmetic mean concentration, and 95% upper confidence limit (UCL_{95}) on the mean concentration the latest version of ProUCL (current version 4.00.04, http://www.epa.gov/esd/tsc/software.htm) will be used to generate UCL95 and background threshold values;
- All screening values; and
- Final COPC status.

When determining summary statistics for chemicals that have non-detected concentrations, a surrogate concentration of one-half of the reported non-detected concentration will be used in the calculations. Chemicals with reporting limits that exceed their respective risk-screening value are special cases that will be evaluated as follows:

- Where the constituent is detected in at least one sample, the maximum detection is compared with screening levels to determine COPC status;
- Where the chemical is not detected it will be considered a COPC if any sample has a reporting limit over twice the screening level. It will not be considered a COPC if all samples have reporting limits that are below twice the screening level.

The result of this process is to include chemicals that were not detected, but had minimum reporting limits that were in excess of twice their respective screening levels, as COPCs (e.g. evaluating constituent at one-half the minimum reporting level versus risk-based criteria).

4.3 EXPOSURE ASSESSMENT

4.3.1 Current and Future Land Use

The majority of the former NOP site is currently owned by UNL-ARDC, which is expected to continue. Other portions of the site are owned by the Nebraska Army National Guard, the U.S. Air Force, the U.S. Army Reserves, and the U.S. Department of Commerce. A few private landowners, private pastures, crop fields, and private light industry are also located on-site. No changes in the current land usage are expected. Deed restrictions exist on the North Burning Grounds prohibiting any change in current land use (U.S. 2005b).

4.3.2 Potential Exposed Populations, Exposure Media, and Exposure Pathways

The current conceptual site exposure model (CSEM) shows potentially exposed populations, environmental media of concern, and exposure pathways and account for any existing deed restrictions (U.S. 2005a). Environmental media of concern are surface soil (0 to 0.5 ft bgs) and subsurface soil (0.5 to 8 ft bgs) at the North Burning Ground/Potential Landfill Area; surface water, sediment, and fish from Johnson Creek/Clear Creek and Silver Creek; and inhalation of VOCs via vapor intrusion in the buildings. Based on current land use at the North Burning Ground/Potential Landfill Area, surface soil exposure can occur through ingestion, inhalation, and dermal contact for construction workers, maintenance workers, adult trespassers, and juvenile trespassers. Subsurface soil exposure is limited to construction workers during excavation activities. The receptors for the North Burning Ground are based on site access limitations provided in the deed restriction for the property (U.S. 2005b). The receptors for the Potential Landfill Area were chosen to match the North Burning Ground based on current land use, even though there is no known deed restriction on the land. A surface and subsurface soil CSEM is shown in Figure 4-1. Surface water exposure consists of dermal contact with the surface waters and sediment as well as an ingestion of the surface water, sediment, and food intake from eating contaminated fish for recreational adult and child fishing scenarios. A CSEM for Johnson Creek, Clear Creek, and Silver Creek

is shown in Figure 4-2. Receptors to be considered for each of the buildings of interest for the vapor intrusion assessment are as follows:

- Unit 001 – Building 103 – Diary Farm Manager Residence: Adult and Child Resident
- Unit 003 – Feed Mill (LL1 plume): Industrial Worker
- Unit 006 – Building 101 – UNL-ARDC Storage Building : Industrial Worker/Limited Daily Use
- Unit 011 – Building 401 –AFE Fire Shop: Industrial Worker

Note that for Unit 006 (UNL Storage Building), exposure parameters will be set to account for the limited occupancy of the building based on its use as a storage building rather than a workspace.

4.3.3 Exposure Point Concentrations

The Reasonable Maximum Exposure (RME) estimates the highest exposure reasonably expected to occur at each investigation area. Due to the inherent uncertainty with estimates of exposure concentration, the upper confidence limit (UCL) on the mean will be used for evaluating the RME. The USEPA recommended statistical program ProUCL 4.0 (http://www.epa.gov/esd/tsc/software.htm) will be used to generate confidence limits on the mean. The exposure point concentration for each COPC in each medium will be the smaller value between the ProUCL recommended UCL and the MDC. The latest version of ProUCL (current version 4.00.04, http://www.epa.gov/esd/tsc/software.htm) will be used to generate UCL_{95} and background threshold values.

Note that the exposure point concentration for indoor air in the buildings will be set to the measured concentration of COPCs in the indoor air sample.

4.3.4 Exposure Parameters and Exposure Calculation Results

Standard intake equations from USEPA guidance (USEPA 1989, USEPA 2004) for ingestion, dermal contact, and inhalation of chemicals (shown below) will be used along with the exposure parameters (i.e. ingestion rate, dermal absorption factors) shown in Tables 4-4 and 4-5.

4.3.4.1 Ingestion of Surface Water

Intakes for ingestion for surface water COPCs will be estimated using equation (1):

$$Chemical_Intake\left(\frac{mg}{kg-day}\right)=\frac{C_w \times IR_w \times EF \times ED \times ET}{BW \times AT} \quad (1)$$

Where:

C_w	=	chemical concentration in water (mg/L)
IR_w	=	ingestion rate of water (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
ET	=	exposure time (hours)
BW	=	body weight (kg)
AT	=	averaging (days) for carcinogens or non-carcinogens

4.3.4.2 Dermal contact with Surface Water

The dermal absorbed doses (DADs) from organic chemicals in surface water will be calculated using equation (2) as follows (USEPA 2004):

$$DAD\left(\frac{mg}{kg-day}\right)=\frac{DA_{event}\times EV\times EF\times ED\times SA}{BW\times AT} \tag{2}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
EV	=	event frequency (1 event/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
SA	=	surface area of skin exposed (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days) for carcinogens or non-carcinogens

For organics, DA_{event} is calculated as follows:

(1) If $t_{event} \leq t^*$ then:

$$DA_{event}\left(\frac{mg}{cm^2-event}\right)=2\times FA\times K_p\times C_w\times CF\times\left(6\tau_{event}\times\frac{t_{event}}{\pi}\right)^{1/2} \tag{3}$$

(2) If $t_{event} > t^*$ then:

$$DA_{event}\left(\frac{mg}{cm^2-event}\right)=FA\times K_p\times C_w\times CF\times\left[\frac{t_{event}}{(1+B)}+2\tau_{event}\left(\frac{1+3B+3B^2}{\{1+B\}^2}\right)\right] \tag{4}$$

Where:

DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
FA	=	fraction absorbed in water (chemical-specific, dimensionless)
K_p	=	permeability constant in water (chemical-specific, cm/hr)
C_w	=	concentration of chemical in water (mg/L)
CF	=	conversion factor (10^{-3} L/cm^3)
τ_{event}	=	lag time per event (chemical-specific, hr/event)
t_{event}	=	duration of event (hr/event; same value as exposure time)
B	=	chemical-specific constant reflecting the partitioning properties (dimensionless)
t*	=	chemical-specific time to reach steady-state (hour)

Values and equations for FA, K_p, t*, and B are from USEPA (2004). If a K_p value is not available for an organic COPC, it is calculated using the following empirical predictive equation (USEPA 2004):

$$\log(K_p)=-2.80+0.66\log(K_{ow})-0.0056W_M \tag{5}$$

Where:

K_{ow}	=	octanol/water coefficient (chemical-specific)
M_W	=	molecular weight (g/mole)

For inorganics, DA_{event} was calculated as follows:

$$DA_{event}\left(\frac{mg}{kg-event}\right) = K_p \times C_w \times CF \times t_{event} \tag{6}$$

Where K_p, C_w, CF, and t_{event} are defined as shown above. Note that chemical-specific values for K_p are available from Risk Assessment Guidance for Superfund (RAGS) Part E (USEPA 2004) for selected inorganics. If no K_p value was provided, then a default value of 0.001 centimeters (cm) per hour is used for this class of chemicals (USEPA 2004).

4.3.4.3 Ingestion of Soil and Sediment

Intakes for incidental ingestion of soil will be estimated by using equation (7):

$$Chemical_Intake\left(\frac{mg}{kg-day}\right) = \frac{C_S \times IR_S \times EF \times ED \times FI}{BW \times AT} \tag{7}$$

Where:

C_s	=	chemical concentration in soil (mg/kg)
IR_s	=	ingestion rate (kg/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
FI	=	fraction ingested (assumed value of 1, unitless)
BW	=	body weight (kg)
AT	=	averaging time (days) for carcinogens or non-carcinogens

4.3.4.4 Dermal Contact with Soil and Sediment

The DAD from chemicals in soil will be calculated using equation (8) from USEPA 2004.

$$Chemical_DAD\left(\frac{mg}{kg-day}\right) = \frac{DA_{event} \times EV \times EF \times ED \times SA}{BW \times AT} \tag{8}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	absorbed dose per event in soil (mg/cm^2-event)
EV	=	event frequency (1 event/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
SA	=	surface area of skin exposed (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (days) for carcinogens or non-carcinogens

DA_{event} (mg/cm^2-event) is calculated as follows for soil COPCs:

$$DA_{event}\left(\frac{mg}{cm^2-event}\right) = C_s \times CF \times AF \times ABS \tag{9}$$

Where:

C_s	=	chemical concentration in soil (mg/kg)
CF	=	conversion factor (10^{-6} kg/mg)
AF	=	soil-to-skin adherence factor (mg/cm^2-event)
ABS	=	chemical-specific dermal absorption factor (unitless; USEPA 2004)

Note that only certain chemicals have a value for the dermal absorption factor (USEPA 2004). Therefore, the dermal contact with soil pathway is quantified only for these specific COPCs with a value for the dermal absorption factor.

4.3.4.5 Inhalation of Soil Intake

Intakes for inhalation of soil will be calculated using equation (10) USEPA 2009b):

$$EC\left(\frac{mg}{m^3}\right) = \left(\frac{C_a \times EF \times ED \times ET}{AT}\right) \tag{10}$$

Where:

EC	=	exposure concentration (mg/m^3)
C_a	=	chemical concentration in soil (mg/kg)
ET	=	exposure time (hrs/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AT	=	averaging time (days) for carcinogens or non-carcinogens

Ca is estimated using equation (11) USEPA 2002.:

$$C_a\left(\frac{mg}{m^3}\right) = C_s\left(\frac{1}{PEF}\right) \tag{11}$$

Where:

C_s	=	chemical concentration in soil (mg,kg)
PEF	=	particulate emission factor (m3/kg)

The particulate emission factor value used for all receptors (1.36×10^9 m^3/kg) is the default value in USEPA (2002).

4.3.4.6 Intake through Ingestion of Fish

Intakes for ingestion of COPCs for consumption of fish will be estimated using equation (12):

$$Chemical_Daily_Intake\left(\frac{mg}{kg-day}\right) = \frac{C_w \times MF \times IR_{fish} \times FI \times EF \times ED}{BW \times AT} \tag{12}$$

Where:

C_w	=	Concentration of chemical in surface water (µg/L)
EF	=	Exposure Frequency (days/year)
ED	=	exposure duration, different values for adult and child (years)
BW	=	body weight, different values for adult and child (years)
AT	=	averaging time (days)

MF	=	modeling factor to convert surface water to fish tissue concentration, (L/kg)
IR_{fish}	=	ingestion rate for fish, (kg/day)
FI	=	fraction of daily fish ingested from fish caught in Johnson Creek and Clear Creek (unitless).

4.3.4.7 Inhalation of Volatiles in Air

Intakes for inhalation of volatile compounds in air will be calculated using equation (13):

$$EC\left(\frac{mg}{m^3}\right) = \frac{C_a \times EF \times ED \times ET}{AT} \tag{13}$$

Where:

EC	=	exposure concentration (mg/m^3)
C_s	=	chemical concentration in air (mg/m^3)
ET	=	exposure time (hrs/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AT	=	averaging time (hours) for carcinogens or non-carcinogens

4.4 TOXICITY ASSESSMENT

The toxicity assessment will evaluate the potential for COPCs to cause adverse health effects in exposed individuals. If possible, it will estimate the relationship between intake or dose of a COPC and the likelihood or severity of adverse health effects as a result of exposure. Toxic effects have been evaluated extensively by USEPA, as presented in USEPA's *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA 2003), which provides for selection of toxicity values from the following three-tiered hierarchy:

1. Tier 1 – USEPA's Integrated Risk Information System (USEPA 2009a);

2. Tier 2 – USEPA Provisional Peer Reviewed Toxicity Values;

3. Tier 3 – Other toxicity values from additional USEPA and non-USEPA sources, including California Environmental Protection Agency, Agency for Toxic Substances and Disease Registry minimum risk levels, and USEPA's Health Effects Assessment Summary Tables (USEPA 1997b).

4.5 RISK CHARACTERIZATION

The purpose of the risk characterization is to integrate the information obtained through the exposure and toxicity assessments to estimate potential risks and hazards. Potential carcinogenic effects are characterized by using projected intakes and chemical-specific, dose-response data [i.e., cancer slope factors (CSFs)] to estimate the probability that an individual will develop cancer over a lifetime. Potential non-carcinogenic effects will be characterized by comparing projected intakes of contaminants to toxicity values [i.e., reference dose (RfDs)]. The numerical risk and hazard estimates presented in the BLRA must be interpreted in the context of the uncertainties and assumptions associated with the risk assessment process and with the data upon which the risk estimates are based.

4.5.1 Risk Characterization for Carcinogens

For carcinogens, risk is expressed as the probability that an individual will develop cancer over a lifetime as a result of exposure to the carcinogen. Cancer risk from exposure to contamination is expressed as the ILCR, or the increased chance of cancer above the normal background rate of cancer. In the U.S., the background chance of contracting cancer will be a little more than three in 10, or 3×10^{-1}. The calculated ILCRs will be compared to the target goal of 1×10^{-6}, the lowest of the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 1×10^{-4} to 1×10^{-6}, or 1-in-10,000 to 1-in-1,000,000 exposed persons developing an excess cancer.

The ILCR for each medium/carcinogenic COPC will be calculated using one of the equations below (USEPA 1989, USEPA 2009b):

$$ILCR = I \times CSF \tag{14}$$

$$ILCR = IUR \times EC \tag{15}$$

Where:

I	=	chronic daily intake or DAD calculated in the exposure assessment (mg/kg-d)
EC	=	Exposure concentration (mg/m^3)
IUR	=	Inhalalation unit risk $(mg/m^3)^{-1}$
CSF	=	cancer slope factor $(mg/kg\text{-}d)^{-1}$

For a given exposure pathway from each investigation area, the total risk to a receptor exposed to several carcinogenic COPCs is the sum of the ILCRs for each carcinogen, as shown in equation 16 below:

$$ILCR_{total} = \Sigma ILCR_i \tag{16}$$

Where:

$ILCR_{total}$	=	total probability of cancer incidence associated with all carcinogenic COPCs
$ILCR_i$	=	ILCR for the ith COPC

In addition to summing risks across all carcinogenic COPCs, risks will be summed across all exposure pathways for a given environmental medium (e.g., ingestion, inhalation, and dermal contact with surface soil). Per USEPA (1989) guidance, there will be two steps required to determine whether risks or HIs for two or more pathways should be combined for a single exposed individual or group of individuals. The first will be to identify reasonable exposure pathway combinations. The second will be to examine whether it will be likely that the same individuals would consistently face the RME by more than one pathway. It is reasonable to assume that the same individual may be exposed to a given exposure medium at the RME level by multiple pathways.

4.5.2 Risk Characterization for Non-Carcinogens

In addition to developing cancer from exposure to contaminants, an individual may experience other toxic effects. The term “toxic effects” is used here to describe a wide variety of systemic effects ranging from minor irritations, such as eye irritation and headaches, to more substantial effects, such as kidney or liver disease and neurological damage. The risks associated with toxic (i.e., non-carcinogenic) chemicals will be evaluated by comparing an estimated exposure (i.e., intake or dose) from site media to an acceptable exposure expressed as a RfD. The RfD is the threshold level below which no toxic effects is

expected to occur in a population, including sensitive subpopulations. The ratio of intake over the RfD is the hazard quotient (HQ) (USEPA 1989) and will be calculated as:

$$HQ = \frac{I}{RfD} \tag{17}$$

Where

I	=	daily intake or DAD of a COPC (mg/kg-d)
RfD	=	reference dose (mg/kg-d)

The HQs for each COPC/investigation area will be summed to obtain a HI for an investigation area, as shown below:

$$HI = \Sigma HQ_i \tag{18}$$

Where

HI	=	hazard index for all toxic effects
HQ_i	=	hazard quotient for the ith COPC

An HI greater than one has been defined as the level of concern for potential adverse non-carcinogenic health effects (USEPA 1989). This approach differs from the probabilistic approach used to evaluate carcinogens. An HQ of 0.01 does not imply a 1-in-100 chance of an adverse effect but indicates only that the estimated intake will be 100 times less than the threshold level at which adverse health effects may occur. In addition to summing hazards across all COPCs, hazards will be summed across all exposure pathways for a given environmental medium.

Note that HIs are determined by assuming dose additivity for those constituents acting by the same mechanism and inducing the same effects (USEPA 1989). Initially, all of the COPCs are assumed to have the same mechanism of toxicity. If the HI (across all COPCs) is below 1, then all target organ-specific HIs will also be below 1. If the HI exceeds 1, then HIs are calculated for each target organ. This approach provides a more accurate estimation of the potential systemic toxicity associated with exposure to the constituent mixture.

4.5.3 Identification of Contaminants of Concern

Carcinogenic COCs are defined for each media as those contaminants that have a total ILCR greater than 1×10^{-6} for a receptor in this BLRA. Non-carcinogenic COCs are defined for each media as those contaminants that produce an HI greater than 1 for a receptor in this BLRA.

4.5.4 Results

Risks and HQs for each investigation area at former NOP will be quantified for:

- Surface soil (0 to 0.5 ft bgs) for construction workers and adult or juvenile trespassers.
- Sub-surface soil (0.5 to 8 ft bgs) for construction workers.
- Surface water and sediment COPCs for an adult and child in a recreational fishing scenario.
- Inhalation from vapor intrusion for the resident adult and child.
- Occupational inhalation exposure for the adult worker.

Detailed risk and hazard results for each receptor from each investigation area will be presented in the BLRA, and COCs will be identified on the tables that present the risk and hazard results. The results for each medium/receptor will be discussed, including a statement discussing if the total risks are above or below the target goal of 1×10^{-6}, and below the target organ-specific hazard of 1.0. A discussion of the significance of all identified COCs will be included. A summary table displaying total risks and hazards across all COPCs for each receptor/medium/investigation area combination will also be shown in the BLRA.

4.6 UNCERTAINTY ANALYSIS

Uncertainties associated with each step of the risk assessment process will be discussed in the BLRA, where possible. Uncertainties include those associated with the data evaluation process, exposure assessment, toxicity assessment, and risk characterization. The uncertainty analysis will focus on site-specific factors that influence uncertainty such as land-use and data quality issues.

4.7 BASELINE RISK ASSESSMENT SUMMARY AND CONCLUSIONS

A summary and conclusions section will be included in the BLRA section to summarize which media and receptors were evaluated at the investigation areas in the former NOP, and list the major steps that were taken to generate conclusions regarding human health risks and hazards associated with contaminated media at former NOP.

A brief summary of the risks and hazards will be presented, noting which chemicals will be determined to be COCs for each investigation area.

5. GENERAL REQUIREMENTS

General requirements follow the Site-Wide WP (Section 4, ECC 2009a).

5.1 INFORMATION SECURITY

Without written consent of the CENWK PM, GEO will not release any data, reports, or materials collected, or developed, while completing this project (GEO 2010b).

5.2 ENVIRONMENTAL

GEO will identify applicable federal, state, and local laws and regulations, as well as applicable site-specific orders, agreements, or rules; and perform in accordance with said authorities. GEO will ensure that all activities performed by its personnel, subcontractors, and suppliers are executed in accordance with said authorities. Any incident of noncompliance noted by GEO will immediately be brought to the attention of the CENWK PM. GEO will obtain all permits, licenses, approvals, and/or certificates required or necessary to accomplish the work (GEO 2010b). GEO will handle all transportation and management of IDW, contaminated soil or water, and other wastes in accordance with Section 7.0 of the FSP in the Site-Wide SAP (ECC 2009d).

5.3 PROJECT INFORMATION REPOSITORY

All data generated for this project will be stored in the Project Database. Existing laboratory data will be reviewed using the Automated Data Review module tool associated with the database. Key contractor personnel will be trained and authorized for use and access of the database.

The project information repository is currently maintained at:

Mead Public Library
316 South Vine Street
Mead, Nebraska 68041

GEO will submit copies (one hard copy and one electronic copy on compact disc) of all final documents to the site's operation and management contractor, ECC at attention: Tim Thares, 905 County Road 6, Ashland, Nebraska 68003, for inclusion into the project information repository. An index of documents stored both electronically and in hardcopy will be maintained by ECC (GEO 2010b).

5.4 LINES OF COMMUNICATION

It is understood that GEO's primary contact for all communication is the CENWK PM. All requests, transmittals, issues, suggestions, and problems will be addressed to CENWK for resolution. The formal communications and transmittal of data/reports shall be sent to the following address:

SHIP TO:

Project Manager Environmental Branch
U.S. Army Corps of Engineers, Kansas City District
601 E. 12th Street
Kansas City, MO 64106

POINTS OF CONTACT:

Matthew Dolly
Contracting Officer Representative/CENWK
816-389-3919
Matthew.O.Dolly@usace.army.mil

Kristine Stein
Project Manager/CENWK
816-389-3172
Kristine.M.Stein@usace.army.mil

Communication between GEO and NDEQ or USEPA will only occur with CENWK involvement or knowledge. Any necessary meeting requests, phone calls, presentations, or other communication between GEO and the regulators will be coordinated with CENWK. GEO will provide the necessary support to initiate, schedule, and address all regulatory aspects of the project. CENWK will be the signature authority for all regulatory agreements and transmittals. All communications by phone with regulators will be documented, kept on file, and submitted with monthly updates.

It is understood that there may be instances when information can be secured quicker by USACE speaking directly to GEO's subcontractors, which is acceptable, provided that GEO's PM is copied on all correspondence (GEO 2010b).

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TABLES

Table 2-1a. OU-3 investigation areas and summary of OU-3 Remedial Investigations

Identification No. in Figure 2-2	Investigation Area	Phase I/II (1995/1996)		Phase III (1999)		Screening Results	Status of Areas Based on Previous Work
		Geophysical survey (EM-31 Terrain Conductivity Meter)	Soil sampling from boreholes (Depth; Analyte Groups)	Geophysical survey	Test Pits; Soil sampling		
7	Ammonium Nitrate Plant (former) - Potential Waste Area	Anomalies detected; soil samples collected adjacent to anomalies	0 to 20 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
2	Atlas Missile Area (former) - Potential Waste Area	No anomalies	0 to 20 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	Manganese exceeded screening level (i.e., background) but only in one location (i.e., isolated occurrence); other metals explosives, VOCs, and SVOCs were below screening levels.	Identified as No Further Action required (W-C 1997)
3	Bermed Area southwest of LL 1	NS	0 to 3 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
10	Former Potential Waste Area SE of the Bomb Booster Area	Anomalies detected; soil samples collected adjacent to anomalies	0 to 20 ft; Metals, Explosives, VOCs, SVOCs, and PCBs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
5	Demolition Ground (former)	Anomalies detected	0 to 20 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
6	Detonation Craters (former)	No anomalies	0 to 3 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	Manganese exceeded background but only in one location (i.e., isolated occurrence); other metals explosives, VOCs, and SVOCs were below screening levels.	Identified as No Further Action required (W-C 1997)
8	NOP Landfill Area (former)	NS	NS	NS	NS	NS	Identified as No Further Action required (W-C 1997)
9	Raw Product Igloo Storage Areas (former)	NS	0 to 1 ft; Metals, High explosives (screening), Explosives	NS	NS	No explosives above screening levels; no metals exceeded risk-based criteria	Identified as No Further Action required (W-C 1997)
10	Tetryl Pelleting Area (former)	NS	0 to 2 ft; Metals, Explosives	NS	NS	No explosives above screening levels; barium, copper and zinc background but at isolated occurrences of limited horizontal and vertical extent.	Identified as No Further Action required (W-C 1997)
14	Geophysical Anomaly at LL3	Anomalies detected; soil samples collected adjacent to anomalies	0 to 20 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
12	LL1, Bomb Production Buildings (former)	NS	0 to 2 ft; Metals, Explosives	NS	NS	Metals and explosives above screening levels	Included in BLRA (URS 2000b)
13	LL2, Bomb Production Buildings (former)	NS	0 to 2 ft; Metals, Explosives	NS	NS	Metals and explosives above screening levels	Included in BLRA (URS 2000b)
14	LL3, Bomb Production Buildings (former)	NS	0 to 2 ft; Metals, Explosives	NS	NS	Metals and explosives above screening levels	Included in BLRA (URS 2000b)
15	LL4, Bomb Production Buildings (former)	NS	0 to 2 ft; Metals, Explosives	NS	NS	Metals and explosives above screening levels	Included in BLRA (URS 2000b)

Source: Woodward-Clyde 1997; URS 2000a
[a] Nature and extent of explosives not included because this was addressed in the OU-1 RI (Woodward-Clyde 1997)
EM—electromagnetics
ft—feet or foot
NS—Not Sampled
PCB—polychlorinated biphenyl
SE – southeast
SVOC – semi-volatile organic compound
VOC – volatile organic compound

Table 2-1a. OU-3 investigation areas and summary of OU-3 Remedial Investigations (Continued)

Identification No. in Figure 2-2	Investigation Area	Phase I/II (1995/1996)		Phase III (1999)		Screening Results	Status of Areas Based on Previous Work
		Geophysical survey (EM-31 Terrain Conductivity Meter)	Soil sampling from boreholes (Depth; Analyte Groups)	Geophysical survey	Test Pits; Soil sampling		
12	LL1, Paint Operation Areas (former)	NS	0 to 2 ft; Metals	NS	NS	Metals above screening levels	Included in BLRA (URS 2000b)
13	LL2, Paint Operation Areas (former)	NS	0 to 2 ft; Metals	NS	NS	Metals above screening levels	Included in BLRA (URS 2000b)
14	LL3, Paint Operation Areas (former)	NS	0 to 2 ft; Metals	NS	NS	Metals above screening levels	Included in BLRA (URS 2000b)
15	LL4, Paint Operation Areas (former)	NS	0 to 2 ft; Metals	NS	NS	Metals above screening levels	Included in BLRA (URS 2000b)
16	Potential Waste Disposal Area north of the former Nike Maintenance Area	Anomalies detected; soil samples collected adjacent to anomalies	0 to 2 ft; Metals, Explosives, VOCs, SVOCs	NS	NS	No VOCs, SVOCs, explosives or metals exceeded screening levels	Identified as No Further Action required (W-C 1997)
18	Northeast Boundary Area	NS	NS	No Anomalies	Three test pits (4 ft deep); topsoil overlying loess or alluvium observed in test pits. Soils samples collected for explosives, metals, SVOCs, VOCs, high explosives screening.	Metals exceeded screening levels; included in BLRA (URS 2000b)	Included in BLRA (URS 2000b)
17	North Burning Ground (former)	NS	0 to 20 ft; Metals; VOCs; SVOCS [a]	NS	Two test pits (6 ft deep) at assumed location of revetments: Fill overlying loess with trace metals observed in test pits. Soil samples collected for High explosives field screening.	Metals exceeded screening levels (background) but in isolated locations (URS 2000a); no explosives above screening levels.	Identified as No Further Action required (W-C 1997); however, "Burn layer" found during UNL Removal Action (2009).
21	Proving Grounds (former)	NS	0 to 10 ft, Metals, VOCs, SVOCs [a]	Anomalies identified; test pits locations selected to investigate anomalies	Thirty-three test pits (3 to 10 ft deep); various buried debris including wood, burnt wood, plastic sheeting. Ash was noted but only in 3 test pits. Soil samples collected for explosives.	Metals above screening in isolated locations; explosives exceeded screening levels.	Included in BLRA (URS 2000b)
20	Potential Landfill Area	Anomalies detected	0 to 10 ft; Explosives; Metals; SVOCs; VOCs	Anomalies identified; test pits locations selected to investigate anomalies	Thirty-nine test pits; various buried debris including nails, wire, wood, burnt wood and ash. Soil samples collected for explosives.	Metals and explosives exceeded screening levels.	Included in BLRA (URS 2000b)
23	South Burning Ground (former)	NS	0 to 3 ft; Metals; VOCs; SVOCs [a]	NS	NS	No VOCs exceeded screening levels; no metals exceeded background; SVOCs 2,4-DNT and 2,6-DNT exceeded screening criteria at one location; the location was excavated and remediated as part of OU-1 Removal Actions.	Identified as No Further Action required after SVOC exceedence was addressed during OU-1 Removal Action (OHM 1998)

Source: Woodward-Clyde 1997; URS 2000a
[a] Nature and extent of explosives not included because this was addressed in the OU-1 RI (Woodward-Clyde 1997)
DNT—dinitotoluene
EM—electromagnetics
ft—feet or foot
NS—Not Sampled
SVOC—semi-volatile organic compound
VOC—volatile organic compound

Table 2-1a. OU-3 investigation areas and summary of OU-3 Remedial Investigations (Continued)

Identification No. in Figure 2-2	Investigation Area	Phase I/II (1995/1996)		Phase III (1999)		Screening Results	Status of Areas Based on Previous Work
		Geophysical survey (EM-31 Terrain Conductivity Meter)	Soil sampling from boreholes (Depth; Analyte Groups)	Geophysical survey	Test Pits; Soil sampling		
1	Administration (former)- underground storage tank	Anomalies detected; soil samples collected adjacent to anomalies	0 to 30 ft; BTEX, SVOCs, and TRPH	NS	NS	BTEX not detected. SVOCs and TRPH detected at greater than screening levels in uppermost surface soil. Area was used by private businesses and source of SVOCs and TRPH may be from recent activities (W-C 1997).	Underground storage tanks are being addressed outside of OU-3.
24	Air Force Global Communication Center (former)- underground storage tanks	Anomalies detected; soil samples collected adjacent to anomalies	0 to 47 ft; BTEX, SVOCs, and TRPH	NS	NS	PAHs (polynuclear aromatic hydrocarbons) were detected above screening levels (W-C 1997). Polynuclear aromatic hydrocarbons commonly occur in surface soils from road run-off and vehicle emissions.	Underground storage tanks are being addressed outside of OU-3.
2	Atlas Missile Area (former) - underground storage tanks	Anomalies detected but may be due to interferences from surface features	0 to 39 ft; BTEX, SVOCs, and TRPH	NS	NS	Only TRPH detected at concentration greater than screening level and only at one surface location. Area was being used by the National Guard and TRPH maybe from recent activities (W-C 1997).	Underground storage tanks are being addressed outside of OU-3.
10	Bomb Booster Area (former) - Above Ground Storage tanks	NS	0 to 30 ft; BTEX, SVOCs, and TRPH	NS	NS	Only SVOCs detected at concentrations below screening.	Underground storage tanks are being addressed outside of OU-3.

Source: Woodward-Clyde 1997; URS 2000a

[a] Nature and extent of explosives not included because this was addressed in the OU-1 RI (Woodward-Clyde 1997)

BTEX – benzene, toluene, ethylbenzene, and xylenes

EM—electromagnetics

ft—feet or foot

NS—Not Sampled

PAHs—polynuclear aromatic hydrocarbons

SVOC—semi-volatile organic compound

TRPH—total recoverable petroleum hydrocarbon

VOC—volatile organic compound

Table 2-1b. Summary of previous OU-3 Remedial Investigations at Johnson Creek, Clear Creek, and Silver Creek and the NRD Reservoir

		Phase I/II (1995/1996)		Phase III (1999)		
Identification No. in Figure 2-2	**Surface Water**	**Surface water Sampling Dates of sampling Analyte Groups**	**Sediment Sampling**	**Surface Water Sampling Date of Sampling Analyte Groups**	**Sediment Sampling**	**Fish Sampling**
4,11	Johnson Creek and Clear Creek	March 1995; May 1996; July 1996 Explosives, metals, VOCs, and SVOCs	April 1995 Explosives, metals, VOCs, and SVOCs	April 1999 Metals	April 1999 Metals	NS
22	Silver Creek	March 1995; May 1996; July 1996 Explosives, metals, VOCs, and SVOCs	March 1995 Explosives, metals, VOCs, and SVOCs	April 1999 Metals	April 1999 Metals	NS
19	NRD Reservoir	NS	NS	April 1999 Explosives, metals, and total suspended solids	April 1999 Explosives and metals	Metals and lipid content [a]

Source: (Woodward-Clyde 1997, URS 2000a)\
NRD—Natural Resources District
NS—Not sampled

[a] Fish tissue samples were analyzed for explosives but data were considered unreliable due to difficulties in extraction.

Table 2-2a. Summary of environmental media and chemicals included in the OU-3 BLRA

Investigation Area (Figure 2-2, 2-3 ID No.)	Media [a]	Chemicals included in BLRA
LL1, Bomb Production Buildings (former) **(12)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Al, Sb, As, Ba, Be, Cd, Co, Pb, Ni, V
LL2, Bomb Production Buildings (former) **(13)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Sb, As, Ba, Cd, Ni
LL3, Bomb Production Buildings (former) **(14)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	TNB, TNT, 2-Am-DNT, 4-Am-DNT, RDX, HMX, Sb, Ba, Cd, Pb, Hg, Ni
LL4, Bomb Production Buildings (former) **(15)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	TNT, 2-Am-DNT, 4-Am-DNT, RDX, HMX, Sb, Ba, Cd, Pb, Hg, Ni
LL1, Paint Operation Areas (former) **(12)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	Sb, Cd, Pb, Ni
LL2, Paint Operation Areas (former) **(13)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	Sb, As, Cd, Co, Pb, Hg, Ni
LL3, Paint Operation Areas (former) **(14)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	Sb, Ba, Cd, Co, Pb, Hg, Ni
LL4, Paint Operation Areas (former) **(15)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft)	Sb, Cd, Pb
Northeast Boundary Area **(18)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft); Surface Soil + Subsurface Soil	Al, Cd, Co, V, 2,6-DNT, benzo(g,h,i)perylene, fluoranthene, pyrene
Proving Grounds (former) **(21)**	Surface Soil (0 to 2 ft) and Surface Soil (0 to 0.5 ft); Surface Soil + Subsurface Soil	TNT, 2-Am-DNT, 4-Am-DNT, 4-Nitrotoluene, RDX, Tetryl, HMX, Sb, Cd, Pb, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, Di-n-butylphthalate, pyrene, 2-hexanone, acetone, methylene chloride, toluene, TCE
Potential Landfill Area (former) **(20)**	Surface Soil (0 to 2 ft); Surface Soil (0 to 0.5 ft); Surface Soil + Subsurface Soil	TNB, TNT, DNT, 2-Am-DNT, 4-Am-DNT, RDX, Tetryl, HMX, Sb, Cd, Co, Pb, Si, Tl, Benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, chrysene, diethylphthalate, di-n-butylphthalate, phenol, pyrene
Johnson Creek **(11)** and Clear Creek **(4)**	Surface Water	RDX, HMX, Al, As, Ba, Be, Co, Fe, Pb, Hg, Ni, Tl, V, Toluene, TCE
	Sediment	4-Methylphenol, Di-n-butylphthalate, Phenol, bis(2-Ethylhexyl)phthalate (DEHP), HMX
	Fish	-same as surface water
Silver Creek **(22)**	Surface Water	Al, Ba, Be, Co, Fe, Pb, Ni, Tl, V, methylene chloride, toluene
	Sediment:	Ag, 4-Methylphenol, Di-n-butylphthalate, pyrene, acetone, toluene
	Fish	-same as surface water
NRD Reservoir **(19)**	Surface Water	2-Am-DNT, Hg
	Sediment	Nitrobenzene, Al, As, Ba, Be, Cd, Ni, Tl
	Fish	2-Am-DNT, Al, Ba, Cd, Cu, Pb, Ni, Se, Ag

Source : (URS 2000b)
[a] Separate risk assessments were conducted for surface soil including data from 0-0.5 ft bgs, and surface soil including data from 0-2 ft bgs. The risk assessment for surface soil + subsurface soil considered data from all depth intervals.

ft—feet or foot; TNB—1,3,5-Trinitrobenzene; TNT—2,4,6-Trinitrotoluene; 2-Am-DNT—2-Amino-4,6-dinitrotoluene; 4-Am-DNT—4-Amino-2,6-dinitrotoluene; RDX—hexahydro-1,3,5-trinitro-1,3,5 triazine ; DNT—2,4-dinitrotoluene; Tetryl—2,4,6-trinitrophenyl-*n*-methylnitramine ; HMX—Octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine; DEHP—bis(2-Ethylhexyl)phthalate; TCE—Trichloroethene; As—Arsenic; Ba—Barium; Be—Beryllium; Cd—Cadmium; Co—Cobalt; Hg—Mercury; Ni— Nickel; V—Vanadium; Sb—Antimony; Cd—Cadmium; Pb—Lead; Fe—Iron; Ag—Silver; Se—Selenium; Cu—Copper ; Tl—Thallium

Table 2-2b. Summary of ILCR for OU-3 investigation areas (excluding surface waters)

Investigation Area (Figure 2-2 2-3 ID No.)	Media [a]	Resident Farmer (Adult)	Resident Farmer (Child)	Adult Trespasser	Juvenile Tresspasser	On-site Worker	Construction Worker
LL1, Bomb Production Buildings (former) **(12)**	Soil (0 to 2 ft)	5.0E-05	2.4E-05	2.4E-06	3.0E-07	5.9E-06	Not a receptor for area
	Soil (0.5 ft)	1.7E-05	2.3E-06	4.9E-06	6.0E-09	1.7E-07	
LL2, Bomb Production Buildings (former) **(13)**	Soil (0 to 2 ft)	4.1E-05	1.7E-05	1.3E-06	1.7E-07	2.1E-06	Not a receptor for area
	Soil (0.5 ft)	4.7E-05	1.8E-05	1.7E-06	2.2E-07	4.3E-06	
LL3, Bomb Production Buildings (former) **(14)**	Soil (0 to 2 ft)	4.7E-05	1.8E-05	1.7E-06	2.2E-07	4.3E-06	Not a receptor for area
	Soil (0.5 ft)	2.2E-05	2.9E-06	5.1E-08	6.2E-09	1.7E-07	
LL4, Bomb Production Buildings (former)**(15)**	Soil (0 to 2 ft)	4.4E-05	1.9E-05	1.8E-06	2.3E-07	4.5E-06	Not a receptor for area
	Soil (0.5 ft)	4.4E-05	1.8E-05	1.7E-06	2.2E-07	4.3E-06	
LL1, Paint Operation Areas (former) **(12)**	Soil (0 to 2 ft)	No carcinogens	No carcinogens	No carcinogens	No carcinogens	No carcinogens	Not a receptor for area
	Soil (0.5 ft)						
LL2, Paint Operation Areas (former) **(13)**	Soil (0 to 2 ft)	2.9E-05	1.8E-05	2.0E-06	2.6E-07	4.9E-06	Not a receptor for area
	Soil (0.5 ft)	2.9E-05	1.8E-05	2.0E-06	2.6E-07	4.9E-06	
LL3, Paint Operation Areas (former) **(14)**	Soil (0 to 2 ft)	No carcinogens	No carcinogens	No carcinogens	No carcinogens	No carcinogens	Not a receptor for area
	Soil (0.5 ft)						
LL4, Paint Operation Areas (former) **(15)**	Soil (0 to 2 ft)	No carcinogens	No carcinogens	No carcinogens	No carcinogens	No carcinogens	Not a receptor for area
	Soil (0.5 ft)						
Northeast Boundary Area **(18)**	Soil (0 to 2 ft)	No carcinogens	No carcinogens	No carcinogens	No carcinogens	Not a receptor for this area	No carcinogens
	Soil (0.5 ft)						
	Soil (0 to 2 ft) + Soil (> 2 ft)						
Proving Grounds (former) **(21)**	Soil (0 to 2 ft)	3.4E-06	4.4E-07	7.2E-09	8.7E-10	Not a receptor for this area	
	Soil (0.5 ft)	1.4E-06	1.8E-07	3.7E-09	4.5E-10		
	Soil (0 to 2 ft) + Soil (> 2 ft)	Pathway incomplete	Pathway incomplete	Pathway incomplete	Pathway incomplete		1.0E-09
Potential Landfill Area (former) **(20**	Soil (0 to 2 ft)	2.8E-05	3.9E-06	1.2E-07	1.5E-08	Not a receptor for this area	
	Soil (0.5 ft)	4.6E-06	6.3E-07	4.7E-08	5.7E-09		
	Soil (0 to 2 ft) + Soil (> 2 ft)	Pathway incomplete	Pathway incomplete	Pathway incomplete	Pathway incomplete		2.6E-08

Source: (URS 2000b)

[a] Separate risk assessments were conducted for surface soil including data from 0-0.5 ft bgs, and surface soil including data from 0-2 ft bgs. The risk assessment for surface soil + subsurface soil considered data from all depth intervals.

ft—feet or foot

Table 2-2c. Summary of HIs for OU-3 investigation areas (excluding surface waters) and removal actions performed to address areas where HI >1

Investigation Area (Figure 2-2 2-3 ID No.)	Media [a]	Receptors: Resident (Adult)	Resident (Child)	Adult Trespasser	Juvenile Trespasser	On-site Worker	Construction Worker	Removal Actions
LL1, Bomb Production Buildings (former) **(12)**	Soil (0 to 2 ft)	0.130	0.500	0.006	0.010	0.052	Not a receptor for this area	
	Soil (0.5 ft)	0.130	0.500	0.006	0.010	0.052		None required
LL2, Bomb Production Buildings (former) **(13)**	Soil (0 to 2 ft)	0.130	0.650	0.004	0.008	0.025	Not a receptor for this area	
	Soil (0.5 ft)	0.190	0.880	0.009	0.015	0.070		None required
LL3, Bomb Production Buildings (former) **(14)**	Soil (0 to 2 ft)	0.190	0.880	0.009	0.015	0.010	Not a receptor for this area	
	Soil (0.5 ft)	0.100	0.290	0.003	0.004	0.048		None required
LL4, Bomb Production Buildings (former) **(15)**	Soil (0 to 2 ft)	0.130	0.580	0.005	0.009	0.036	Not a receptor for this area	
	Soil (0.5 ft)	0.130	0.580	0.005	0.009	0.036		None required
LL1, Paint Operation Areas (former) **(12)**	Soil (0 to 2 ft)	0.023	0.170	0.002	0.003	0.011	Not a receptor for this area	
	Soil (0.5 ft)	0.100	0.790	0.007	0.013	0.051		None required
LL2, Paint Operation Areas (former) **(13)**	Soil (0 to 2 ft)	0.140	0.840	0.008	0.014	0.055	Not a receptor for this area	Risk driven by Sb; Sb-impacted soil removed (Kingston 2008)
	Soil (0.5 ft)	0.270	2.000	0.018	0.033	0.130		
LL3, Paint Operation Areas (former) **(14)**	Soil (0 to 2 ft)	0.054	0.390	0.004	0.007	0.027	Not a receptor for this area	
	Soil (0.5 ft)	0.099	0.730	0.007	0.012	0.048		None required
LL4, Paint Operation Areas (former) **(15)**	Soil (0 to 2 ft)	0.087	0.650	0.006	0.010	0.040	Not a receptor for this area	Risk driven by Sb; Sb-impacted soil removed (Kingston 2008)
	Soil (0.5 ft)	0.560	4.200	0.039	0.070	0.270		
Northeast Boundary Area **(18)**	Soil (0 to 2 ft)	0.066	0.490	0.005	0.008	Not a receptor for this area		
	Soil (0.5 ft)	0.003	0.021	0.0002	0.0004			
	Soil (0 to 2 ft) + Soil (> 2 ft)	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete		0.160	None required
Proving Grounds (former) **(21)**	Soil (0 to 2 ft)	0.035	0.190	0.002	0.003	Not a receptor for this area		
	Soil (0.5 ft)	0.014	0.079	0.001	0.001			
	Soil (0 to 2 ft) + Soil (> 2 ft)	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete		0.009	None required
Potential Landfill Area (former) **(20)**	Soil (0 to 2 ft)	0.400	2.400	0.022	0.039	Not a receptor for this area		Risk driven by Sb; Sb-impacted soil removed (Kingston 2008). Ash noted in trench logs from Phase III RI (URS 2000a) but no metals data were collected.
	Soil (0.5 ft)	0.087	0.470	0.004	0.008			
	Soil (0 to 2 ft) + Soil (> 2 ft)	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete	Pathway Incomplete		0.460	

Source: URS 2000b
ft—feet or foot
Sb—Antimony
Hazard index greater than 1

[a] Separate risk assessments were conducted for surface soil including data from 0-0.5 ft bgs, and surface soil including data from 0-2 ft bgs. The risk assessment for surface soil + subsurface soil considered data from all depth intervals.

Table 2-2d. Summary of ILCR and HIs for site receptors from exposure to surface waters

Surface Water	Incremental Lifetime Cancer Risk Adult Recreational Fisherman	Incremental Lifetime Cancer Risk Child Recreational Fisherman	Remarks
Johnson Creek and Clear Creek	0.000070	0.000015	Need to be updated based on surface water data collected 2004 to 2009
Silver Creek	0.000018	0.000004	Need to be updated based on surface water data collected 2004 to 2009
NRD Reservoir	No Carcinogens	No Carcinogens	

Surface Water	Hazard Index Adult Recreational Fisherman	Hazard Index Child Recreational Fisherman	Remarks
Johnson Creek and Clear Creek	**2.00**	**4.00**	Ingestion of fish contributed the most to this hazard. The fish tissue concentrations were estimated from the surface water concentrations of Hg and Tl. The bioconcentration model is very conservative (URS 2000a). Hg and Tl were not detected in fish samples from NRD reservoir. Thus it is unlikely that these metals are truly present in the fish at Johnson Creek and Clear Creek at levels that pose unacceptable risks to fishermen.
Silver Creek	0.08	0.20	
NRD Reservoir	0.40	**1.20**	Selenium (Se) contributed the most to the hazard. The target organs for Se toxicity are skin, hair, nervous system; the only other chemical that affects the skin is silver. The Hazard Index for Se and Ag is 0.6, < target hazard of one.

NRD—Natural Resources District
Ag—Silver
Hg—Mercury
Se—Selenium
Tl—Thallium
1 – bolded numbers indicate a HI value greater than 1

Table 2-3. Summary of characteristics of buildings of interest for vapor intrusion

Plume	Unit#/Building Identification	Description	Current Use	Approx Age (Years)	Type of Construction	Nearby Wells or Direct-push groundwater samples[1]
LL1	001/103	Dairy Farm Manager Residence	Residential	40	Basement (concrete floor)	GP-108 (4020)
LL1	002/105	Swine Farm Manager Residence	Residential	20	Basement (concrete floor)	GP-08 (283), MW-89, MW-90
LL1	003/---	Feed Mill (970 County Road-10)	Industrial			Not available
LL1	004/104	Entomology Building (1033 County Road-H)	Industrial	40	Slab-on-grade	MW-21, MW-24
LL1	005/102	Dairy Science Building	Industrial	40	Slab-on-grade	MW-02
LL1	006/101	UNL storage/maintenance	Industrial	60+	Slab-on-grade	MW-23
Atlas	007/403	Agronomy Building (650 County Road-H)	Industrial	60	Slab-on-grade	GP-84 (620)
Atlas	008/406	Four Winds Winery	Industrial	10	Slab-on-grade suspected	MW-44, WSW-52
Atlas	009/405	1041 County Road-5	Residential	30+	Pier-and-beam suspected	WSW-53
Atlas	010/404	1061 County Road-5	Residential	30+	Basement (concrete floor)	WSW-54
Atlas	011/401	Feed Lot Office/AFE Fire Shop	Industrial	60+	Slab-on-grade	GP-21(16,000), MW-40, MW-78
Atlas	012/402	North end of LL4	Industrial	60+	Slab-on-grade	MW-09

[1] TCE concentrations measured in "GP" direct-push groundwater samples are shown in parenthesis in µg/L (Lockheed Martin 2007a). TCE concentrations in monitoring and water supply wells are shown in Table 2-4.
LL—Load Line

Table 2-4. Summary of VOC analysis from monitoring wells and water supply wells adjacent to vapor intrusion building of interest

Unit	MW	Location	Depth to groundwater* (ft)	TCE Average (µg/L)	TCE Max (µg/L)	TCE Count** (-)	cis-1,2-DCE Average (µg/L)	cis-1,2-DCE Max (µg/L)	cis-1,2-DCE Count** (-)	trans-1,2-DCE Average (µg/L)	trans-1,2-DCE Max (µg/L)	trans-1,2-DCE Count** (-)
Unit 002	MW-89A	SE of Building 105	57.5	0.9	1.2	4	-	-	0	-	-	0
	MW-89B	SE of Building 105	58.1	1.4	3.0	13	-	-	0	-	-	0
	MW-89D	SE of Building 105	59.2	1.4	2.1	2	-	-	0	-	-	0
	MW-90A	SE of Building 105	47.3	72.4	260	15	0.3	0.3	1			0
	MW-90B	SE of Building 105	47.4	169.3	510	17	0.6	0.7	2			0
	MW-90C	SE of Building 105	47.7	54.4	210	14	0.4	0.6	5	0.9	1.6	2
Unit 004	MW-21A	NE of Building 104	40.9	21.0	65.0	14	0.2	0.3	2	-	-	0
	MW-21B	NE of Building 104	40.9	66.0	83.0	23	1.6	6.7	5	10.0	10.0	1
	MW-21D	NE of Building 104	40.8	167.2	339.0	18	3.1	23.0	11	10.2	30.0	3
	MW-24A	SE of Building 104	43.6	386.6	1300.0	17	6.1	14.0	11	-	-	0
	MW-24B	SE of Building 104	43.3	90.9	212.0	13	0.4	0.6	4	-	-	0
Unit 005	MW-02A	W of Building 102	43.5	9.3	12.8	5	6.2	6.2	1	-	-	0
	MW-02B	W of Building 102	44.7	22.1	62.0	5	2.2	2.2	1	-	-	0
Unit 006	MW-23B	Building 101	34.7	2.4	5.8	4	-	-	0	-	-	0
Unit 008	MW-44A	SE of Building 406	9.9	418.8	707.0	18	2.5	3.8	11	-	-	0
	MW-44B	SE of Building 406	9.8	19.5	46.7	10			0	-	-	0
	MW-44D	SE of Building 406	10.6	23.2	32.6	10	0.2	0.2	1	-	-	0
	WSW-52B	Building 406	NA	0.7	1.2	2			0	-	-	0
	WSW-52C	Building 406	NA	360	360	1	1.8	1.8	1	-	-	0
	WSW-52C-B	Building 406	NA	526.5	2484	23	3.1	5.1	15	-	-	0

*—Average of 5 values, measured in March 2007, October 2007, March 2008, August 2008, and October 2008.

**—Number of detected measurements in portal database as of 4/1/10

NA— Not available

- — non-detect

Table 2-4. Summary of VOC analysis from MWs and WSWs adjacent to vapor intrusion building of interest (Continued)

Unit	MW	Location	Depth to groundwater* (ft)	TCE Average (µg/L)	TCE Max (µg/L)	TCE Count** (-)	cis-1,2-DCE Average (µg/L)	cis-1,2-DCE Max (µg/L)	cis-1,2-DCE Count** (-)	trans-1,2-DCE Average (µg/L)	trans-1,2-DCE Max (µg/L)	trans-1,2-DCE Count** (-)
Unit 009	WSW-53	Building 405	NA	1.4	5.3	8	-	-	0	-	-	0
	WSW-53B	Building 405	NA	7.0	18.0	15	0.5	0.7	4	-	-	0
Unit 010	WSW-54	Building 404	NA	2.0	2.0	1	4.0	4.0	1	-	-	0
	WSW-54A	Building 404	NA	27.1	31.5	3	1.7	1.9	3	-	-	0
	WSW-54B	Building 404	NA	20.0	35.6	18	1.3	3.1	16	-	-	0
Unit 011	MW-40A	Building 401	36.5	10.0	16.0	5	-	-	0	-	-	0
	MW-40B	Building 401	43.4	972.2	4900.0	13	0.9	1.0	3	-	-	0
	MW-78B	NE of Building 401	37.5	59.0	68.0	2	4.7	5.2	2	-	-	0
Unit 012	MW-09A	SE of Building 402	54.5	637.3	2000.0	7	2.8	5.9	3	-	-	0
	MW-09B	SE of Building 402	53.9	157.4	264.0	7	1.1	1.6	4	-	-	0
	MW-09D	SE of Building 402	54.9	726.1	1900.0	7	2.2	3.4	4	-	-	0

*—Average of 5 values, measured in March 2007, October 2007, March 2008, August 2008, and October 2008.

**—Number of detected measurements in portal database as of 4/1/10

- — non-detect

Table 2-5. Summary of TCE analysis in Lockheed Martin/USEPA vapor intrusion study

TCE Screening Levels (compare with Indoor Air Values or 0.1 x SubSlab Soil Gas):
Residential: 0.22 ppbv
Industrial: 1.14 ppb

Location	Bldg. No.	Building Type	Real Time Monitoring by TAGA	SUMMA® Canister Samples		
			Indoor Air Result ppbv	Indoor Air/ 1st floor Result ppbv	Indoor Air/Basement Result ppbv	Sub-Slab Soil Gas Result ppbv
Unit 001	103	Residential/ UNL Dairy Farm Manager	0.27 J	0.12	0.13	0.024
Unit 002	105	Residential/UNL Swine Farm manager	ND (<0.11)	ND (<0.07)	ND (<0.007)	ND (<0.01)
Unit 003		Industrial/UNL Feed Mill	NA	NA	NA	ND (<0.01)
Unit 004	104	Industrial/ UNL Entomology Building	ND (<0.052)	NA	NA	0.018
Unit 005	102	Industrial/UNL Dairy Science Building	ND (<0.052)	NA	NA	ND (<0.01)
Unit 006	101	Industrial/UNL Farm Equipment Storage	0.54	NA	NA	190
Unit 007	403	Industrial/UNL Agronomy Building	ND (<0.019)	NA	NA	0.072
Unit 008	406	Industrial/Private-Four Winds Winery	0.060 J	0.0083	NA	0.021
Unit 009	405	Residential/Private	NA	NA	0.015	NA
Unit 010	404	Residential/Private	ND (<0.019)	0.01	0.012	0.027
Unit 011	401	Industrial/AFE Fire Shop	NA	NA	NA	0.54
Unit 012	402	Industrial/ UNL Building	ND (<0.019)	NA	NA	ND (<0.01)

Source: Lockheed Martin/REAC 2007
DL—Detection Limit; RL—Reporting Limit

Table 3-1. Summary of surface and subsurface sampling locations at the North Burning Ground and Potential Landfill Area (Figure 3-1 for sample locations) proposed for the OU-3 Supplemental RI

Sampling Location / Identification Number	**Depth Intervals** (feet)	**Analytical Group**	**Number of Samples** (identify field duplicates)	**Rationale for Sampling Location**
01 through 09	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval. Field duplicates to be collected from all depth intervals at one of these boreholes.	These boreholes will be located in the vicinity of the trenches excavated during the OU-3 RI where ash was noted in the trench logs (URS 2000a).
10 through 11	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval.	These boreholes will be located near the western wall of the OU-3 removal action excavation where a burn layer was observed (Kingston 2008).
12	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval. Field duplicates to be collected from all depth intervals at this borehole.	This borehole will be located where the burn layer was observed during the UNL removal action (MACTEC 2009).
13 through 15	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval.	These boreholes will be located in the vicinity of the burn ramparts (Figure 2-3).
16 through 18	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval.	These boreholes will be located behind the burn ramparts (Figure 2-3). There is limited sampling coverage from previous investigation in this area.
19 through 20	0 to 0.5; 0.5 to 4; 4 to 8	Metals	One per location and depth interval.	These boreholes will be located in west of the burn ramparts (Figure 2-3). There is limited sampling coverage from previous investigation in this area.

The sampling SOP will follow GEO-TEC-015 found in Appendix C.
OU: Operable Unit, RI: Remedial Investigation, SOP: Standard Operating Procedure, UNL: University of Nebraska – Lincoln, WP: Work Plan

Table 3-2. Summary of surface and subsurface soil sample collection for laboratory analysis

Sampling Procedure	Analyte Group	Number of field samples	Field duplicate	MS/MSD pairs
Direct Push Polyethylene scoop	metals	60 (20 boreholes, 3 depth intervals)	6	3

MS: Matrix Spike
MSD: Matrix Spike Duplicate

Table 3-3. Summary of vapor intrusion sampling proposed for the OU-3 Supplemental RI

Sampling Location / Identification Number	**Location within Building**	**Analytical Group**	**Number of Samples** (identify field duplicates)	**Rationale for Sampling Location**
Unit 001 Residential/ UNL Dairy Farm Manager	Indoor air and sub-slab soil gas	VOCs: *TCE, Cis-1,2-DCE, Trans-1,2-DCE, Vinyl chloride*	Two indoor air and one sub-slab location. Field duplicates to be collected from all locations within this building.	TCE during real-time monitoring (0.27 ppbv) was above the Regional Screening level for Residential Air (0.22 pbbv; USEPA 2009). However, TCE in sub-slab soil gas (0.024 ppbv) and indoor air samples (0.12 ppbv) was below the Residential Air Screening level. Although the sub-slab and indoor air samples are considered more definitive than real-time air monitoring, additional collection of data is recommended to reduce uncertainty in the assessment.
Unit 003 Industrial/UNL Feed Mill	Indoor air and sub-slab soil gas	VOCs : *TCE, Cis-1,2-DCE, Trans-1,2-DCE, Vinyl chloride*	Two indoor air and one sub-slab location.	The only available data for this building is a sub-slab soil gas sample, where TCE was not detected. Because there is no indoor air sample (screen or definitive) for this location, additional collection of data is recommended.
Unit 006 Industrial/UNL Storage	Indoor air and sub-slab soil gas	VOCs *TCE Cis-1,2-DCE Trans-1,2-DCE Vinyl chloride*	Two indoor air and one sub-slab location.	TCE concentration during real-time air monitoring was below the Industrial Regional Screening Level (1.14 ppbv; USEPA 2009) but above the Residential Regional Screening Level (0.22 ppbv; USEPA 2009). The maximum TCE concentration in the sub-slab soil gas was 190 ppbv; the indoor air concentration estimated from this value is 19 ppbv and exceeds the Industrial Regional Screening Level. Definitive indoor air samples have not been collected from this building; it is recommended that these samples be collected and data be used in a risk assessment that accounts for use of the building as storage (i.e., reduced hours of exposure when compared to the default assumption for industrial workers).
Unit 011 Industrial/Feed Lot Office	Indoor air and sub-slab soil gas	VOCs: *TCE, Cis-1,2-DCE, Trans-1,2-DCE, Vinyl chloride,*	Two indoor air and one sub-slab location.	Only a sub-slab soil gas sample was collected from this building. TCE was detected at 0.54 ppbv in this sample; the estimated indoor air concentration from this value is 0.054 ppbv using the recommended attenuation factor from USEPA (2002b). The estimated indoor air concentration is below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). However, risk assessments based on indoor air data are more reliable (DoD 2009). It is recommended that indoor air samples coupled with sub-slab soil gas be collected from this building.
Background locations	Not applicable	VOCs: *TCE, Cis-1,2-DCE, Trans-1,2-DCE, Vinyl chloride*	Two outdoor locations	Background air sampling is recommended for vapor intrusion assessments.

Table 3-4. Rationale for not sampling selected buildings of previous interest

Building Location	Rationale for not including this building in the OU-3 Supplemental RI
Unit 002, Residence/ UNL Swine Farm manager	• TCE was not detected in sub-slab soil gas and indoor air samples during real-time air monitoring of indoor air within the building. The detection/reporting limits for all analyses were below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).
Unit 004, Industrial/ Entomology Building	• TCE was not detected during real-time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (USEPA 2009). • TCE in the sub-slab soil gas sample was at 0.018 ppbv, less than 10% of the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). • Comparison of the sub-slab soil gas TCE against the Residential Air Screening Level is very conservative for the following reasons: (1) the estimated indoor air concentration is approximately 0.10 of the sub-slab soil gas level (USEPA 2002a), and (2) the building's use as University of Nebraska—Lincoln's Entomology Building is comparable to an industrial, rather than a residential scenario.
Unit 005, Industrial/ UNL Dairy Science Building	• TCE was not detected during real-time air monitoring of indoor air. • TCE was not detected in the sub-slab soil gas sample. • The detection limits for both the real-time air monitoring system and analysis of the sub-slab soil gas sample are below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).
Unit 007, Industrial/ Agronomy Building	• TCE was not detected during real-time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). • TCE in the sub-slab soil gas sample was at 0.072 ppbv, less that 40% of the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). • Comparison of the sub-slab soil gas TCE against the Residential Air Screening Level is very conservative for the following reasons: (1) the estimated indoor air concentration is approximately 0.10 of the sub-slab soil gas level (USEPA 2002b), and (2) the building's use as UNL's Agronomy Building is comparable to an industrial, rather than a residential scenario.
Unit 008, Industrial/Private-Four Winds Winery	• TCE was detected during real time air monitoring of indoor air (0.060 ppbv) in sub-slab soil gas sample (0.021 ppbv), and in indoor air samples (0.0083 ppbv), but at levels that are below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).
Unit 009, Residential/Private	• TCE was detected in the indoor air sample at 0.015 ppbv, less than 10% of the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).
Unit 010, Residential/Private	• TCE was not detected during real time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). • TCE was detected in the sub-slab soil gas (0.027 ppbv) and indoor air samples (0.01 to 0.012 ppbv); all these levels are less than 15% of the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).
Unit 012, Industrial/ UNL Building	• TCE was not detected during real-time air monitoring of indoor air. TCE was not detected in the sub-slab soil gas sample. The detection limits for both the real-time air monitoring system and analysis of the sub-slab soil gas sample are below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009).

Table 3-5. Summary of vapor intrusion sample collection for laboratory analysis

Sub-Slab Soil Gas and Air Sampling Method	Analyte Group	Number of field samples	Field duplicate
6 liter SUMMA® canister	VOCs: TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride	Four buildings, two indoor air and one sub-slab soil gas Two background air sampling locations Total field samples = 14	Will be collected at two indoor air locations and one sub-slab soil gas location within one building [1]

[1] See QAPP for selected location from which field duplicates will be collected.

Table 3-6. Sample containers, preservation and holding times

Matrix	Analytes/Method	Container	Preservation	Holding Time
Soil	Metals (6010B/7471A)	4 ounce glass	Cooled to 4°C	180 days from collection. 28 days from collection for mercury
Air	Volatile organic compounds (TO-15)	6 Liter SUMMA® canister	Not Applicable	30 days from collection

Table 4-1. Selected soil screening levels

Analyte	CAS #	2000 BLRA (mg/kg)	Source	2010 Residential Soil (mg/kg)	2010 Industrial Soil (mg/kg)
Aluminum	7429-90-5	33,852	2 x BG	77,000	990,000
Antimony	7440-36-0	31	PRG	31	410
Arsenic	7440-38-2	13.5	2 x BG	0.39	1.6
Cadmium	7440-43-9	39	PRG	70	800
Chromium	18540-29-9	37	2 x BG	0.29	5.6
Cobalt	7440-48-4	17.2	2 x BG	23	300
Copper	7440-50-8	33.9	2 x BG	3100	41,000
Lead	7439-92-1	400	PRG	400	800
Mercury	7439-97-6	23	PRG	5.6	34
Vanadium	7440-62-2	72.5	2 x BG	5.5	72
Zinc	7440-66-6	119.5	2 x BG	23,000	310,000

Source of 2010 soil screening levels: Mid-Atlantic Risk Assessment, May 2010, USEPA 2010
BG—arithmetic mean of concentrations in background soil samples collected during Phase I/II RI (Woodward-Clyde 1997)
BLRA—Baseline Risk Assessment
CAS—Chemical Abstracts Service
PRG—USEPA Preliminary Remediation Goals 1995

Table 4-2. Vapor intrusion screening levels for indoor air quality

Compound	2010 Residential Indoor Air[1] ($\mu g/m^3$)
Trichloroethene	1.2 c
Cis-1,2-Dichloroethene	NL
Trans-1,2- Dichloroethene	63 n
Vinyl Chloride	0.16 c

c—cancer risk, n—noncancer, NL—Not Listed
1. USEPA May 2010 Summary Table. Mid-Atlantic Risk Assessment (reporting limit of 10^{-6}, HQ of 1).

Table 4-3. Site-specific background soils statistics

Metal	CAS #	# Samples	Minimum (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	BTV (mg/kg)	2xBG (mg/kg)	Range of Detection Limits (mg/kg)
Aluminum	7429-90-5	10	9660	20,700	16,926	22,769	33,852	(24.7 to 27.6)
Arsenic	7440-38-2	10	3.80	8.40	6.77	9.48	13.5	(5.8 to 6.5)
Barium	7440-39-3	10	192	244	220	253	440	(0.43 to 0.48)
Beryllium [b]	7440-41-7	10	0.540	0.860	0.760	0.86	1.52	(0.22 to 0.24)
Cadmium	7440-43-9	9	0.150	0.360	0.216	0.345	0.431	(0.11 to 1.2)
Calcium	7440-70-2	10	2370	3730	3043	3830	6086	(31.2 to 34.8)
Chromium	18540-29-9	10	13.1	21.3	18.5	23.1	37.0	(1.5 to 1.7)
Cobalt	7440-48-4	10	7.10	9.90	8.60	10.3	17.2	(1.1 to 1.2)
Copper	7440-50-8	10	11.9	22.1	16.9	23.2	33.9	(1.1 to 1.2)
Iron [b]	7439-89-6	10	11,300	21,000	18,140	21,000	36,280	(20.9 to 23.3)
Lead	7439-92-1	10	13.4	15.7	14.5	15.9	28.9	(3.4 to 3.8)
Magnesium	7439-95-4	10	2080	4310	3349	4639	6698	(11.6 to 13)
Manganese	7439-96-5	10	447	660	541	660	1083	(0.43 to 0.48)
Nickel	7440-02-0	10	12.0	24.6	19.7	27.0	39.3	(5.2 to 5.8)
Potassium	7440-09-7	10	1720	3600	2739	3759	5478	(66.2 to 74)
Selenium [a]	7782-49-2	4	0.890	1.200	1.073	NA	2.145	(0.73 to 7.9)
Thallium [a]	7440-28-0	1	0.860	0.860	0.860	NA	1.720	(0.77 to 0.86)
Vanadium	7440-62-2	10	27.5	41.3	36.2	45.1	72.5	(1.3 to 1.4)
Zinc	7440-66-6	10	42.8	67.5	59.8	74.6	120	(2.6 to 2.9)

CAS: Chemical Abstracts Service
Source of background soil data (Woodward Clyde 1997)
[a] Insufficient data to determine a BTV due to number of samples
[b] BTV calculated assuming a gamma distribution but was not normally, lognormally, or gamma distributed at a 5% significance level.

Table 4-4. Exposure parameters for receptors exposed to surface and sub-surface soil at the former NOP

Parameter	Units	Construction Worker*	Source/ Note	Ground Maintenance Worker†	Source /Note	Adult Trespasser†	Source/ Note	Juvenile Trespasser†	Source/ Note
Incidental Ingestion of Soil									
Soil Ingestion Rate (IRs)	(mg/day)	480	a	480	a	100	a	100	a
Exposure Frequency (EF)	(days/year)	130	b	40	b	24	b	24	b
Exposure Duration (ED)	(years)	0.5	c	25	c	70	d	5	d
Body Weight (BW)	(kg)	70	e	70	e	70	e	37	f
Carcinogen Average Time (AT)	(days)	25,550	g	25,550	g	25,550	g	25,550	g
Non-carcinogen Averaging Time (AT)	(days)	183	h	9125	h	25,550	h	1825	h
Fraction ingested (FI)	(-)	1	i	1	i	1	i	1	i
Dermal Contact with Soil									
Conversion factor	(kg/mg)	1.00E-06							
Adherence Factor (AF)	(mg/cm^2)	1	j	1	j	1	j	1	j
Absorption Factor (ABS)	(-)	Chemical-specific		Chemical-specific		Chemical-specific		Chemical-specific	
Skin Area (SA)	(cm^2)	5230	k	5230	k	5230	k	4602	k
Event Frequency (EV)	(events/day)	1	m	1	m	1	m	1	m
Exposure Frequency (EF)	(days/year)	130	b	40	b	24	b	24	b
Exposure Duration (ED)	(years)	0.5	c	25	c	70	d	5	d
Body weight (BW)	(kg)	70	e	70	e	70	e	37	f
Carcinogen Averaging Time (AT)	(days)	25,550	g	25,550	g	25,550	g	25,550	g
Non-carcinogen Averaging Time (AT)	(days)	183	h	9125	h	25,550	h	1825	h
Inhalation of Dust									
Particulate Emission factor (PEF)	(m^3/kg)	1.36E+09	n	1.36E+09	n	1.36E+09	n	1.36E+09	n
Exposure Frequency (EF)	(days/year)	130	b	40	b	24	b	24	b
Exposure Duration (ED)	(years)	0.5	c	25	c	70	d	5	d
Exposure Time (ET)	(hrs/day)	8	o	8	o	2	o	2	o
Carcinogen averaging time (AT)	(days)	25,550	g	25,550	g	25,550	g	25,550	g
Non-carcinogen averaging time (AT)	(days)	183	h	9125	h	25,550	h	1825	h

* Exposure scenarios for both soil and sub-surface soils.

† Exposure scenarios for surface soils only.

(a) These values were used in the OU-3 BLRA (URS 2000). For conservatism, the upperbound soil ingestion rate from Standard Default Exposure Factors (EPA 1991b) was used for the construction worker; this value will also be used for the maintenance worker.

(b) The exposure frequency for the construction worker is the same as that used in the OU-3 BLRA (URS 2000b), which was based on 5 working days per week for 6 months. It is assumed that ground maintenance is conducted one day a week for 40 out of 52 weeks (excludes winter), and site trespasser/visitor enters the areas 2 days per month.

(c) Construction activity is assumed to occur for 6 months (consistent with OU-3 BLRA (URS 2000b). Exposure duration for the grounds maintenance worker is the default value in EPA (1991) for commercial/industrial land use.

(d) The exposure durations for adult trespasser are assumed to be the same as the exposure time for residents in the OU-3 BLRA (URS 2000b), the exposure duration for 8 to 13-year old juveniles is assumed to be the entire 5-year period.

(e) A body-weight of 70 kg is assumed for all adult receptors (EPA 1989).

(f) Body weight for 8 to 13-year old children are based on time-weighted average values from the Exposure Factors Handbook (EPA 1989).

(g) Averaging time for carcinogenic effects is based on assumed lifetime of 70 years.

(h) Averaging time for non-carcinogenic effects is based on the exposure duration.

(i) For conservatism, the upper bound value is assumed.

(j) The recommended dermal adherence for soil is 1.0 mg/cm^2 for RME (EPA 1992).

(k) Exposed dermal surface area for adult RME is based on head, hands, forearms, and lower legs; the exposed surface areas for a juvenile are based on a time-weighted average for 8 to 13 year old children (EPA 1989).

(m) Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual (EPA 2004).

(n) Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24. Office of Solid Waste and Emergency Response. (EPA 2002).

(o) Risk Assessment Guidance for Superfund, Volume I Human Health Evaluation Manual, Part F (EPA 2009b).

Table 4-5. Exposure parameters for receptors exposed to surface water at the former NOP for recreational fishing scenarios

Parameter	Units	Adult Recreational	Source/Note	Child Recreational	Source/Note
Ingestion of Surface Water/Sediment while Fishing					
Water ingestion rate	(L/hour)	0.005	b	0.005	b
Sediment Ingestion Rate	(mg/day)	100	c	200	c
Exposure Frequency	(days/year)	26	d	52	e
Exposure Duration	(year)	70	f	6	f
Body weight	(kg)	70	g	15	h
Carcinogen Averaging Time	(days)	25,550	i	25,550	i
Non-carcinogen Averaging Time	(days)	25,550	j	2190	j
Dermal Contact with Surface Water/Sediment while Fishing					
Skin Area	(cm^2)	8620	k	6500	k
Dermal Sediment Adherence	(mg/cm^2)	1	m	1	m
Permeability Constant	(cm/hr)	Chemical-Specific		Chemical-Specific	
Conversion Factor	(L/cm^3)	0.001		0.001	
Exposure Time	(hrs/day)	10	n, *	10	n, *
Exposure Frequency	(days/year)	17	x	34	x
Exposure duration	(year)	70	f	6	f
Body weight	(kg)	70	g	15	h
Carcinogen Averaging Time	(days)	25,550	i	25,550	i
Non-carcinogen Averaging Time	(days)	25,550	j	2190	j
Ingestion of Fish					
Ingestion (Fish) Rate	(kg/day)	0.025	o	0.0125	o
Fraction Ingested from Contaminated Sources	(-)	0.2	p	0.2	p
Exposure Frequency	(days/year)	365	o	365	o
Bioconcentration Factor	(-)	Chemical-Specific		Chemical-Specific	

* - Recommended by USACE/CENWK 2009b, USACE/CENWK 2009c

(a) Reasonable Maximum Exposure (RME) is defined by USEPA as the reasonable upperbound exposure among potential exposed populations

(b) Assumed o be one-tenth of the RAGS (USEPA 1989a) recommended surface water ingestion rate while swimming (50 mL/hour)

(c) Standard default sediment ingestion rates of 100 mg/day and 200 mg/day for children assumed (USEPA 1991b)

(d) - Assume 2 days a week over 13 weeks of summer = 26 days for the year.

(e) - Assume 4 days a week over 13 weeks of summer = 52 days for the year.

(f) The exposure duration for an adult recreational fisherman are assumed to be the same for residents. The exposure duration for a child recreational fisherman (age 0 to 6) is assumed to be the entire 6 year period.

(g) The body weight of an adult is assumed to be 70 kg for all receptors.

(h) The body weight for 0 to 6 year old child is based on time-weighted average values from the Exposure Factors Handbook (USEPA 1989b)

(i) Averaging time for carcinogenic effects is based on assumed lifetime of 70 years

(j) Averaging time for non-carcinogenic effects is based on the exposure duration

(k) The surface area of the entire body is used.

(m) Dermal Adherence based on Dermal Exposure Assessment: Principles and Applications (USEPA 1992)

(n) Assumes 10 hours of fishing per day

(o) The recommended adult daily intake value over a year (365 days) is used to evaluate adult exposure (USEPA 1997), one-half of the adult rate is assumed for a 0-6 year old child.

(p) Assumed that 20% of the fish consumed where from the Creeks.

Table 4-6. Exposure parameters for inhalation of volatiles for exposed receptors in buildings considered in vapor intrusion assessment

		Unit 001 - Building 103 Dairy Farm Manager Residence				Unit 006 - Building 101 UNL Storage		Unit 003 - Feed Mill Unit 011 - Feed Lot Office	
Parameter	**Units**	**Adult Resident**	**Source/ Note**	**Child Resident**	**Source/ Note**	**Industrial Worker**	**Source/ Note**	**Industrial Worker**	**Source/ Note**
Exposure Time	hours/day	24	2	24	2	1	a	8	2
Exposure Frequency	days/year	350	1	350	1	250	1	250	1
Exposure duration	years	25	b	6	1	25	1	25	1
Averaging Time - non-carcinogens	hours	219,000	c	52,560	c	219,000	c	219,000	c
Averaging Time - carcinogens	hours	613,200	d	613,200	d	613,200	d	613,200	d

1- USEPA 1991, 2 - USEPA 2009b

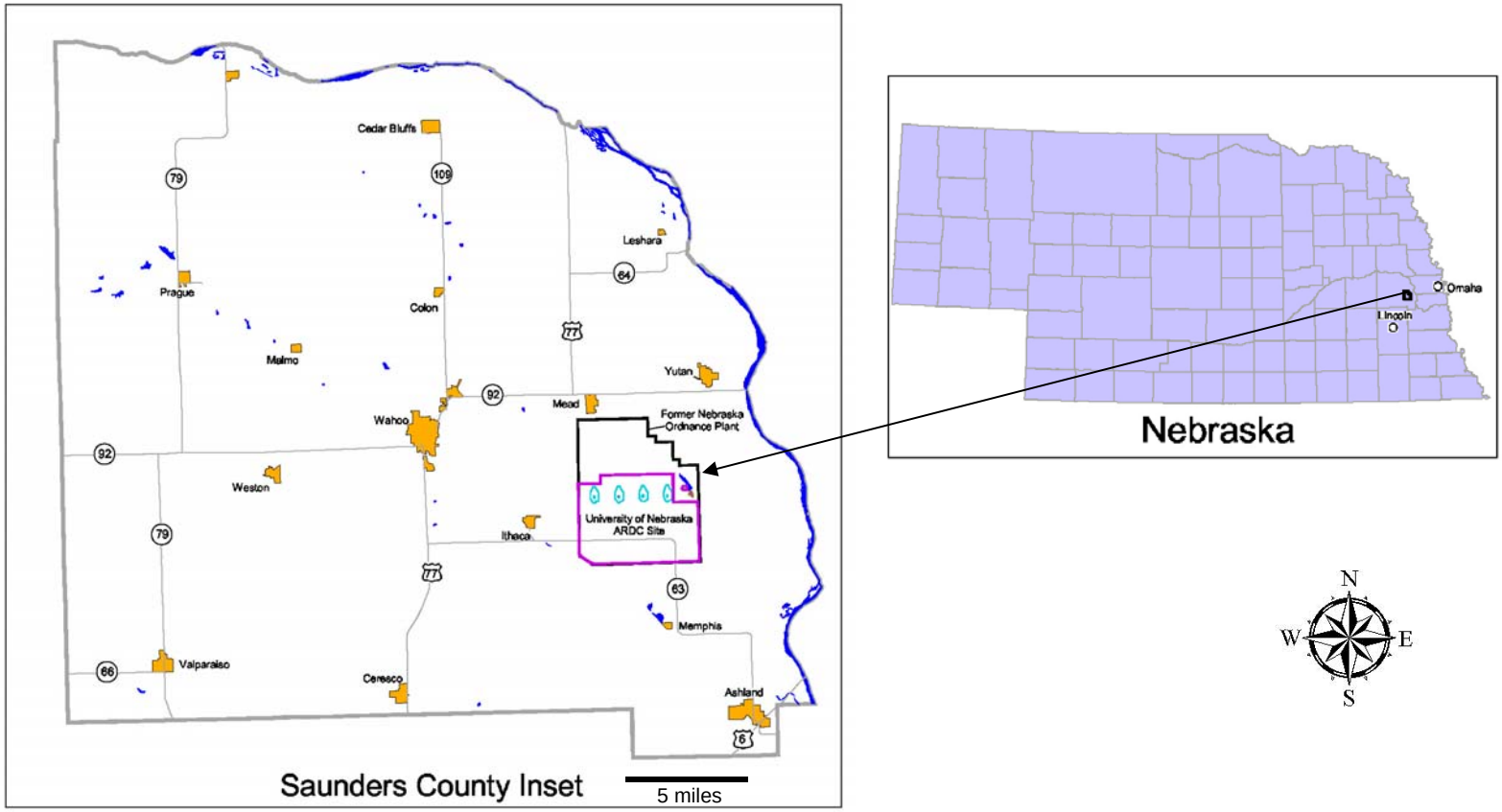
a - Assumes an hour per work day based on building usage as a Storage Building

b- Set to exposure duration recommended for an industrial worker (USEPA 1991) since residence is used by UNL Dairy Farm Manager

c - Based on Exposure Duration

d - Based on lifetime of 70 years

FIGURES



Source: MACTEC 2009. Final Report. Removal Action Completion Report. Former Nebraska Ordnance Plant Superfund Site, Operable Unit 5. University of Nebraska Agricultural Research and Development Center, Mead, Nebraska. MACTEC Project No. 46630700156.0

Figure 2-1. Site location.

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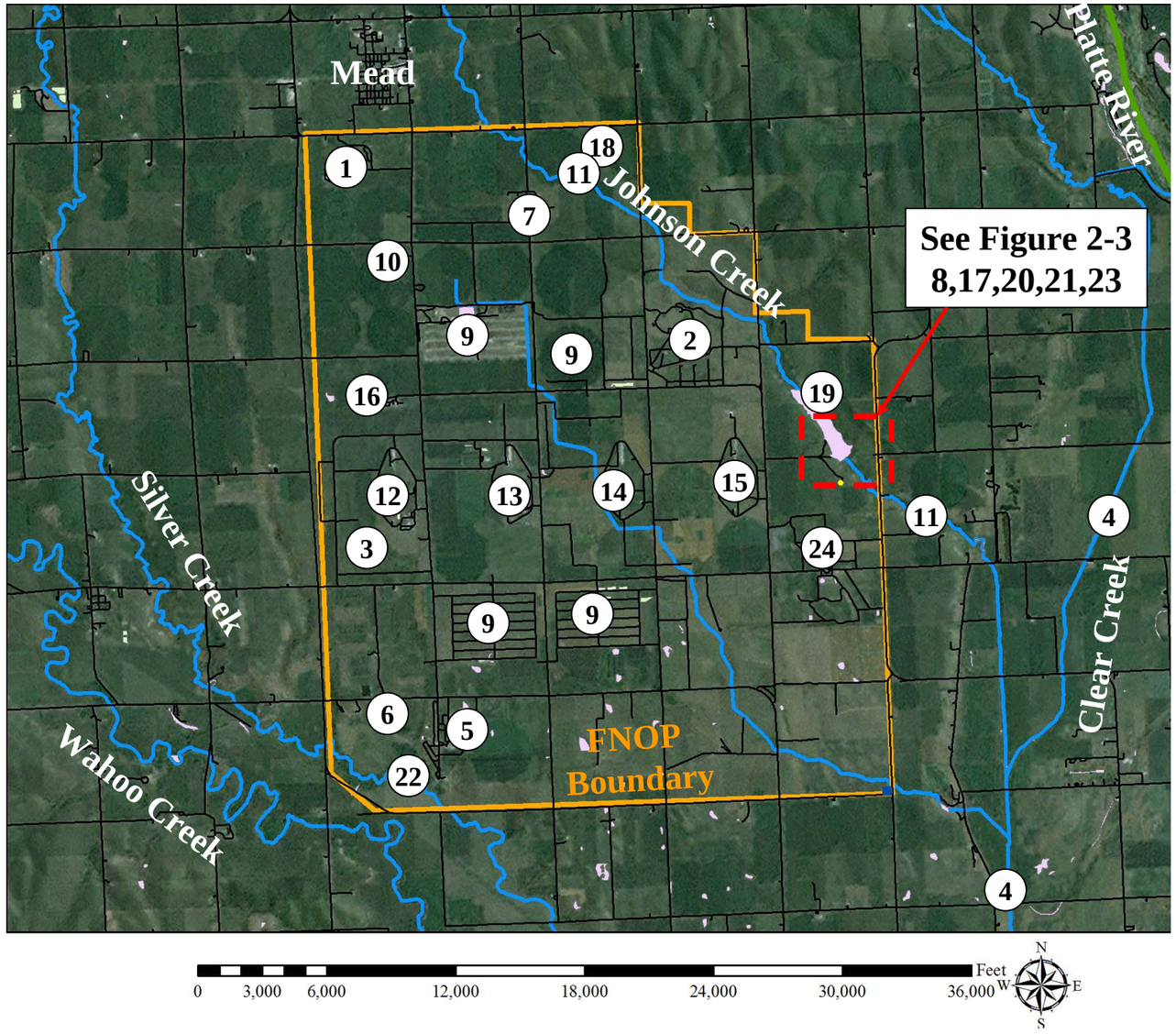

Legend:

Former Administration Area	1
Former Atlas Missile Area	2
Bermed Area Southwest of Load Line 1	3
Clear Creek	4
Former Demolition Ground	5
Former Detonation Craters	6
Former Ammonium Nitrate Plant	7
Former NOP Landfill Area	8
Former Raw Product Igloo Storage	9
Former Tetryl Pelleting Area / Bomb Booster Assembly	10
Johnson Creek	11
Former Load Line 1	12
Former Load Line 2	13
Former Load Line 3	14
Former Load Line 4	15
Former Nike Missile Maintenance Area	16
Former North Burning Ground	17
Northeast Boundary Area	18
NRD Reservoir	19
Potential Landfill Area	20
Former Proving Grounds	21
Silver Creek	22
Former South Burning Ground	23
Former Air Force Global Communications Area	24

Figure 2-2. Former Nebraska Ordnance Plant site layout/OU-3 investigation areas.
Source Base Map: ESRI World Imagery 2009

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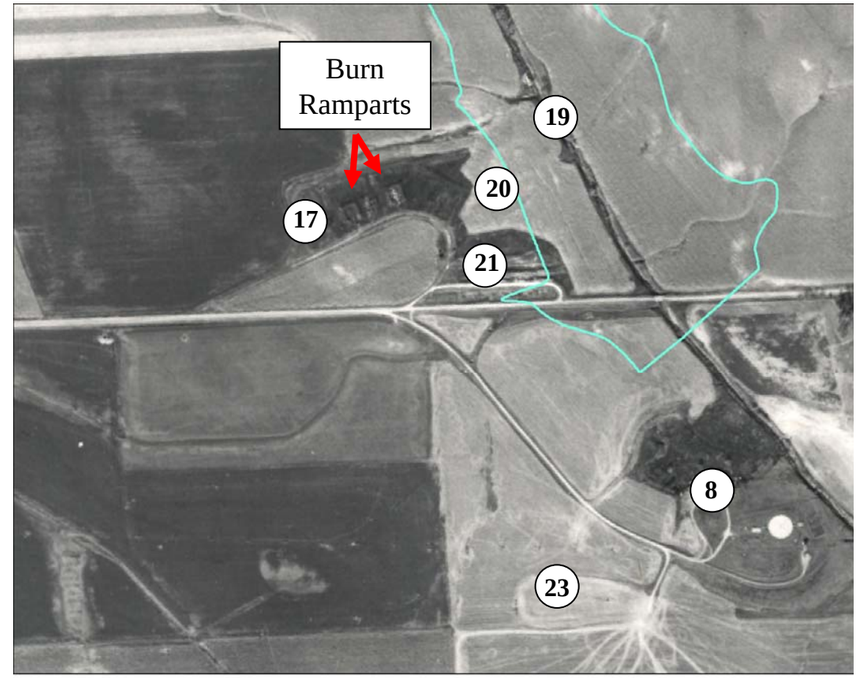
Source Base Map: ESRI World Imagery 2009

0 250 500 1,000 1,500 2,000 Feet

Source Aerial Photograph: University of Nebraska 1965



0 250 500 1,000 1,500 2,000 Feet

Legend:

Former NOP Landfill Area	8
North Burning Ground	17
NRD Reservoir	19
Potential Landfill Area	20
Proving Grounds	21
South Burning Ground	23

Figure 2-3. Former Nebraska Ordnance Plant site layout/OU-3 investigation areas near the Natural Resources District Reservoir.

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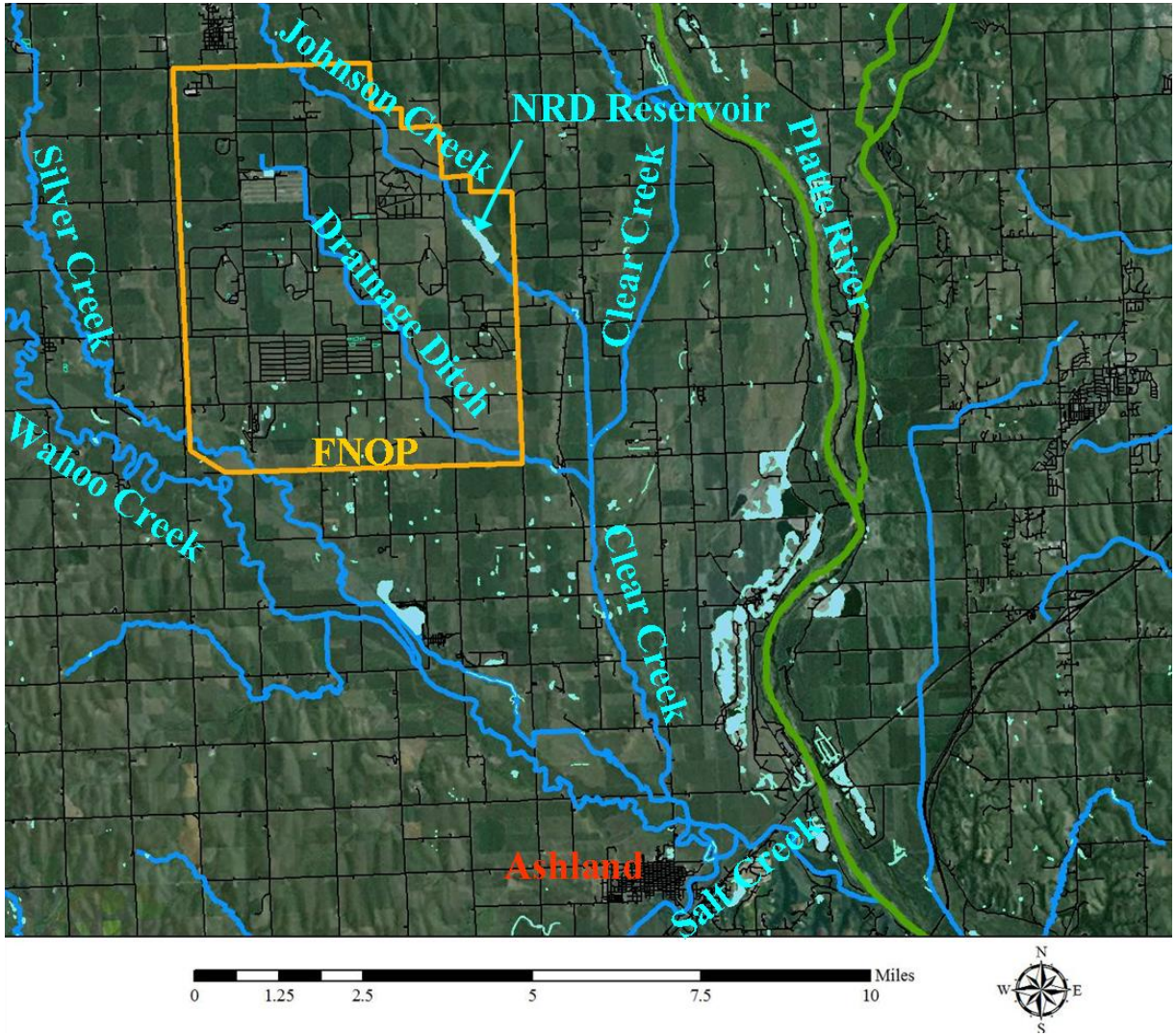

Figure 2-4. Site location map for the former Nebraska Ordnance Plant surface water features.
Source Base Map: ESRI World Imagery 2009

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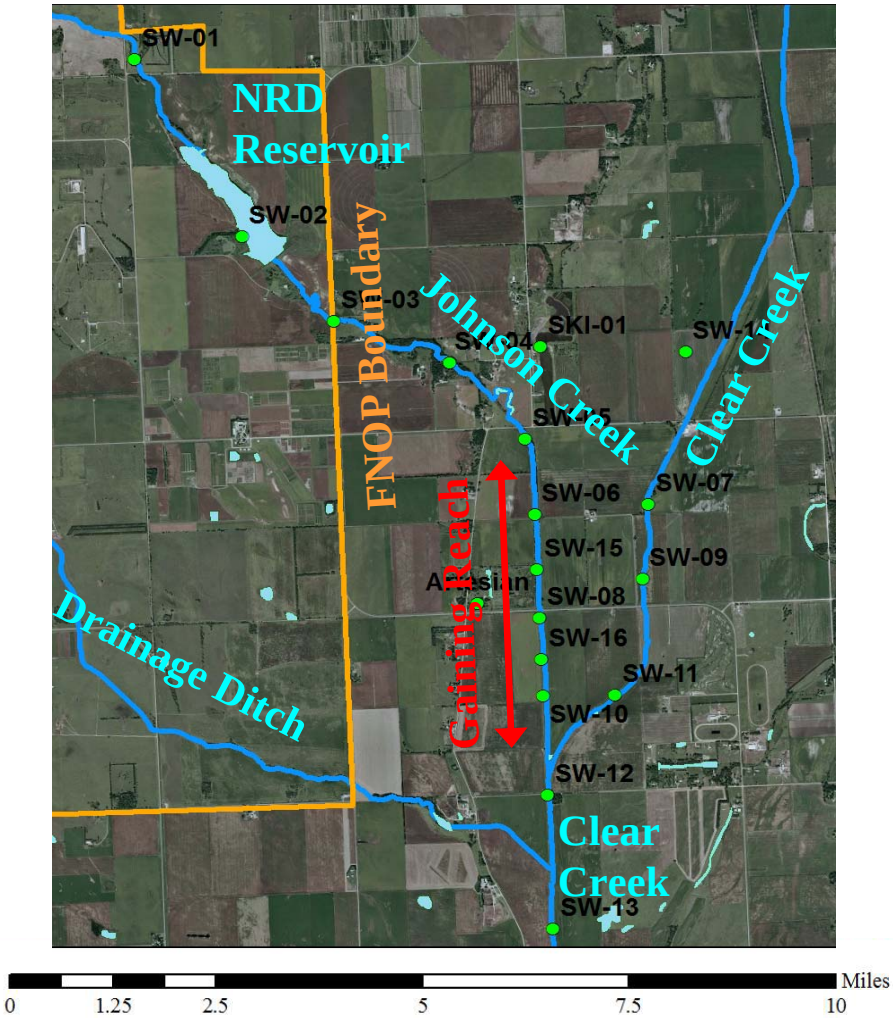
Former Nebraska Ordnance Plant Mead, Nebraska

2-5 A



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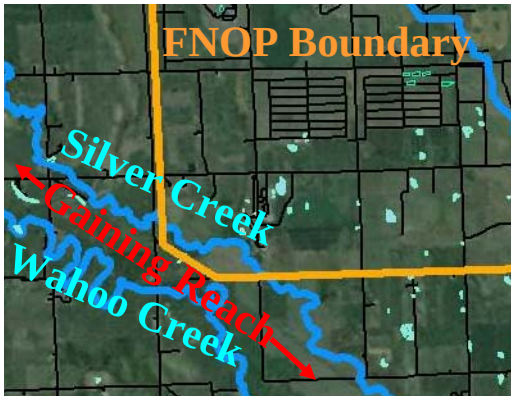

Figure 2-5. Gaining reaches of Johnson Creek, Clear Creek, and Silver Creek.

Source Base Map: ESRI World Imagery 2009

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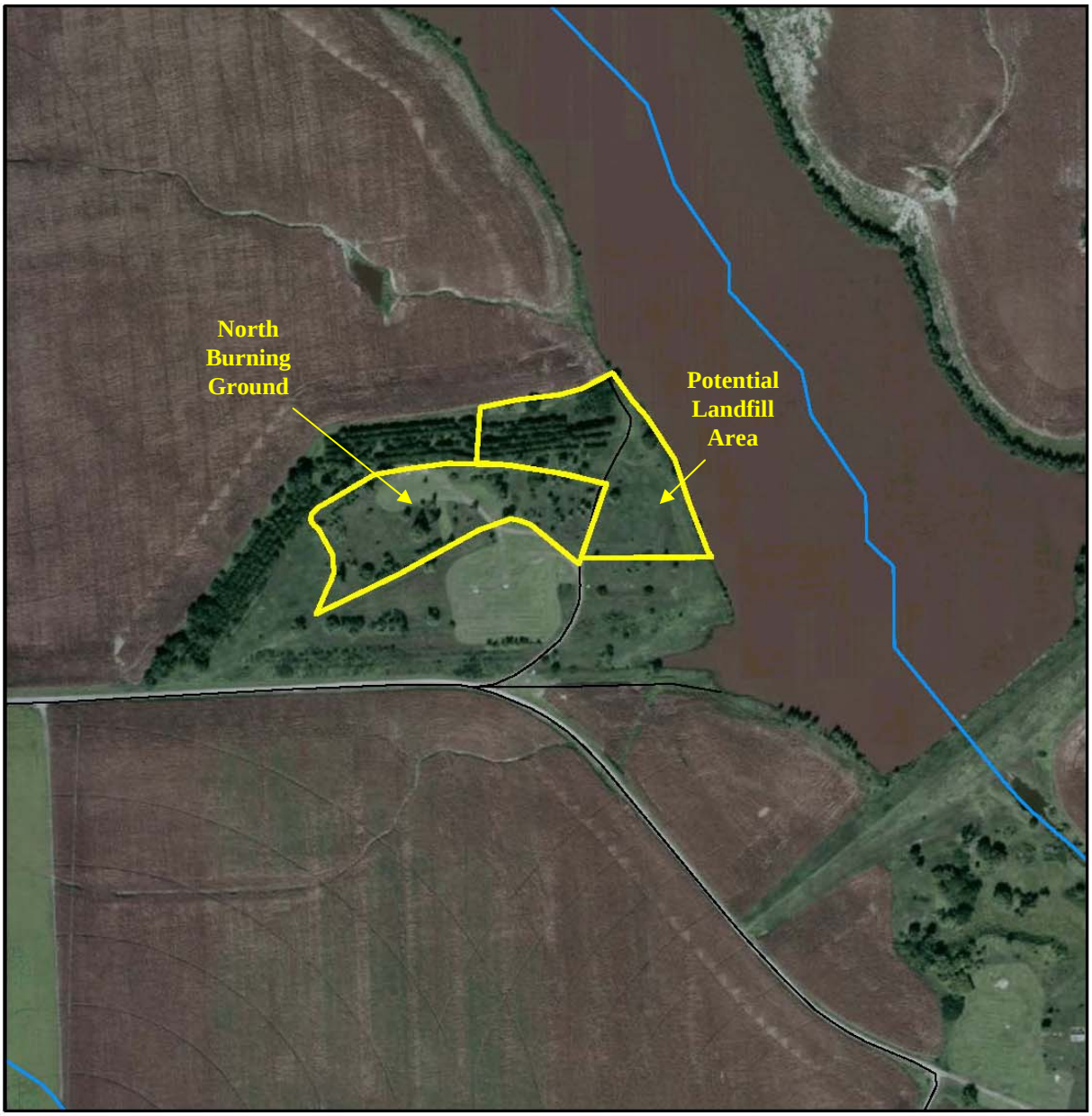
Former Nebraska Ordnance Plant
Mead, Nebraska



Legend

Surface Water

0 125 250 500 750 1,000 Feet

N
W E
S

Figure 2-6. Site location map for the former Nebraska Ordnance Plant North Burning Ground and Potential Landfill Area.

Source Base Map: ESRI World Imagery 2009

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Former Nebraska Ordnance Plant Mead, Nebraska

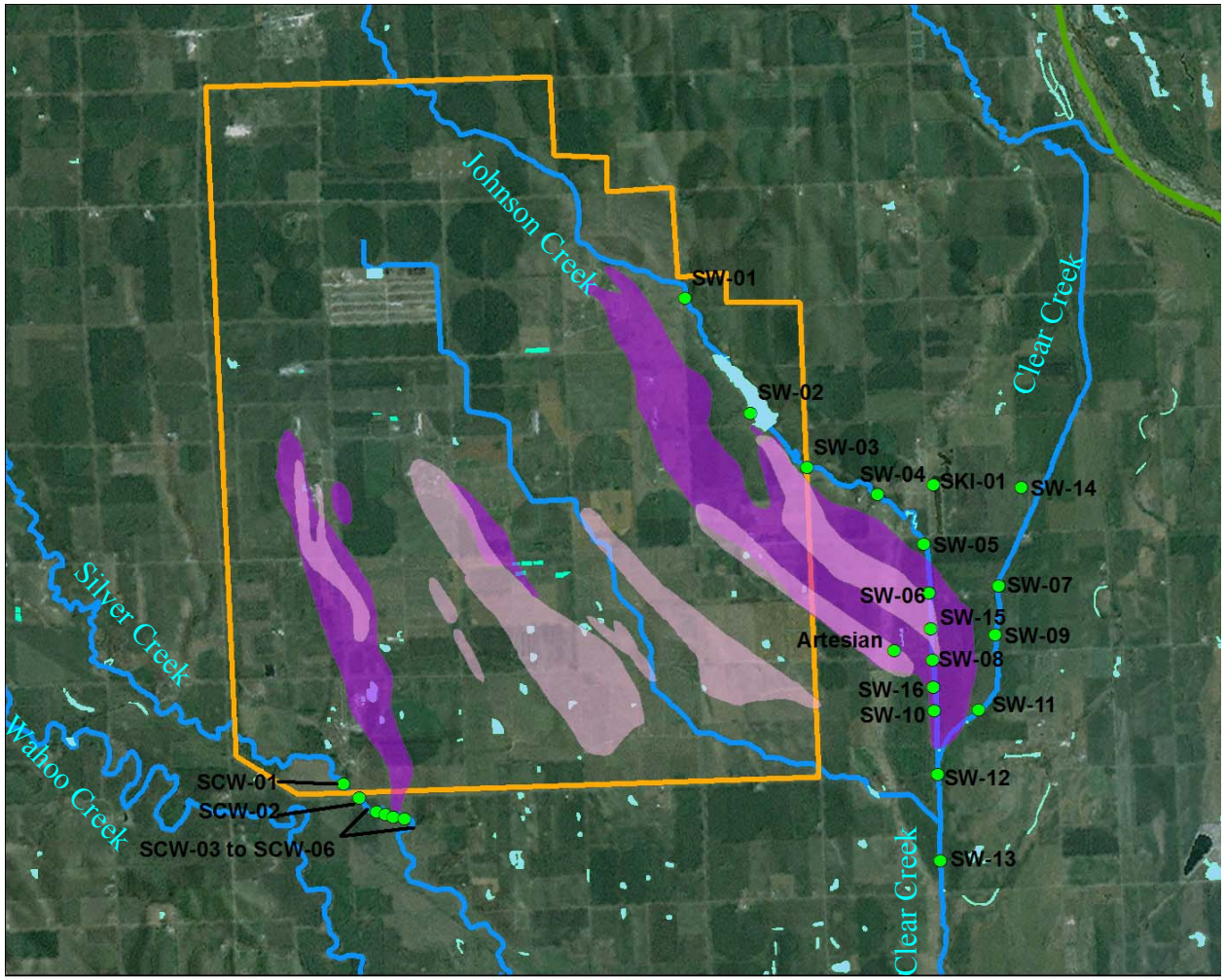

Figure 2-7. Surface water samples collected along Johnson Creek, Clear Creek, and Silver Creek from 2004-2009 as part of the OU-2 Groundwater Monitoring Program.

Source Base Map: ESRI World Imagery 2009; Source of Plume: URS (September 2009)

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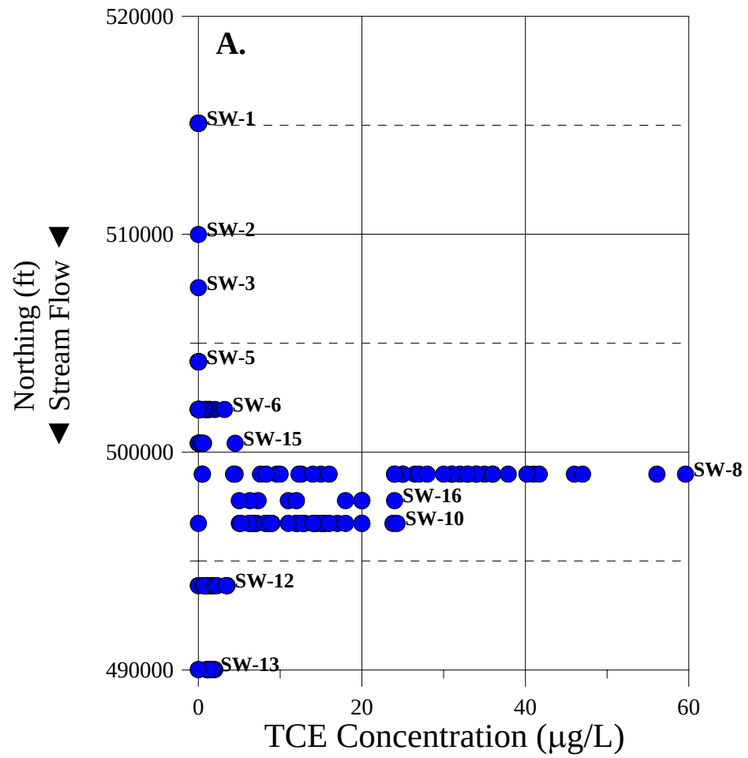
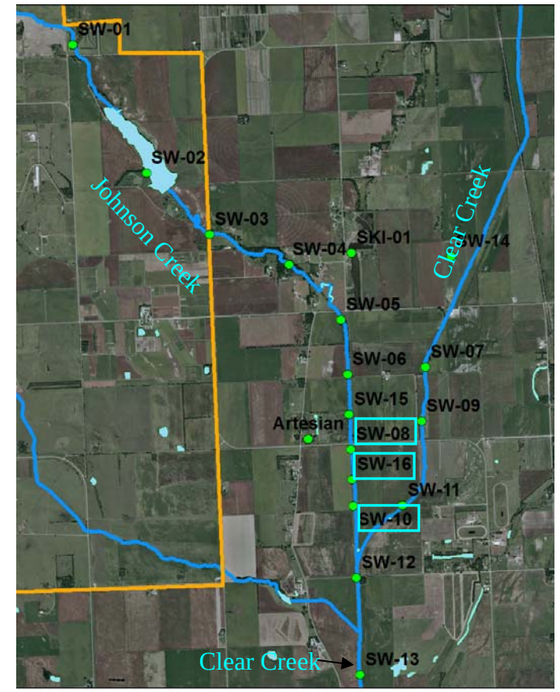
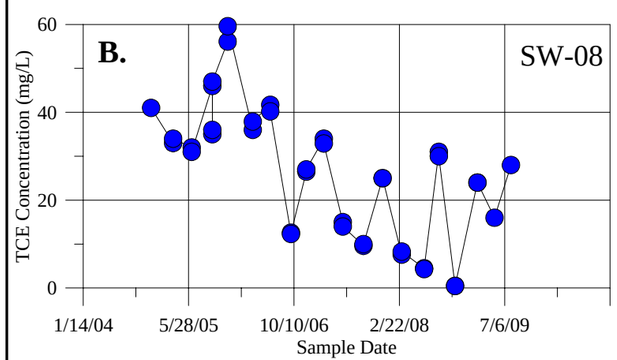
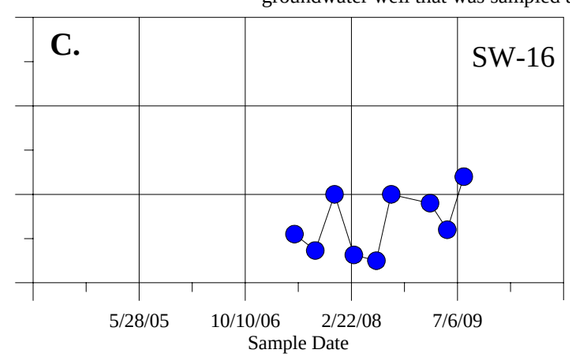




TCE from these sampling points are plotted versus time below.

*The point labeled "Artesian" is not a surface water sampling location; it is an artesian groundwater well that was sampled along with the surface water.





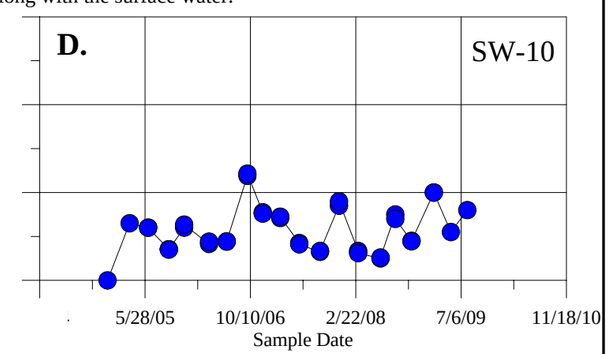


Figure 2-8. Measured TCE concentrations in Johnson Creek.

Source Base Map: ESRI World Imagery 2009

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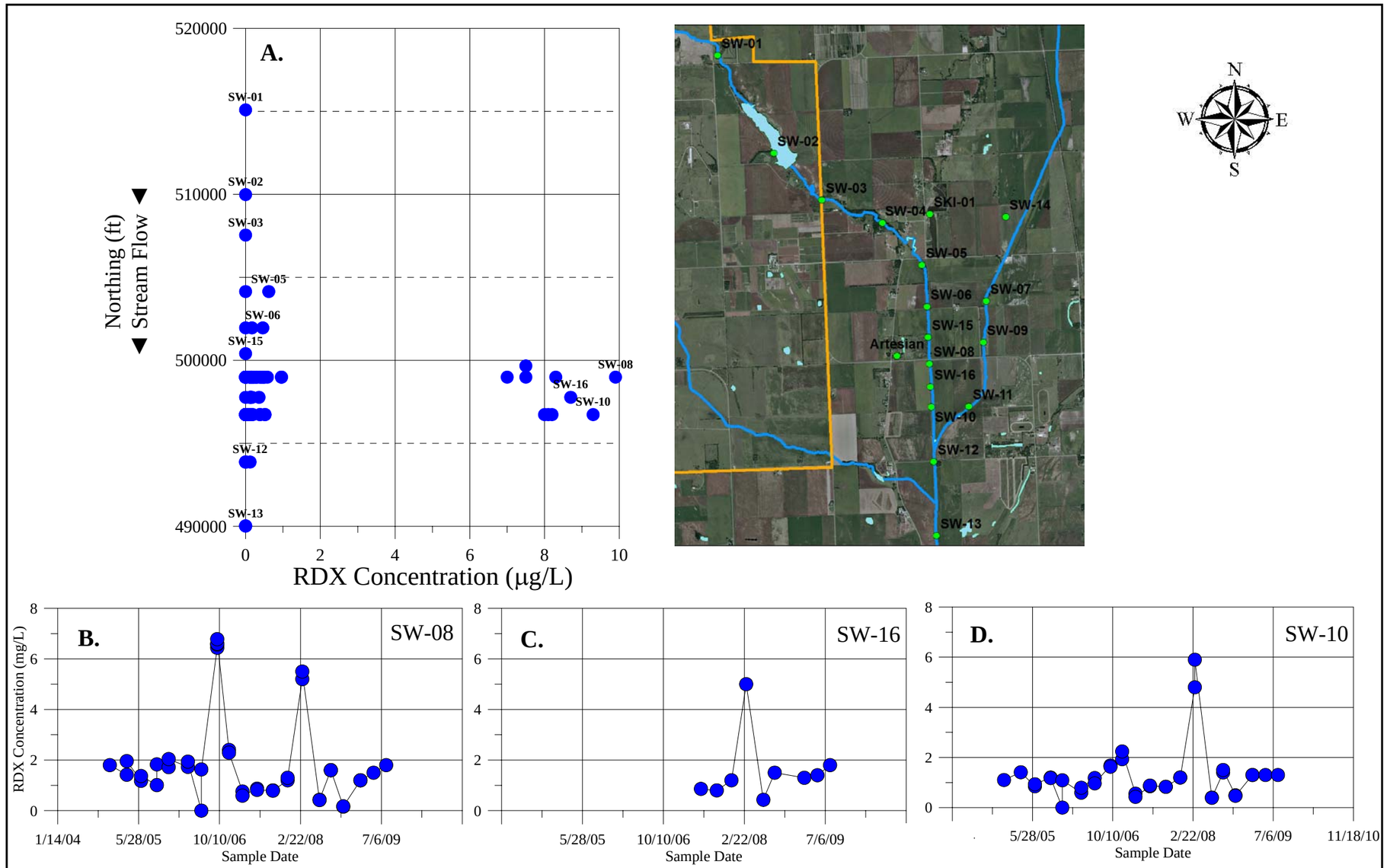

Figure 2-9. Measured RDX concentrations in Johnson Creek.

Source Base Map: ESRI World Imagery 2009

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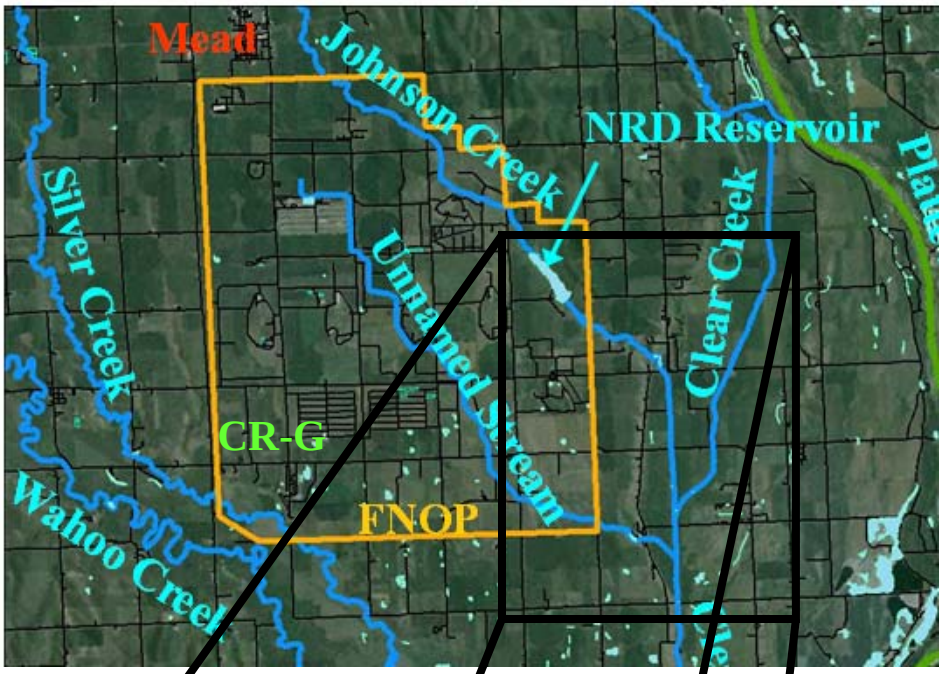

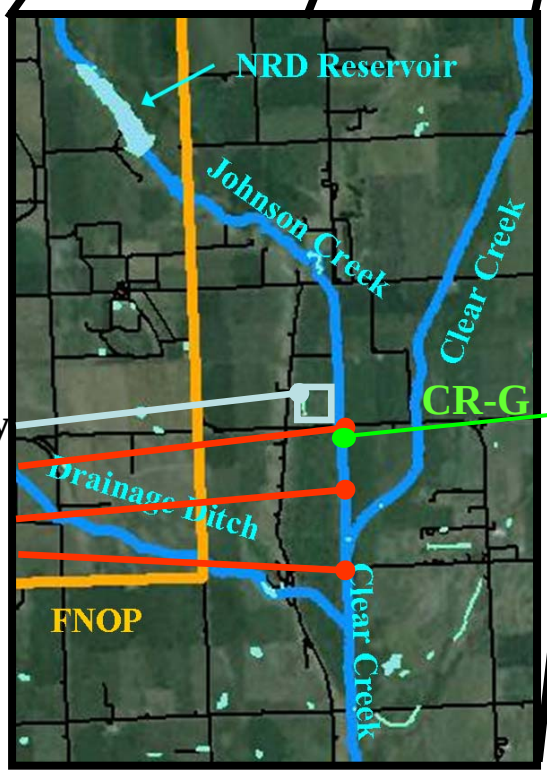

* "ART property:" Property where an unused artesian groundwater well and seeps are located, suggesting an area of groundwater discharge that may be impacting nearby Johnson Creek. Location is approximate.

ART Property

DT-15
DT-06
DT-02

SW-08

DT: Drain tile location
SW-08: Surface water sampling location where maximum TCE in surface water has been measured (see Figure 2-7 for all locations)

Figure 2-10. Location of artesian property and selected drain tiles.
Source Base Map: ESRI World Imagery 2009

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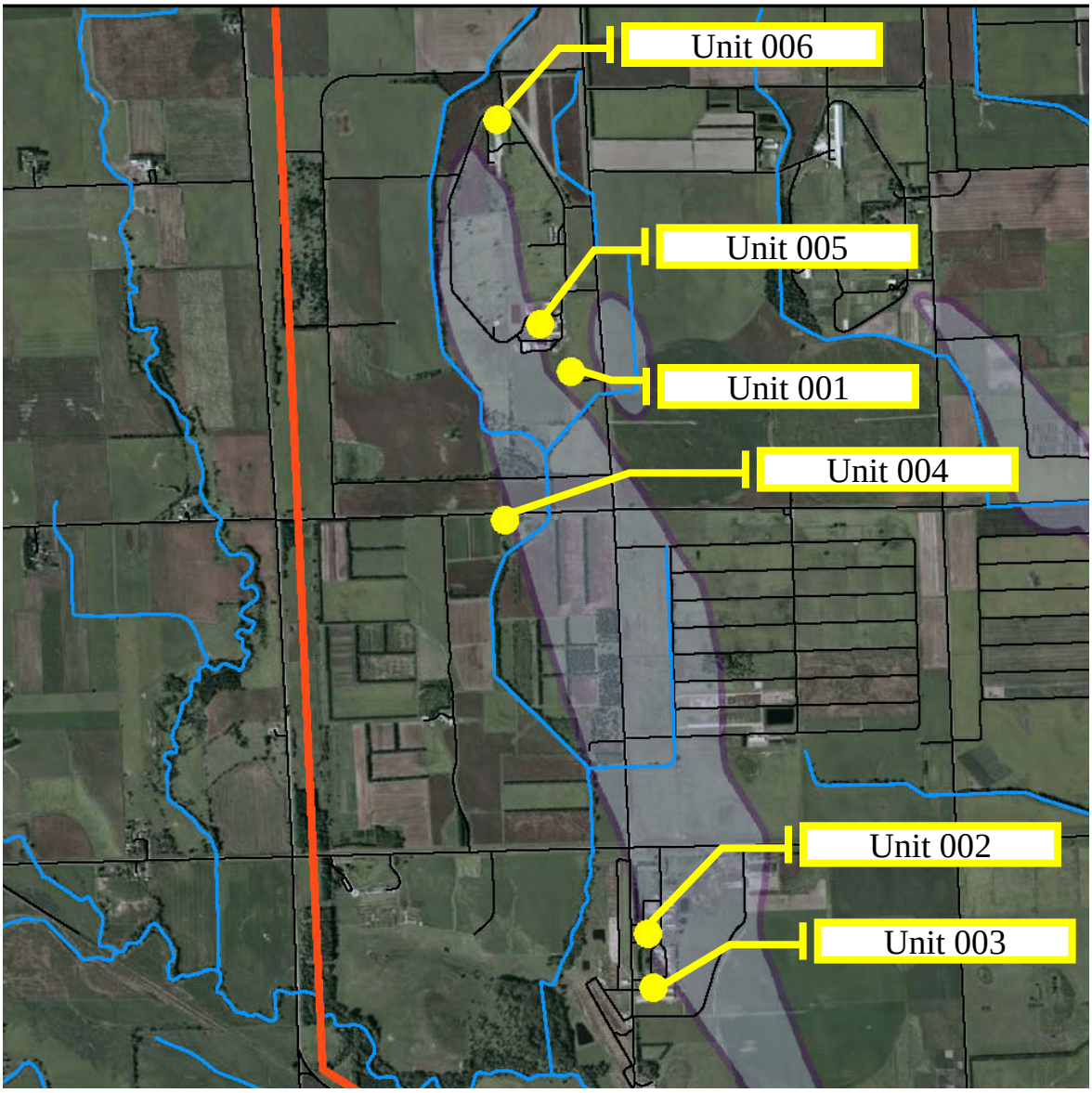

Legend

- Vapor Intrusion
- Former NOP boundary
- Surface Water
- Roads
- TCE (≥5µg/L) September 2009

0 1,200 2,400 4,800 7,200 9,600 Feet

N W E S

Figure 2-11. Vapor intrusion buildings of concern for Load Line 1 TCE plume.
TCE plume: TCE ≥ 5 µg/L as of Sept. 2009.
Source Base Map: ESRI World Imagery 2009; Source TCE plume: URS (September 2009)

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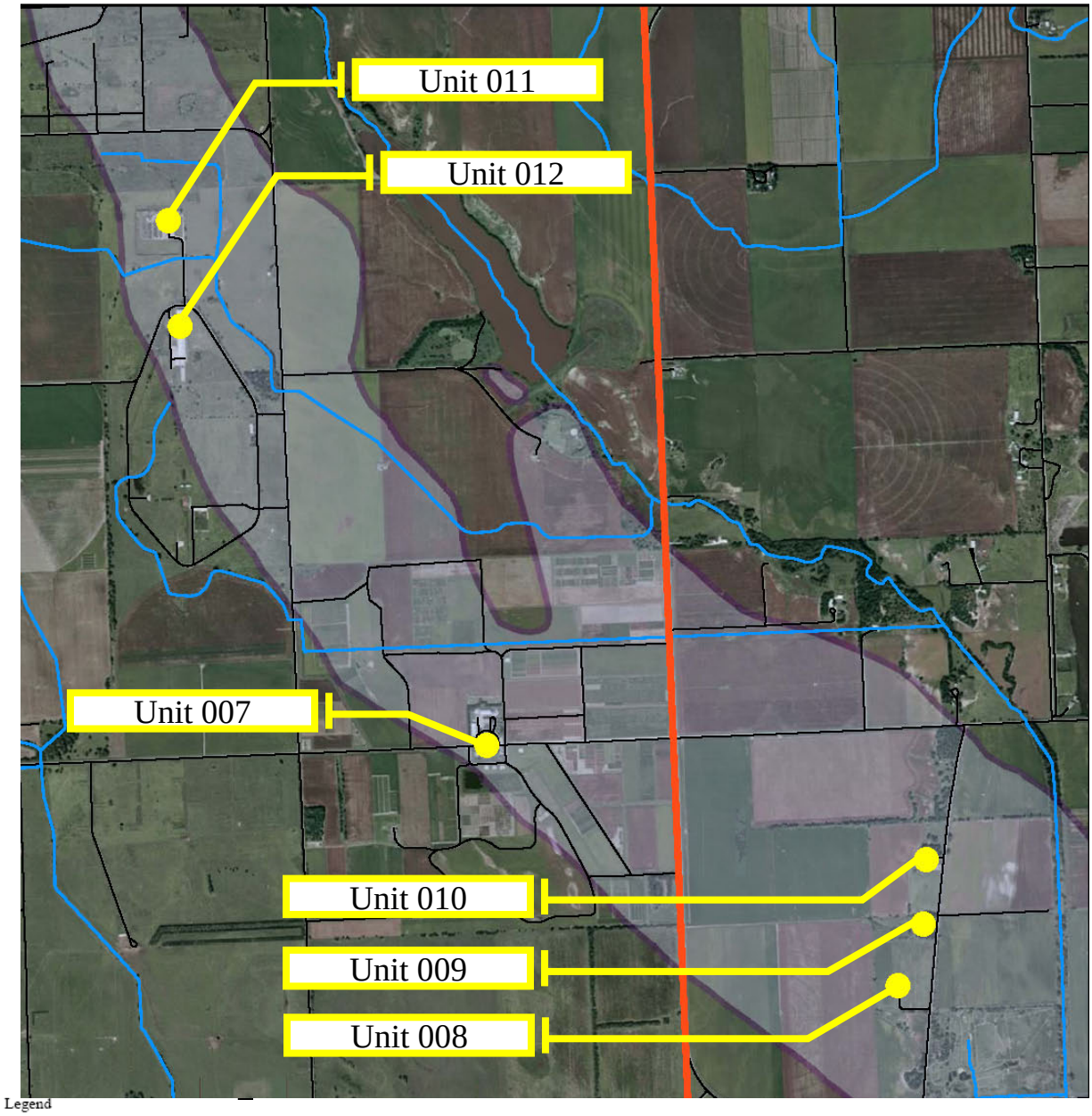

Figure 2-12. Vapor intrusion buildings of concern for Atlas Missile Area TCE plume. **TCE plume: TCE ≥ 5 µg/L as of Sept. 2009.**
Source Base Map: ESRI World Imagery 2009; Source TCE plume: URS (September 2009)

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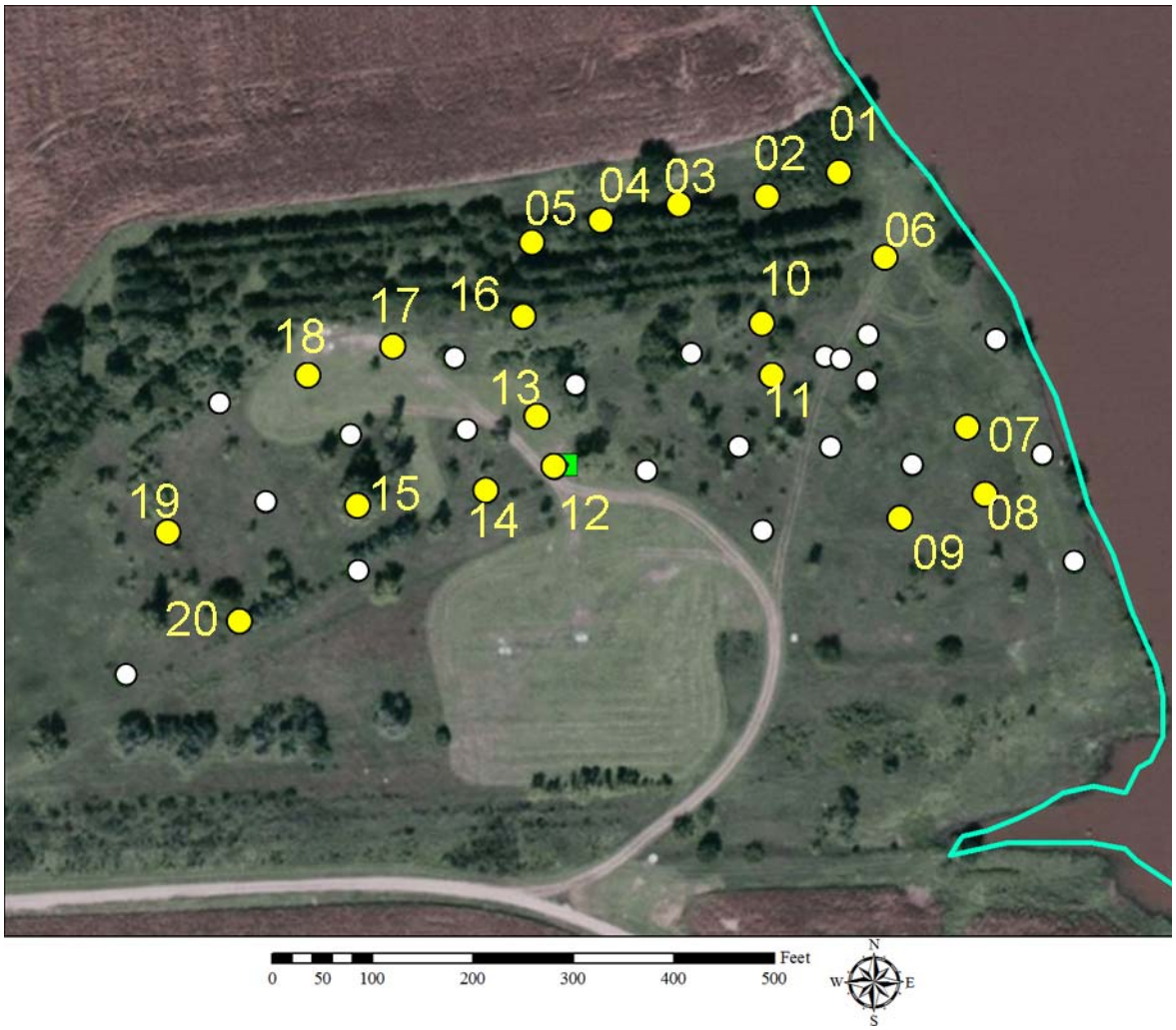

OU-5 test pit

Proposed Supplemental RI sample location

Previous soil sample locations from Phase I and II (metals)

Figure 3-1. Proposed supplemental soil sampling locations.

Source Base Map: ESRI World Imagery 2009

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Impacted Media	Release Mechanism	Exposure Route	Adult Trespasser	Juvenile Tresspasser	Construction Worker	Maintenance Worker
Surface Soil (0-0.5 ft)	Direct Contact	Ingestion	●	●	●	●
		Dermal Contact	●	●	●	●
	Particulate and Volatile Emissions	Inhalation of Particulates and Volatiles	●	●	●	●
	Plant Uptake	Food Intake	--	--	--	--
Subsurface Soil (0.5 - 8 ft)	Direct Contact	Ingestion	--	--	●	--

● Complete Pathway

-- Incomplete Pathway

Figure 4-1. Conceptual site exposure model for surface and subsurface soils.

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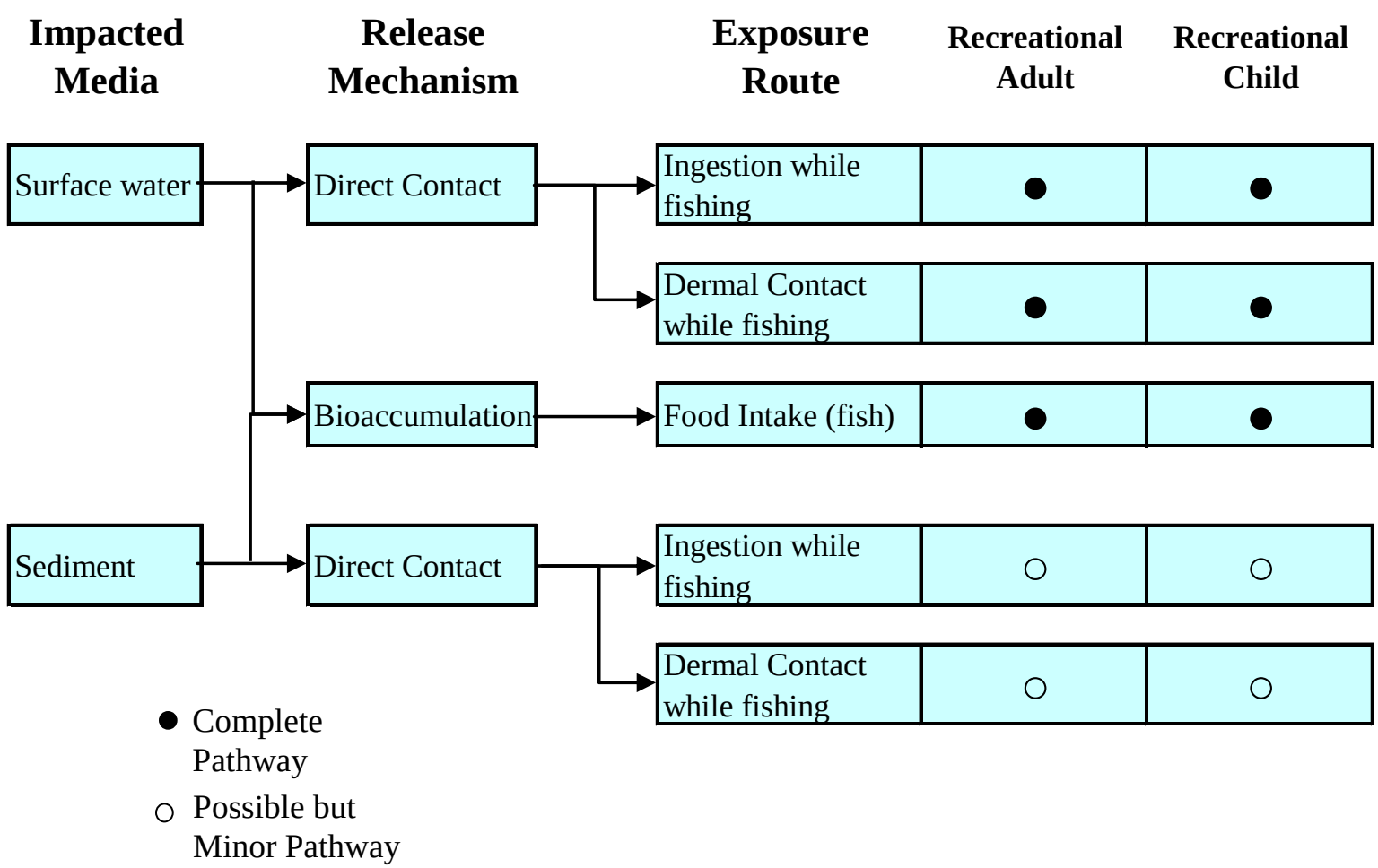

Figure 4-2. Conceptual site exposure model for Johnson Creek, Clear Creek, and Silver Creek.

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APPENDIX A

QUALITY ASSURANCE PROGRAM PLAN

GEO/10-243
Final

U.S. Army Corps of Engineers
Kansas City District

Quality Assurance Project Plan
Former Nebraska Ordnance Plant
Operable Unit-3 Supplemental Remedial Investigation
Work Plan
Mead, Nebraska

Prepared for
U.S. Army Corps of Engineers
Kansas City District
Contract No. W912DQ-10-D-3012
Delivery Order 0001

Prepared by
GEO Consultants, LLC
325 Kentucky Avenue
Kevil, Kentucky 42053

August 2010

GEO/10-243
Final

Quality Assurance Project Plan
Former Nebraska Ordnance Plant
OU-3 Supplemental Remedial Investigation Work Plan
Mead, Nebraska

Date Issued – August 2010

Prepared by
GEO Consultants, LLC
325 Kentucky Avenue
Kevil, Kentucky 42053
Contract No. W912DQ-10-D-3012
Delivery Order 0001

Prepared for the
U.S. Army Corps of Engineers
Kansas City District
700 Federal Building
601 East 12th Street
Kansas City, Missouri
64106-2896

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

GEO Consultants, LLC (GEO) has completed the Draft Site-Specific Safety and Health Plan/Accident Prevention Plan for the Supplemental Remedial Investigation Work Plan, for Operable Unit (OU)-3 at the former Nebraska Ordnance Plant, Mead, Nebraska. Notice is hereby given that an independent technical review (ITR) has been conducted that is appropriate to the level of risk and complexity inherent in the project as defined in GEO's Quality Control Plan. During the independent technical review, compliance with established policy, principles and procedures, using justified and valid assumptions, was verified. This included review of technical scope, assumptions, technical methods, procedures, and materials used in analyses, appropriateness of data, reasonableness of results, including whether the product meets the customer's needs consistent with the law and existing Corps policy.

Todd Buchanan
Project Manager

6-11-10
Date

Randy Hansen, CSP, CHP, CPEA
Project Health and Safety Officer

6/10/10
Date

Kim Morris
Quality Program Manager

6/11/10
Date

Significant concerns and the explanation of the resolution are as follows:

None

As noted above, all concerns resulting from the independent technical review of the project have been considered.

Larry Copeland, P.E.
Senior Program Manager, GEO Consultants, LLC

6/11/10
Date

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Figure A-2. Site layout map showing OU-3 investigation areas.
Figure A-3. OU-3 investigation areas near the Natural Resources District Reservoir.
Figure A-4. Previous and proposed soil sampling locations at the former North Burning Ground and Potential Landfill Area.
Figure A-5. Vapor intrusion buildings of concern for Load Line 1 TCE plume.
Figure A-6. Vapor intrusion buildings of potential concern for Atlas Missile Area TCE plume.

ACRONYMS and ABBREVIATIONS

°C	degrees Celsius
bgs	below ground surface
BLRA	Baseline Risk Assessment
CCV	continuing calibrations verification
CENWK	U.S. Army Corps of Engineers, Kansas City District
DCE	dichloroethylene
DoD	Department of Defense
DQO	Data Quality Objective
EM	Engineering Manual
FOM	Field Operations Manager
ft	feet/foot
GEO	GEO Consultants, LLC
GPS	global positioning system
ICP-OES	Inductively Coupled Argon Plasma Optical Emission Spectrometer
in.	inch(es)
ITR	independent technical review
LCS	laboratory control sample
LCSD	laboratory control spike duplicate
mg/kg	milligram(s) per kilogram
MS	matrix spike
MSD	matrix spike duplicate
NDEQ	Nebraska Department of Environmental Quality
NELAP	National Environmental Laboratory Accreditation Program
NOP	Nebraska Ordnance Plant
OU	Operable Unit
PM	Project Manager
ppbv	parts per billion (by volume)
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCP	Quality Control Plan
R	regression correlation coefficient
Rev.	Revision
RI	Remedial Investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SSHP	Site-Specific Safety and Health Plan
TCE	trichloroethene
UFP	Uniform Federal Policy
UNL	University of Nebraska-Lincoln
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WP	Work Plan

INTRODUCTION

This QAPP was prepared for a Supplemental Remedial Investigation (RI) Work Plan (WP) by GEO Consultants, LLC (GEO) for the former Nebraska Ordnance Plant (NOP) in Mead, Nebraska (Figure A-1). Woodward-Clyde and URS performed and reported on RIs at the investigation areas shown in Figures A-2 and A-3 within OU-3 (Woodward-Clyde 1997, URS 2000a). No further action was recommended for many of the investigation areas since either the analytical data were below screening values (Woodward-Clyde 1996) or a Baseline Risk Assessment (BLRA) found no risk (URS 2000b).

QAPP Worksheet #1 – Title and Approval Page

Draft QAPP, OU-3 Supplemental RI WP
Document Title

USACE, CENWK
Lead Organization

Olivia R. West, Ph.D., P.E., GEO
Preparer's Name and Organizational Affiliation

325 Kentucky Avenue, Kevil, KY 42053, 270-462-3882 (westor@geoconsultantsllc.com)
Preparer's Address, Telephone Number, and E-mail Address

June 15, 2010

Preparation Date

CENWK Project Manager: _____
Signature

Kristine Stein/CENWK/_____
Printed Name/Organization/Date

Lead Organization's Project Manager: _____
Signature

Todd Buchanan/GEO/_____
Printed Name/Organization/Date

QAPP Worksheet #2 – QAPP Identifying Information

Site Name/Project Name: Former NOP/OU-3 Supplemental RI
Site Location: Mead, Nebraska
Site Number/Code: B07NE0037
Operable Unit: OU-3
Contractor Name: GEO
Contract Number: W912DQ-10-D-3012, Delivery Order 0001
Contract Title: OU-3, Former NOP, Mead, Nebraska
Work Assignment Number (Optional): Not applicable

1. Identify guidance used to prepare QAPP:

Uniform Federal Policy (UFP)-QAPP, and USEPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS (USEPA 2002a).

2. Identify regulatory programs:

- The Comprehensive Environmental Response, Compensation, and Liability Act, and as amended by the Superfund Amendments and Reauthorization Act,
- Management Guidance for the Defense Environmental Restoration Program, (Office of the Deputy Undersecretary of Defense, 2001),
- the National Oil and Hazardous Substances Contingency Plan,
- the Resource Conservation and Recovery Act,
- the Defense Environmental Restoration Program, and
- Department of Defense (DoD) and Army Policy.

3. Indicate whether the QAPP is a generic or a project-specific QAPP.

Project Specific

4. List dates of scoping sessions that were held:

March 24, 2010, GEO presented "OU-3 Historical Review and Preliminary Approach to Supplemental RI" to CENWK, USEPA Region VII, and NDEQ. The presentation was for informational purposes only.

QAPP Worksheet #2 – QAPP Identifying Information (Continued)

The following table shows where information required in QAPPs, as specified in USEPA (2002), can be found in the QAPP worksheets.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to QAPP Worksheet #	Information provided in QAPP Worksheet
Project Management and Objectives		
2.1 Title and Approval Page	1	- Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	2	- Table of Contents - QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	3 4	- Distribution List - Project Personnel Sign-Off Sheet
2.4 Project Organization		
2.4.1 Project Organizational Chart	5	- Project Organizational Chart
2.4.2 Communication Pathways	6	- Communication Pathways
2.4.3 Personnel Responsibilities and Qualifications	7	- Personnel Responsibilities and Qualifications Table
2.4.4 Special Training Requirements and Certification	8	- Special Personnel Training Requirements Table
2.5 Project Planning/Problem Definition		
2.5.1 Project Planning (Scoping)	9	- Project Scoping Session Participants Sheet
2.5.2 Problem Definition, Site History, and Background	10	- Problem Definition, Site History, and Background

QAPP Worksheet #2 – QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to QAPP Worksheet #	Information provided in QAPP Worksheet
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	11 12	- Site-Specific Project Quality Objectives - Measurement Performance Criteria Table
2.7 Secondary Data Evaluation	13	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	14 15 16	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	17 18 19 20 21 22	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field QC Sample Summary Table - Sampling SOPs - Field Equipment Calibration, Maintenance, Testing, and Inspection Table

QAPP Worksheet #2 – QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to QAPP Worksheet #	Information provided in QAPP Worksheet
3.2 Analytical Tasks		
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3.2.2 Analytical Instrument Calibration Procedures	24	- Analytical Instrument Calibration Table
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	25	- Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table
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3.4.1 Sampling Quality Control Samples		
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3.5.1 Project Documentation and Records	29	- Project Documents and Records Table
3.5.2 Data Package Deliverables	30	- Analytical Services Table
3.5.3 Data Reporting Formats		
3.5.4 Data Handling and Management		
3.5.5 Data Tracking and Control		
Assessment/Oversight		
4.1 Assessments and Response Actions		
4.1.1 Planned Assessments	31	- Planned Project Assessments Table
4.1.2 Assessment Findings and Corrective Action Responses	32	- Assessment Findings and Corrective Actions Responses
4.2 Quality Assurance Management Reports	33	- Quality Assurance Management Reports Table
4.3 Final Project Report		

QAPP Worksheet #2 – QAPP Identifying Information (Continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Crosswalk to QAPP Worksheet #	Information provided in QAPP Worksheet
	Data Review	
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	34 35 36	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	Not applicable	

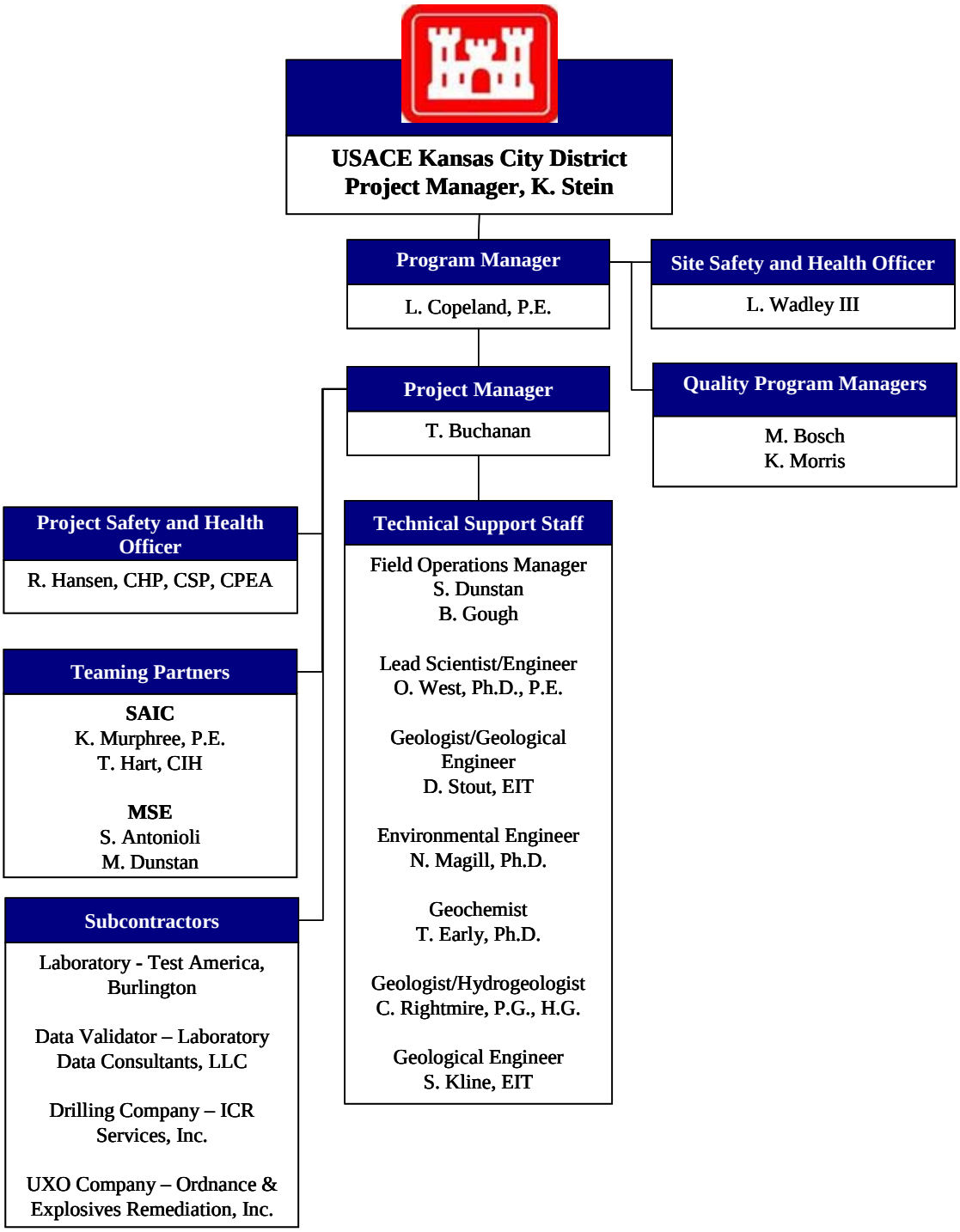
QAPP Worksheet #3 – Distribution List

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number
Kristine Stein	Project Manager	CENWK	816-389-3172	Kristine.M.Stein@usace.army.mil	
Kirk Boese	Project Engineer	CENWK	816-389-3558	Kirk.D.Boese@usace.army.mil	
Larry Copeland, P.E.	Program Manager	GEO	270-462-3882	copelandl@geoconsultantsllc.com	
Todd Buchanan	Project Manager	GEO	270-462-3882	buchanant@geoconsultantsllc.com	
Mike Bosch	Quality Program Manager	GEO	270-462-3882	boschm@geoconsultantsllc.com	
Kim Morris	Alternate Project Quality Program Manager	GEO	270-462-3882	morrisk@geoconsultantsllc.com	
Steve Dunstan	Field Operations Manager	GEO	270-462-3882	dunstans@geoconsultantsllc.com	
Sara Goff	Laboratory Project Manager	Test America Burlington	802-923-1027	Sara.Goff@testamericainc.com	

QAPP Worksheet #4 – Project Personnel Sign-Off Sheet

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read Email Receipt
Kristine Stein	CENWK Project Manager	816-389-3172		
Kirk Boese	CENWK Project Engineer	816-389-3558		
Larry Copeland, P.E.	GEO Program Manager	270-462-3882		
Todd Buchanan	GEO Project Manager	270-462-3882		
Mike Bosch	GEO Quality Program Manager	270-462-3882		
Kim Morris	GEO Alternative Quality Program Manager	270-462-3882		
Steve Dunstan	GEO Field Operations Manager	270-462-3882		
Sara Goff	Laboratory Project Manager	802-923-1027		

QAPP Worksheet #5 – Project Organizational Chart



QAPP Worksheet #6 – Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Approval for project modifications; corrective actions; delay in field work	CENWK Project Manager	Kristine Stein (CENWK)	816-389-3172	All project documentation and reports will be provided to the CENWK PM by the GEO PM.
Facilitate communications between GEO and CENWK	CENWK Project Engineer	Kirk Boese (CENWK)	816-389-3558	All project documentation and reports will be also be provided to the CENWK Project Engineer by the GEO PM.
Management of all project phases/field corrective actions related to the OU-3 Supplemental RI	Project Manager	Todd Buchanan (GEO)	270-462-3882	During the field work, the PM (or designee) will communicate daily with the Field Operations Manager via phone, fax, or email to obtain updates regarding the field activities. The PM (or designee) will notify the CENWK PM [or designee(s)] of field changes, via phone, email, or fax by close of business on the next business day.
Management of field operations	Field Operations Manager	Steve Dunstan (GEO)	406-490-3475	During the field work, the Field Operations Manager will communicate daily with the PM via phone, fax, or email to provide updates regarding field activities, including any recommendations for field modifications. During field work, the Field Operations Manager will communicate daily with the Project Safety and Health Officer and report any safety issues that arise during field operations.

QAPP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Management of contractor safety and health	Site Safety and Health Officer	Luke Wadley, III (GEO)	865-274-3540	The Site Safety and Health Officer will communicate daily with the Project Safety and Health Officer during field work to ensure that operations are conducted safely and in accordance with the SSHP (GEO 2010b). The Site Safety and Health Officer shall receive daily reports from the Project Safety and Health Officer during the field work. The Site Safety and Health Officer will then communicate such issues to the PM and with the CENWK PM (if deemed necessary by the Site Safety and Health Officer).
Field management of contractor safety and health	Project Safety and Health Officer	Randy Hansen (SAIC)	314-486-6916	The Contractor Project Safety and Health Officer will monitor field operations and communicate daily with the Contractor Field Operations Manager during the field work. The Contractor Project Safety and Health Officer will then report to the Contractor Site Safety and Health Officer any safety issues and concerns that arise during the field activities. If required, the Contractor Project Safety and Health Officer will coordinate modifications to the SSHP (GEO 2010) with the Contractor PM, Environmental Chemical Company's Health and Safety Manager, and CENWK. The Contractor Project Safety and Health Officer will communicate these changes to the SSHP to the Field Operations Manager to ensure that the changes are implemented.

QAPP Worksheet #6 – Communication Pathways (Continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Management of project quality assurance	Quality Program Manager	Mike Bosch/ Kim Morris (GEO)	270-462-3882	Corrective actions needed to address quality assurance issues, as related to field project activities, will be communicated immediately to appropriate personnel via face-to-face, telephone, or electronic means. The Contractor PM will be kept informed of these corrective actions and will be responsible for ensuring the corrective actions are implemented. To ensure that there are no conflicts of interest, the Quality PM will not report to the Contractor PM.
Management of sampling and laboratory analytical QC	Lead Scientist	Olivia West (GEO)	865-671-4401	The Lead Scientist (or designee) will review daily field documentation as related to analytical sampling to ensure that documentation is accurate and samples are being collected. The Lead Scientist (or designee) will consult with the laboratory to ensure that data received meet project needs. The Lead Scientist (or designee) will report any issues regarding analytical QC that can not be resolved with the laboratory to the PM and Quality PM.
Management of laboratory QC	Laboratory Project Manager	Sara Goff (Test America Burlington)	802-923-1027	QC issues with the samples will be communicated by the laboratory to the Lead Scientist within two business days of the occurrence. The Lead Scientist will determine if consultation with the Quality PM is necessary to resolve any issues.

QAPP Worksheet #7 – Personnel Responsibilities and Qualifications

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Kristine Stein	Project Manager	CENWK	Overall oversight of project	--
Kirk Boese	Project Engineer	CENWK	Assist CENWK PM in over-all oversight of project	--
Larry Copeland, P.E.	Program Manager	GEO	Oversight of CENWK projects for GEO	Resume in Appendix F of OU-3 Quality Control Plan (QCP) (GEO 2010c).
Todd Buchanan	Project Manager	GEO	Oversight of project for GEO	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Mike Bosch/Kim Morris	Quality Program Manager/Alternate Quality Program Managers	GEO	Ensure compliance with project Quality Control Plan (GEO 2010c). Responsible for conducting Field Technical Services Audit during field sampling	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Steve Dunstan	Field Operations Manager	GEO	Overall management of field sampling activities	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Luke Wadley III	Site Safety and Health Officer	GEO	Ensure compliance with project SSHP (GEO 2010b)	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Randy Hansen	Project Safety and Health Officer	SAIC	Assist the Site Safety Health Officer in ensuring compliance with project SSHP (GEO 2010b)	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Olivia West	Lead Scientist	GEO	Technical lead, ensure field sampling and laboratory analysis satisfy project quality objectives	Resume in Appendix F of OU-3 QCP (GEO 2010c).
Sara Goff	Laboratory Project Manager	Test America Burlington	Overall management of laboratory sampling analyses	--

QAPP Worksheet #8 – Special Personnel Training Requirements

No specialized training by GEO personnel is required.

QAPP Worksheet #9 – Project Scoping Session Participants Sheet

GEO presented a historical summary and proposed an OU-3 Supplemental RI approach to CENWK, USEPA Region VII and NDEQ on March 24, 2010. This presentation was for informational purposes only and did not include a discussion of the OU-3 Supplemental RI sampling scope.

QAPP Worksheet #10 – Problem Definition

The overall objective of the OU-3 Supplemental RI is to collect additional characterization data and conduct a BLRA for areas of potential concern (investigation area) identified after completion of the previous OU-3 RI activities (Woodward-Clyde 1997; URS 2000a; URS 2000b). OU-3 consists of a former on-site landfill and all other formerly unidentified waste disposal areas not previously identified (USEPA et al. 1991, ECC 2009a). As mentioned in the Introduction of this QAPP, and discussed in more detail in the OU-3 Supplemental RI WP (GEO 2010a), remaining investigation areas that need to be evaluated are as follows:

- Burn layers and ash were identified at the former North Burning Ground and Potential Landfill Area during previous investigations (TCT 1991; URS 2000a) and removal actions (MACTEC 2009; Kingston 2008). A sample of the burn layer contained antimony and lead [258 mg/kg and 709 mg/kg, respectively (MACTEC 2009)] that exceeded the Residential Regional Screening Levels for these metals. Data regarding the depth, areal extent/spatial distribution, and metals content of burn layers/ash at the former North Burning Ground and Potential Landfill Area are needed for a quantitative risk assessment. The results of the risk assessment will be used to determine if further action is needed to protect potential site receptors.
- Surface water samples were collected from Johnson Creek, Clear Creek and Silver Creek from 2004 through 2009 and analyzed for VOCs and explosives as part of the Groundwater Monitoring Program (ECC 2006). An analysis of the 2004 through 2009 data presented in the OU-3 Supplemental RI WP (GEO 2010a) indicates that the nature and extent of constituents detected in these creeks has been defined by the recently collected data. Thus, the revision of the BLRA for these creeks will use the data collected to date; no additional surface water sampling is proposed for the OU-3 Supplemental RI.
- Vapor intrusion of VOCs into buildings located above the existing TCE groundwater plumes was investigated in 2007 by Lockheed Martin on behalf of USEPA using indoor, sub-slab soil gas, and ambient air monitoring in several buildings (Lockheed Martin 2007). The results of the study suggest that, with the exception of one building (Unit 006, Building 101, UNL Storage), the risks are below 1:1,000,000 (10^{-6}) from vapor intrusion by TCE. This inference regarding minimal risk is based on TCE concentrations in the indoor air samples being either below detection limits or below the USEPA Regional Screening Level for Residential Air. In buildings where indoor air samples were not collected, indoor air concentrations for TCE were estimated from sub-slab soil gas samples using published attenuation factors (USEPA, 2002b). Except for Unit 006 (Building 101, UNL Storage Building), the estimated TCE indoor air concentrations were below the USEPA Regional Screening Level for Residential Air. However, the 2009 DoD guidance for vapor intrusion assessment recommends that risk assessments be conducted based on measured indoor air data rather than estimated from other environmental samples (i.e., soil gas). Thus, indoor air sampling coupled with simultaneous sub-slab soil gas sampling (also recommended in the DoD guidance) is proposed as part of the OU-3 Supplemental RI at the buildings for which indoor air samples were not collected during the Lockheed Martin/USEPA study. The air samples will be analyzed for TCE, cis-1,2-dichloroethylene (DCE), and trans-1,2-DCE based on these chemicals being most frequently detected in the groundwater at former NOP. Although vinyl chloride has not been detected in any of the groundwater samples collected from the site to date, this chemical will be included in the air sample analyses because vinyl chloride is a degradation by-product of TCE and is highly toxic.

QAPP Worksheet #11 – Project Quality Objectives/Systematic Planning Process Statements

Project quality objectives for characterizing the burn layer/ash at the former North Burning Ground and Potential Landfill are as follows:

- Soil samples need to be collected from the former North Proving Ground in the vicinity of the former burn ramparts (see Figure A-3). The burn layer during the UNL removal action (MACTEC 2009) was found in the vicinity of these ramparts. Thus, the former location of the burn ramparts is the likely area where actual burning took place. Because there is no longer any visual evidence for these ramparts, the approximate location will be based on georeferencing the aerial photograph from 1965 against the 2009 georeferenced photograph (both shown in Figure A-3).
- Soil samples need to be collected for metals analysis from the location of the trenches at the Potential Landfill Area (Figure A-3) where ash was noted in the trench logs from the previous OU-3 RI (URS 2000a).
- The soil samples will only be analyzed for metals based on the results of the burn layer analysis from MACTEC (2009).
- The detection limits of the analysis method need to be below the USEPA Regional Screening Levels (USEPA 2009) for metals in soil. The same metals analyzed during the previous OU-3 investigation will be included in the analysis of soil samples for the OU-3 Supplemental RI.
- The depth and aerial extent of the burn layer/ash are needed to evaluate the likelihood of site receptors (e.g., UNL maintenance workers, construction workers) being exposed to any risks/hazards associated with these materials. Thus, visual observations and soil core logging are essential to the proposed field investigation.

Project quality objectives for sampling to support the vapor intrusion assessment are as follows:

- Indoor air samples are needed from buildings that were included in the previous Lockheed/USEPA study from which indoor air samples were not collected. The results of the indoor air sample analyses can be more reliably used in risk assessment (DoD 2009).
- Sub-slab soil gas samples will be collected simultaneously with the indoor air samples, in accordance with DoD guidance (2009).
- Background air samples will be collected.
- The detection limits for air sample analysis method must be below the USEPA Regional Screening Levels for TCE, cis-1,2-DCE, trans-1,2-DCE and vinyl chloride in air (USEPA 2009).

QAPP Worksheet #12 – Measurement Performance Criteria

Matrix: Soil
Analytical Group: Metals (except mercury)

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Used to Assess Measurement Performance	Quality Control Sample Assesses Error for Sampling, Analysis, or both
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Precision – Overall	Relative Percent Difference ≤ 50%	Field Duplicates	Sampling & Analysis
GEO-TEC-015; also see Section3.2.3 of WP (GEO 2010a)	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Precision – Laboratory	Relative Percent Difference ≤ 20%	Laboratory Duplicates	Analysis
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Accuracy/Bias-Contamination	No target compounds ≥ Risk Level	Equipment blanks	Sampling & Analysis
Not applicable	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Accuracy/Bias-Contamination	No target compounds ≥ Risk Level	Method blanks, instrument calibration blanks, continuing calibration blanks	Analysis
GEO-TEC-015; also see Section3.2.3 of WP (GEO 2010a)	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Accuracy/Bias	Percent Recovery between 80 to 120%	Laboratory control samples (LCSs); MSs	Analysis
Not applicable	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10	Sensitivity	Method Detection Limits must be at or below Regional Screening Levels (USEPA, 2009) for Soil	Method Detection Limit studies conducted at initial method set-up and verified annually	Not applicable

QAPP Worksheet #12 – Measurement Performance Criteria (Continued)

Matrix: Soil
Analytical Group: Metals (Mercury)

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Used to Assess Measurement Performance	Quality Control Sample Assesses Error for Sampling, Analysis or both
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Precision-Overall	Relative Percent Difference ≤ 50%	Field Duplicates	Sampling & Analysis
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Precision – Laboratory	Relative Percent Difference ≤ 20%	Laboratory Duplicates	Analysis
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Accuracy/Bias-Contamination	No target compounds ≥ Risk Level	Equipment blanks	Sampling & Analysis
Not applicable	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Accuracy/Bias-Contamination	No target compounds ≥ Risk Level	Method blanks, instrument calibration blanks, continuing calibration blanks	Analysis
GEO-TEC-015; also see Section 3.2.3 of WP (GEO 2010a)	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Accuracy/Bias	Percent Recovery between 80 to120%	LCSs; MSs	Analysis
Not applicable	Method 7471A/ SOP No. BR-ME-004, Rev. 12	Sensitivity	Method Detection Limits must be at or below Regional Screening Levels (USEPA, 2009) for Soil	Method Detection Limit studies conducted at initial method set-up and verified annually	Not applicable

QAPP Worksheet #12 – Measurement Performance Criteria (Continued)

Matrix: Air
Analytical Group: VOCs (TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride)

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators	Measurement Performance Criteria	Quality Control Sample Used to Assess Measurement Performance	Quality Control Sample Assesses Error for Sampling, Analysis, or both
Section 3.2.4 of WP (GEO 2010a)	Method TO-15/ SOP No. BR-AT-004, Rev. 7	Precision-Overall	Relative Percent Difference ≤ 30%	Field Duplicates	Sampling & Analysis
Section 3.2.4 of WP (GEO 2010a)	Method TO-15/ SOP No. BR-AT-004, Rev. 7	Precision – Laboratory	Relative Percent Difference ≤ 25%	LCS duplicates	Analysis
Not applicable	Method TO-15/ SOP No. BR-AT-004, Rev. 7	Accuracy/Bias - Contamination	No target compounds ≥ Risk Level	Method blanks	Analysis
Section 3.2.4 of WP (GEO 2010a)	Method TO-15/ SOP No. BR-AT-004, Rev. 7	Accuracy/Bias	%Recovery – 70-130%	LCSs	Analysis
Not applicable	Method TO-15/ SOP No. BR-AT-004, Rev. 7	Sensitivity	Method Detection Limits must be at or below USEPA Regional Screening Levels (USEPA, 2009) for Air	Method Detection Limits studies conducted at initial method set-up and verified annually	Not applicable

QAPP Worksheet #13 – Secondary Data Criteria and Limitations

Secondary Data	Data Source	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
Weather data (during days of indoor air and sub-slab soil gas monitoring) – temperature, dew point, humidity, wind speed, wind gust, wind direction, barometric pressure, precipitation	Weather station at UNL Beef Research Feedlot (weather data available online at: http://www.wunderground.com/weatherstation/WXDailyHistory.asp?ID=KNEITHAC2	University of Nebraska – Lincoln	To evaluate the impact of outdoor weather conditions on indoor air and sub-slab soil gas data collected as part of the Vapor Intrusion investigation	None

QAPP Worksheet #14 – Summary of Project Tasks

Sampling Tasks: Soil samples will be collected from the North Burning Ground and Potential Landfill Area to evaluate risks from the potential presence of a "burn layer." Indoor air samples will be collected to evaluate risks from vapor intrusion. Description and rationale for OU-3 Supplemental RI sampling are detailed in QAPP worksheet #17 and #18.

Analysis Tasks: Metals in Soil (Method 3050A/6010B and Method 7471A), VOCs (TCE, cis-1,2-DCE, trans-1,2-DCE and vinyl chloride) in indoor air and sub-slab soil gas samples (Method T0-15).

Quality Control Tasks: The following QC samples will be analyzed: method blanks, equipment blanks (for soil samples), field duplicates, MSs for soil samples, MSDs for soil samples. All analytical methods will perform the required initial calibrations, continuing calibrations verifications (CCVs), instrument, laboratory control samples (LCSs), laboratory control sample duplicates (LCSDs), and all other applicable QC samples defined in the method.

Data Management Tasks: Analytical data will be placed in the NOP portal database.

Documentation and Records:

All samples collected will have GPS locations and depth documented in the field logbook. Other sample documentation will include chain-of-custody forms, airbills, drilling logs, and air sampling logs.

Data Packages: Data packages will be provided in Contract Laboratory Program format, and will include, but not be limited to, the following:

- Summary of field sample identifications, laboratory identifications, re-analyses, dilutions, and collection, extraction/prep, and analysis dates;
- Table of contents;
- The original Chain of Custody Record(s);
- Case narrative summarizing any problems with the analysis or the laboratory QC and the corrective action taken;
- Laboratory Certification Statement authorizing release of the sample results signed by the appropriate laboratory designee;
- Definitions of laboratory qualifiers;
- Sample condition upon receipt information;

- Summary of results;
- Summary Forms I through VIII as specified in the National Functional Guidelines for Organic and Inorganic Data Review;
- Form Is or the summary of results should indicate Method Detection Limit and Method Quantitation Limit; and
- Raw analytical data as required.

Assessment/Audit Tasks: A field technical sampling audit will be conducted by the GEO Quality Program Manager during the field work. However, because this project involves a single sampling and analysis event, GEO is not planning to conduct any audits of the laboratory. CENWK personnel have the option to conduct field and laboratory audits to ensure proper communication and awareness of the project Data Quality Objectives (DQOs). Any deficiencies noted during either field audits by GEO and/or a laboratory audit by CENWK must be addressed in a corrective action report to the auditor within seven days. If necessary, work will be suspended until a satisfactory corrective action is performed and approved by the auditor, the GEO PM and the CENWK PM (if appropriate). All audit reports and corrective action reports will be kept in the project files.

Data Review Tasks: The laboratory will perform a QC review of the data to ensure the validity of the data prior to submittal. The laboratory will perform a minimum of three levels of review to evaluate data generation and reduction. Each level of review requires evaluation of the data quality based on the results of the QC data and the professional judgment of the data reviewer. Each review will be documented using an appropriate checklist signed and dated by the reviewer. The checklist will specify the items required for review. The minimum required levels of review and the items to be checked for each review are described below.

Level I – Consists of a review of the quality of the analytical work. The analyst who performed the test and has documented training in the method and the laboratory standard analytical requirements performs the Level I review. At a minimum, this review ensures that:

- Sample preparation and analytical results information are correct;
- Appropriate SOPs were followed;
- QC samples are within established limits;
- Data transfers were verified; and
- Documentation is correct and complete.

Level II – Consists of a technical review of the quality of the analytical work. It is performed by personnel who did not perform the test and have documented training for the method and laboratory standard analytical requirements.

The purpose of this review is to provide an independent, complete peer review of the analytical data package. Level II review requires the review of all calibration data, QC sample results, and analytical results including the raw data.

Level III – Consists of a total overview of the data package by a laboratory QC officer, supervisor, or other laboratory designee with documented training on Level III review. Level III review includes the following:

- Spot check of raw data;
- Review of manual integrations and calculations;
- Review of the sample receipt information; and
- Final report verification to ensure compliance with project-specific requirements.

Any errors will be corrected and documented. The Level III reviewer is responsible for final approval of the applicable Laboratory Information Management System. Each level of review will be performed by a different individual. The percentage of data reviewed for each of the three levels will be specified by standard laboratory procedures. In addition to the three levels of review, the laboratory Quality Assurance (QA) department will review the reporting process for at least 10% of the data produced by the laboratory.

The GEO Lead Scientist will conduct a review of the analytical data using the automated review tools built into the Project Database (https://portal.synectics.net) and determine whether DQOs have been met and data can be used for quantitative BLRA to be conducted as part of the OU-3 Supplemental RI. In addition, the entire data package will be subjected to a full data validation by a third party (i.e., an individual from a laboratory or data validation company not involved in the sample analyses). The data validation report will be included in the OU-3 Supplemental RI report.

Laboratory Documents and Certifications:

The National Environmental Laboratory Accreditation Program (NELAP) certification for the contract laboratory can be found in Appendix F of the WP (GEO 2010a).

QAPP Worksheet #15 – Reference Limits and Evaluation Table

Matrix: Soil
Analytical Group: Metals

Analyte	Chemical Abstract Service	Residential Regional Screening Level for Soil (USEPA 2009) (mg/kg)	Industrial Regional Screening Level for Soil (USEPA 2009) (mg/kg)	Laboratory Method Detection Limit (mg/kg)	Laboratory Quantitation Limit (mg/kg)
Aluminum	7429-90-5	77,000	990,000	5.6	20.0
Antimony	7440-36-0	31	410	0.33	6.0
Arsenic	7440-38-2	0.39	1.6	0.40	1.0
Barium	7440-39-3	15,000	190,000	0.44	20.0
Beryllium	7440-41-7	160	2000	0.052	0.50
Cadmium	7440-43-9	70	800	0.057	0.50
Calcium	7440-70-2	GRAS	GRAS	12	500.0
Chromium [1]	7440-47-3	0.29	5.6	0.080	1.0
Cobalt	7440-48-4	23	300	0.075	5.0
Copper	7440-50-8	3100	41,000	0.21	2.5
Iron	7439-89-6	55,000	720,000	2.7	20.0
Lead	7439-92-1	400	800	0.35	1.0
Magnesium	7439-95-4	GRAS	GRAS	4.9	500.0
Manganese	7439-96-5	1800	2300	0.024	1.5
Mercury	7439-97-6	5.6	34	0.0070	0.034
Nickel	7440-02-0	1500	20,000	0.13	4.0
Potassium	7440-09-7	GRAS	GRAS	20	500.0
Selenium	7782-49-2	390	5100	0.59	3.5
Silver	7440-22-4	390	5100	0.19	1.0
Sodium	7440-23-5	GRAS	GRAS	5.1	500.0
Thallium	7440-28-0	None	None	0.28	2.5
Vanadium	7440-62-2	5.5	72	0.077	5.0
Zinc	7440-66-6	23,000	310,000	0.094	2.0

[1] Because there are no Regional Screening Levels for Total Chromium, the Regional Screening Levels for Chromium (VI) are shown.

QAPP Worksheet #15 – Reference Limits and Evaluation Table (Continued)

Matrix: Air
Analytical Group: VOCs (TCE, cis-1,2,-DCE, trans-1,2,-DCE, vinyl chloride)

Analyte	Chemical Abstract Service	Residential Regional Screening Level for Air (USEPA 2009) (ppbv)	Industrial Regional Screening Level for Air (USEPA 2009) (ppbv)	Laboratory Method Detection Limit (ppbv)	Laboratory Quantitation Limit (ppbv)
cis-1,2- DCE	156-59-2	15.89	65.59	0.050	0.20
trans-1,2-DCE	156-60-5	15.89	65.59	0.050	0.20
Trichloroethene	79-01-6	0.22	1.14	0.014	0.20
Vinyl Chloride	75-01-4	0.06	1.10	0.025	0.20

QAPP Worksheet #16 – Project Schedule / Timeline Table

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of OU-3 Preliminary-Draft Supplemental RI WP	GEO	January 15, 2010	April 30, 2010	Preliminary-Draft WP	April 30, 2010
Revision, Preparation of Draft WP	GEO,CENWK	May 15, 2010	June 21, 2010	Draft WP	June 21, 2010
Regulatory review of Draft WP	USEPA, NDEQ	June 22, 2010	July 22, 2010	Draft WP Comments	July 22, 2010
Revision, Preparation of Draft Final WP	GEO, CENWK	July 23, 2010	August 30, 2010	Draft WP	August 30, 2010
Regulatory review of Draft-Final WP	USEPA, NDEQ	August 31, 2010	October 29, 2010	Regulatory concurrence of comment resolution	October 29, 2010
Approval of Final WP	USEPA, NDEQ	October 29, 2010	October 30, 2010	Final WP	October 30, 2010
Field Work and Sample Analysis		To Be Determined	To Be Determined	Field Sampling and Analysis	To Be Determined
Data validation and analysis, Report preparation		To Be Determined	To Be Determined	Draft Report	To Be Determined

QAPP Worksheet #17 – Sampling Design

Figure A-4 shows the proposed soil sampling locations at the former North Burning Ground and the Potential Landfill Area for characterizing the burn layers/ash. Rationale for each location found in QAPP Worksheet #18. Soil samples will be collected from the following depths: 0 to 0.5 ft, 0.5 ft to 4 ft, 4 to 8 ft. In the risk assessment, data from 0 to 0.5 ft soil samples will be composited in estimating the exposure point concentration for "surface soil," while data from the 0.5 to 4 ft and 4 to 8 ft intervals will be composited to estimate the exposure point concentration for "subsurface soil."

Figures A-5 and A-6 show the buildings from which indoor air and sub-slab soil samples will be collected as part of the OU-3 Supplemental RI. The buildings were selected based on the results of the Lockheed/USEPA Vapor Intrusion Assessment (2007). The rationale for sampling these buildings are provided in QAPP Worksheet #18 while the rationale for NOT sampling the rest of the buildings are listed below (more details in the WP, GEO 2010a):

Building Location	Rationale for not including this building in the OU-3 Supplemental RI
Unit 002, Residence/ UNL Swine Farm manager	TCE was not detected during real-time air monitoring of indoor air within the building, in sub-slab soil gas and indoor air samples. The detection/reporting limits for all analyses were below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).
Unit 004, Industrial/ Entomology Building	TCE was not detected during real-time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (USEPA 2009). TCE in the sub-slab soil gas sample was at 0.018 ppbv, less 10% of the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009). Comparison of the sub-slab soil gas TCE against the Residential Air Screening Level is very conservative for the following reasons: (1) the estimated indoor air concentration is approximately 1/10th of the sub-slab soil gas level (USEPA 2002a), and (2) the building's use as UNL's Entomology Building is comparable to an industrial rather than a residential scenario.
Unit 005, Industrial/ UNL Dairy Science Building	TCE was not detected during real-time air monitoring of indoor air. TCE was not detected in the sub-slab soil gas sample. The detection limits for both the real-time air monitoring system and analysis of the sub-slab soil gas sample are below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).
Unit 007, Industrial/ Agronomy Building	TCE was not detected during real-time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009). TCE in the sub-slab soil gas sample was at 0.072 ppbv, less 40% of the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009). Comparison of the sub-slab soil gas TCE against the Residential Air Screening Level is very conservative for the following reasons: (1) the estimated indoor air concentration is approximately 1/10th of the sub-slab soil gas level (USEPA 2002b), and (2) the building's use as UNL's Agronomy Building is comparable to an industrial rather than a residential scenario.

Building Location	Rationale for not including this building in the OU-3 Supplemental RI
Unit 008, Industrial/Private-Four Winds Winery	TCE was detected during real time air monitoring of indoor air (0.060 ppbv), in sub-slab soil gas sample (0.021 ppbv), and in indoor air samples (0.0083 ppbv) but at levels that are below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).
Unit 009, Residential/Private	TCE was detected in the indoor air sample at 0.015 ppbv, less than 10% of the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).
Unit 010, Residential/Private	TCE was not detected during real time air monitoring of indoor air. The detection limit for the real-time air monitoring system is below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009). TCE was detected in the sub-slab soil gas (0.027 ppbv) and indoor air samples (0.01 to 0.012 ppbv); all these levels are less than 15% of the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).
Unit 012, Industrial/ UNL Building	TCE was not detected during real-time air monitoring of indoor air. TCE was not detected in the sub-slab soil gas sample. The detection limits for both the real-time air monitoring system and analysis of the sub-slab soil gas sample are below the Regional Screening Level for Residential Air (0.22 ppbv, USEPA 2009).

QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements

Soil sampling at the former North Burning Ground and Potential Landfill Area. Sampling locations identification numbers are shown in Figure A-4.

Sampling Location / Identification Number	**Depth** (ft bgs)	**Analytical Group**	**Number of Samples** (identify field duplicates)	**Sampling SOP or Procedure**	**Rationale for Sampling Location**
01 through 09	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval. Field duplicates to be collected from all depth intervals at one of these boreholes.	GEO-TEC-015 and Section 3.2.3 of WP	These boreholes will be located in the vicinity of the trenches excavated during the OU-3 RI where ash was noted in the trench logs (URS 2000a).
10 through 11	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval.	GEO-TEC-015 and Section 3.2.3 of WP	These boreholes will be located near the western wall of the OU-3 removal action excavation where a burn layer was observed (Kingston 2008).
12	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval. Field duplicates to be collected from all depth intervals at this borehole.	GEO-TEC-015 and Section 3.2.3 of WP	This borehole will be located where the burn layer was observed during the UNL removal action (MACTEC 2009).
13 through 15	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval.	GEO-TEC-015 and Section 3.2.3 of WP	These boreholes will be located in the vicinity of the burn ramparts (Figure 3).
16 through 18	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval.	GEO-TEC-015 and Section 3.2.3 of WP	These boreholes will be located in behind the burn ramparts (Figure A-3). There is limited sampling coverage from previous investigation in this area.
19 through 20	0 to 0.5 0.5 to 4 4 to 8	Metals	One per location and depth interval.	GEO-TEC-015 and Section 3.2.3 of WP	These boreholes will be located in west of the burn ramparts (Figure A-3). There is limited sampling coverage from previous investigation in this area.

QAPP Worksheet #18 – Sampling Locations and Methods/SOP Requirements Table (Continued)

Air sampling will be conducted at the following locations. Maps of these buildings can be found in Figures A-5 and A-6.

Building	Location within Building	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP or Procedure	Rationale for Sampling Location
Unit 001 Residential/ UNL Dairy Farm Manager	Indoor air and sub-slab soil gas	VOCs *TCE* *Cis-1,2-DCE* *Trans-1,2-DCE* *Vinyl chloride*	Two indoor air and one sub-slab location. Field duplicates to be collected from all locations within this building.	Section 3.2.4 of WP	TCE during real-time monitoring (0.27 ppbv) was above the Regional Screening level for Residential Air (0.22 pbbv; USEPA 2009). However, TCE in sub-slab soil gas (0.024 ppbv) and indoor air samples (0.12 ppbv) was below the Residential Air Screening level. Although the sub-slab and indoor air samples are considered more definitive than real-time air monitoring, additional collection of data is recommended to reduce uncertainty in the assessment.
Unit 003 Industrial/ UNL Feed Mill	Indoor air and sub-slab soil gas	VOCs *TCE* *Cis-1,2-DCE* *Trans-1,2-DCE* *Vinyl chloride*	Two indoor air and one sub-slab location.	Section 3.2.4 of WP	The only available data for this building is a sub-slab soil gas sample, where TCE was not detected. Because there is no indoor air sample (screen or definitive) for this location, additional collection of data is recommended.
Unit 006 Industrial/ UNL Storage	Indoor air and sub-slab soil gas	VOCs *TCE* *Cis-1,2-DCE* *Trans-1,2-DCE* *Vinyl chloride*	Two indoor air and one sub-slab location.	Section 3.2.4 of WP	TCE concentration during real-time air monitoring was below the Industrial Regional Screening Level (1.14 ppbv; USEPA 2009) but above the Residential Regional Screening Level (0.22 ppbv; USEPA 2009). The maximum TCE concentration in the sub-slab soil gas was 190 ppbv; the indoor air concentration estimated from this value is 19 ppbv and exceeds the Industrial Regional Screening Level. Definitive indoor air samples have not been collected from this building; it is recommended that these samples be collected and data be used in a risk assessment that accounts for use of the building as storage (i.e., reduced hours of exposure when compared to the default assumption for industrial workers).

Building	Location within Building	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP or Procedure	Rationale for Sampling Location
Unit 011 Industrial/AFE Fire Shop	Indoor air and sub-slab soil gas	VOCs *TCE* *Cis-1,2-DCE* *Trans-1,2-DCE* *Vinyl chloride*	Two indoor air and one sub-slab location.	Section 3.2.4 of WP	Only a sub-slab soil gas sample was collected from this building. TCE was detected at 0.54 ppbv in this sample; the estimated indoor air concentration from this value is 0.054 ppbv using the recommended attenuation factor from USEPA (2002b). The estimated indoor air concentration is below the Regional Screening Level for Residential Air (0.22 ppbv; USEPA 2009). However, risk assessments based on indoor air data are more reliable (DoD 2009). It is recommended that indoor air samples coupled with sub-slab soil gas be collected from this building.
Background locations	Not applicable	VOCs *TCE* *Cis-1,2-DCE* *Trans-1,2-DCE* *Vinyl chloride*	Two outdoor locations.	Section 3.2.4 of WP	Background air sampling is recommended for Vapor Intrusion Assessments.

QAPP Worksheet #19 – Analytical SOP Requirements

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method / SOP Reference	Containers Type (Number)	Preservation Requirements	Maximum Holding Time
Soil	Metals	Per method	Method 6010B/ SOP No. BR-ME-005, Rev. 11; Method 3050A/ SOP No. BR-ME-011, Rev. 10 Method 7471A (Mercury)/ SOP No. BR-ME-004, Rev. 12	4 ounce glass jar (75)	4°C ± 2	180 days from collection 28 days from collection (for Method 7471A)
Ambient Air	VOCs *TCE* *cis-1,2-DCE* *trans-1,2-DCE* *Vinyl chloride*	Low Level	Method TO-15/ SOP No. BR-AT-004, Rev. 7	6 Liter Summa® Canister (14)	None	30 days from collection

QAPP Worksheet #20 – Field Quality Control Sample Summary

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSD pairs	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil	Metals	60 *20 boring locations, 3 depth intervals*	1 per 10 (6)	1 per 20 (3 pairs)	0	1 per sampling day (estimate 3)	Not applicable[1]	75
Air	VOCs TCE cis-1,2-DCE Trans-1,2,-DCE Vinyl chloride	Two outdoor background locations Four buildings, *Each building two indoor air, one sub-slab soil gas*	At one building: one indoor air and one sub-slab soil gas sampling location	Not applicable	0	Not applicable	Not applicable[1]	16

[1]Because this is a one-time sampling event, performance testing samples will not be required.

QAPP Worksheet #21 – Project Sampling SOP References

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
GEO-TEC-006	Sample Chain of Custody, Revision 3	GEO	Chain of Custody forms in Appendix C of the WP (GEO 2010a)	N	
GEO-TEC-010	Equipment Cleaning and Decontamination, Revision 4	GEO	See Section 8.1 of GEO-TEC-010	N	
GEO-TEC-015	Subsurface Soil Sampling, Revision 1	GEO	See Section 6.2 of SOP of GEO-TEC-015	Y	Also see Section 3.2.3 of WP
BR-AT-004r7_TO15	Determination of VOCs in Ambient Air USEPA Compendium Methods TO15 and TO15	Test America Burlington	See Section 6.1 of SOP of BR-AT-004r7_TO15	N	
BR-ME-004 r12_7471	Mercury by Cold Vapor Atomic Absorption (SW-846 7471A)	Test America Burlington	See Section 6.0 of SOP of BR-ME-004 r12_7471	N	
BR-ME-005r11_6010	Metals by ICP-OES (SW-846 Method 6010B)	Test America Burlington	See Section 6.0 of SOP of BR-ME-005r11_6010	N	
BE-MR-011 r10_3050	Acid Digestion of Sediments, Sludges and Soils (SW-846 3050A)	Test America Burlington	See Section 6.0 of SOP of BR-ME-005r11_6010	N	

QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection Table

The only field equipment requiring field calibration is the photoionization detector which will be calibrated daily per the instructions in the manufacturer's manual. Field equipment associated with the collection of indoor air and sub-slab soil gas samples will be obtained from the laboratory and will be pre-calibrated and certified.

QAPP Worksheet #23 – Analytical SOP References

Reference Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SOP No. BR-ME-005	Metals by ICP-OES (SW-846 Method 6010B), March 5, 2010, Rev. 11 [1]	Definitive	Metals	ICP-OES	Test America Burlington	N
SOP No. BR-ME-015	Mercury by Cold Vapor Atomic Absorption (SW-846 7471A), March 5, 2010, Rev. 12	Definitive	Metals (Mercury)	Leeman Labs Hydra Atomic Absorption Spectrometer	Test America Burlington	N
SOP No. BR-AT-004	Determination of VOCs in Ambient Air USEPA Compendium Method TO14 and TO15, Sept. 25, 2009, Rev. 7	Definitive	VOCs *TCE* *cis-1,2-DCE* *trans-1,2-DCE* *vinyl chloride*	Gas chromatograph (Agilent 6890 or equivalent)/Mass Spectrometer (Agilent 5963 or 5972 MSD or equivalent)	Test America Burlington	N

ICP-OES—Inductively Coupled Argon Plasma Optical Emission Spectrometer, Thermo Electron Corporation, ICAP Duo 6500 or equivalent
SOP— Standard Operating Procedure
[1] Prior to analysis, samples will be prepared/digested by SOP No. BR-ME-011, March 22, 2010, Rev. 10, Acid Digestion of Sediments, Sludges and Soils (SW-846 3050A)

QAPP Worksheet #24 – Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
ICP-OES; Cold Vapor Atomic Absorption spectrometer	Calibration curve prepared by regression on calibration data consisting of instrument response versus standard concentrations [1]	Daily initial calibration prior to sample analysis	R > 0.995 [2]	Correct problem and repeat initial calibration	Analyst	SOP No. BR-ME-005; SOP No. Br-ME-015
Gas chromatograph / mass spectometer	Relative response factors derived from calibration data consisting of relative response versus standard concentrations [1]	Before sample analysis; whenever instrument operating conditions have change or a new column is installed	See SOP	Correct problem and repeat initial calibration	Analyst	SOP No. BR-AT-004

ICP-OES—Inductively Coupled Argon Plasma Optical Emission Spectrometer
R—regression correlation coefficient
SOP—Standard Operating Procedure
[1] Procedures for analysis of calibration check standards and acceptance criteria are in the laboratory SOPs.
[2] R = regression correlation coefficient

QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Details regarding analytical instrument and equipment maintenance can be found in the laboratory's SOP. The laboratory used will be: Test America, 30 Community Dr, Suite 11, South Burlington, Vermont 05403.

QAPP Worksheet #26 – Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): *Steve Dunstan/GEO and field crew (to be determined)*

Sample Packaging (Personnel/Organization): *Steve Dunstan/GEO and field crew (to be determined)*

Coordination of Shipment (Personnel/Organization): *Steve Dunstan/GEO and field crew (to be determined); Sara Goff/Test America Burlington*

Type of Shipment/Carrier: *Soil samples shipped in coolers; Summa® canister samples shipped in cardboard boxes/Federal Express*

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): *Sara Goff/Test America Burlington*

Sample Custody and Storage (Personnel/Organization): *Sara Goff/Test America Burlington*

Sample Preparation (Personnel/Organization): *(To be determined)/ Test America Burlington*

Sample Determinative Analysis (Personnel/Organization): *(To be determined)/ Test America Burlington*

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): *Metals (driven by holding time for mercury) – 28 days; VOCs in air – 30 days*

Sample Extract/Digestate Storage (No. of days from extraction/digestion): *Metals –30 days*

Biological Sample Storage (No. of days from sample collection): *Not applicable*

SAMPLE DISPOSAL

Personnel/Organization: (To be determined)/Test America Burlington

Number of Days from Analysis: 60

QAPP Worksheet #27 – Sample Custody

Sample custody procedures are described Section 3.2.6, Sample Labeling and Custody Procedures, in the WP (GEO 2010a) and GEO-TEC-006 Revision 3 *Sample Chain of Custody*.

QAPP Worksheet #28 – Quality Control Samples

Matrix: Soil
Analytical Group: Metals (except Mercury)
Analytical Method / SOP Reference: Method 6010B/SOP No. BR-ME-005, Rev. 11 (Sample digestion by Method 3050A/SOP No. BR-ME-011, Rev. 10)

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1/Digestion batch of 20 or fewer samples	No target compounds > Risk Level	Correct problem, redigest and re-analyze Method Blank and associated samples	Analyst/Section Supervisor	Accuracy/Bias – Contamination	No target compounds > Risk Level
LCS	1/Digestion batch of 20 or fewer samples	Percent Recovery: 80-120%	Correct problem, redigest and reanalyze LCS, Method Blank and associated samples for failed analytes if sufficient sample volume is available	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
MS	1/20 field samples	Percent Recovery: 80-120%	Evaluate data to determine if outage is related to analytical error or matrix effect	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
MSD	1/20 field samples	Percent Recovery: 80-120%	Evaluate data to determine if outage is related to analytical error or matrix effect	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
Field duplicate	1/10 field samples	Relative percent difference ≤ 50%	Evaluate data to determine source of difference between results	Analyst/Section Supervisor	Precision	Relative percent difference ≤ 50%
Laboratory duplicate	1/Digestion batch of 20 or fewer samples	Relative percent difference ≤ 20%	Evaluate data to determine source of difference between results	Analyst/Section Supervisor	Precision	Relative percent difference ≤ 20%
Serial dilution	Each digestion batch	5 x dilution within ±10% of original sample result	Perform post-digestion spike	Analyst/Section Supervisor	Accuracy/Bias	5 x dilution within ±10% of original sample result
Post-digestion spike	When dilution test fails	Percent Recovery: 75-125%	Flag data	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 75-125%

QAPP Worksheet #28 – Quality Control Samples (Continued)

Matrix: Soil
Analytical Group: Metals (Mercury)
Analytical Method / SOP Reference: Method 7471A/SOP No. BR-ME-015, Rev. 12

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1/Digestion batch of 20 or fewer samples	No target compounds > Risk Level	Correct problem, redigest and re-analyze Method Blank and associated samples	Analyst/Section Supervisor	Accuracy/Bias – Contamination	No target compounds > Risk Level
LCS	1/Digestion batch of 20 or fewer samples	Percent Recovery: 85-115%	Correct problem, redigest and reanalyze LCS, Method Blank and associated samples for failed analytes if sufficient sample volume is available	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
MS	1/20 field samples	Percent Recovery: 85-115%	Evaluate data to determine if outage is related to analytical error or matrix effect	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
MSD	1/20 field samples	Percent Recovery: 85-115%	Evaluate data to determine if outage is related to analytical error or matrix effect	Analyst/Section Supervisor	Accuracy/Bias	Percent Recovery: 80-120%
Field duplicate	1/10 field samples	Relative percent difference ≤ 50%	Evaluate data to determine source of difference between results	Analyst/Section Supervisor	Precision	Relative percent difference ≤ 50%
Laboratory duplicate	1/ Batch of 20 or fewer samples	Relative percent difference ≤ 20%	Evaluate data to determine source of difference between results	Analyst/Section Supervisor	Precision	Relative percent difference ≤ 20%

QAPP Worksheet #28 – Quality Control Samples (Continued)

Matrix: Air
Analytical Group: VOCs (TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride)
Analytical Method / SOP Reference: Method TO-15/SOP No. BR-AT-004, Rev. 7

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Method Blank	1/Digestion batch of 20 or fewer samples	No target compounds > Risk Level	Reanalyze along with associated samples, unless detects for same compounds found in field samples are greater than 10X the concentration found in the blank	Analyst/Section Supervisor	Accuracy/Bias – Contamination	No target compounds > Risk Level
LCS	1/ batch of 20 or fewer samples	%Recovery: 70-130%	Reanalyze LCS, LCSD, re-prep and reanalyze all associated samples if sufficient sample volume is available. If corrective action not successful, initiate nonconformance report and qualify sample results	Analyst/Section Supervisor	Accuracy/Bias	%Recovery: 70-130%
LCSD	1/ batch of 20 or fewer samples	%Recovery: 70-130%	Reanalyze LCS, LCSD, re-prep and reanalyze all associated samples if sufficient sample volume is available. If corrective action not successful, initiate nonconformance report and qualify sample results	Analyst/Section Supervisor	Accuracy/Bias	%Recovery: 70-130%
Field duplicate	2 (1 indoor air location, 1 sub-slab soil gas location)	Relative percent difference ≤ 25%	Evaluate data to determine source of difference between results	Analyst/Section Supervisor	Precision	Relative percent difference ≤ 50%

QAPP Worksheet #29 – Project Documents and Records

Adapted from Draft Final Site-Wide WP, Support Services, former NOP, Mead, Nebraska, Attachment 2: QAPP (ECC 2009).

Sample Collection Documents and Records	On-Site Analysis Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records
• *Site-Wide SAP(ECC 2009c)* • *Sampling locations (boreholes, indoor air, and sub-slab soil gas) from GPS receiver* • *Drilling logs* • *Air sample collection logs (includes meteorological data from the field)* • *Identification of QC samples* • *Chain-of-custody records for samples* • *Airbills* • *Air sample collection logs* • *Communication logs* • *Corrective action reports* • *Documentation of corrective action reports* • *Documentation of deviation from methods* • *Documentation of internal QA review*	*None (no on-site analysis required)*	• *Chain of Custody records for samples* • *Sample receipt forms and sample tracking forms* • *Preparation and analysis forms and/or logbooks* • *Tabulated data summary forms and raw data for field samples, standards, QC checks and QC samples* • *Case narrative* • *Sample chronology (time of receipt, extraction and analysis)* • *Identification of QC samples* • *Communication logs (including telephone logs and electronic mail)* • *Corrective action reports* • *Definition of laboratory qualifiers* • *Documentation of corrective action results* • *Electronic data deliverables* • *Instrument calibration reports* • *Laboratory name* • *Laboratory sample identification numbers* • *Reporting forms, completed with actual results* • *Signatures for laboratory sign-off (e.g., laboratory QA manager)* • *Standards traceability records* • *Initial precision and accuracy tests*	• *ADR reports* • *Data validation reports* • *Communication logs (including telephone and electronic mail)* • *Corrective action reports* • *Laboratory assessments* • *Laboratory QA plan* • *Method Detection Limits study information* • *NELAP accreditation* • *Site-Wide Data Management Plan (ECC 2009b)* • *Project Database* (https://portal.synectics.net)

QAPP Worksheet #30 – Analytical Services

Matrix	Analytical Group	Concentration Level	Sample Locations	Analytical SOP	Data Package Turnaround Time	Laboratory	Backup Laboratory / Organization (name and address, contact person and telephone number)
Soil	Metals	Range as specified in Analytical SOP	See Figure 2-1	SOP No. BR-ME-011, Rev. 10; SOP No. BR-ME-005, Rev. 11; SOP No. BR-ME-004, Rev. 12	45 days	Test America, Burlington	To be determined
Air in 6 liter Summa® Canister	VOCs *TCE* *cis-1,2-DCE* *trans-1,2-DCE* *vinyl chloride*	Low	See Figure 2-2 and 2-3	SOP No. BR-AT-004, Rev. 7	45 days	Test America, Burlington	To be determined

QAPP Worksheet #31 – Planned Project Assessments

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Action (title and organizational affiliation)
Field Technical Sampling Audit	Once	Internal	GEO	Mike Bosch, Quality Program Manager (GEO)	Steve Dunstan, Field Operations Manager (GEO)	Steve Dunstan, Field Operations Manager (GEO)	Mike Bosch, Quality Program Manager (GEO) Todd Buchanan, PM (GEO)

QAPP Worksheet #32 – Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Technical Sampling Audit	Written Report	Todd Buchanan, GEO Project Manager Larry Copeland, P.E., GEO Program Manager Kristine Stein, CENWK Project Manager Kirk Boese, CENWK Project Engineer	One week from completion of audit	Corrective Action Plan	Kristine Stein, CENWK Project Manager Kirk Boese, CENWK Project Engineer	One week

QAPP Worksheet #33 – Quality Assurance Management Reports

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Data validation report	Once	Approximately 60 days after receipt of data package; Also to be included as an appendix to the Final OU-3 Supplemental RI report	Third party data validator (To be determined)	Todd Buchanan Project Manager (GEO) Kristine Stein, CENWK Project Manager Kirk Boese, CENWK Project Engineer

QAPP Worksheet #34 – Verification (Step I) Process

Adapted from Draft Final Site-Wide WP, Support Services, former NOP, Mead, Nebraska, Attachment 2: QAPP (ECC 2009).

Verification Input	Description	Internal/ External	Responsible for Verification (name, organization)
Chain-of-Custody	Chain-of-Custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the Chain-of-Custody form will be initialed by the reviewer, a copy of the form will be retained in the project file, and the original and remaining copies will be taped inside the cooler for shipment.	Internal/External	Steve Dunstan, Field Operations Manager (GEO) or designee Sara Goff, Laboratory PM or designee (Test America Burlington)
Field Technical Sampling Audit Report	Upon completion of an audit report, a copy will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be to the audit report in the project file. At the beginning of each day, and at the completion of the site work, site file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the GEO PM will be notified to ensure action is taken.	Internal	Mike Bosch, Quality Program Manager (GEO) or designee
Field Notes	Field notes will be reviewed internally and placed in the project file. A copy of the field notes will be attached to the OU-3 Supplemental RI report.	Internal	Steve Dunstan, Field Operations Manager (GEO) or designee
Analytical Data Package	All analytical data packages will be verified internally by the laboratory performing the work for completeness prior to submittal. The laboratory shall complete the appropriate form documenting the organization and complete contents of each data package.	External	Sara Goff, Laboratory PM (Test America Burlington)
Quality Control Summary Report	A summary of all QC sample results will be verified for completeness upon receipt of data packages from the laboratory.	Internal	Olivia West, Lead Scientist (GEO) or designee

QAPP Worksheet #35 – Validation (Steps IIa and IIb) Process

Adapted from Draft Final Site-Wide WP, Support Services, former NOP, Mead, Nebraska, Attachment 2: QAPP (ECC, 2009).

Step IIa / IIb	Validation Input	Description	Responsible for Validation (name, organization)
IIa	Project and field documents	Chain-of-Custody, sample receipt forms, case narratives, communication logs, and corrective action forms will be reviewed to ensure that all samples were collected, transported, and analyzed for the requested parameters, and the laboratory used appropriate analytical methods.	Steve Dunstan, Field Operations Manager (GEO) Olivia West, Lead Scientist (GEO)
IIa/IIb	QC summary forms, Raw data	Full validation. In addition to all project and field documentation validation requirements, all QC sample results will be evaluated against the method quality criteria and the data will be flagged with data qualifiers, accordingly. Raw data will be reviewed, calculations will be checked, and summary forms will be verified for accuracy.	Tim Fitzpatrick, Laboratory Data Consultants, Inc.

QAPP Worksheet #36 – Validation (Steps IIa and IIb) Summary

Adapted from *Draft Final Site-Wide WP, Support Services, former NOP, Mead, Nebraska, Attachment 2: QAPP* (ECC, 2009).

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator (title and organizational affiliation)
IIa/IIb	Soil	Metals	QAPP criteria, SW-846 Methodology, Mead Validation Guidelines	Laboratory Data Consultants, Inc.
IIa/IIb	Air/Soil Gas	VOCs TCE, cis-1,2-DCE, trans-1,2-DCE, vinyl chloride	QAPP criteria, TO-15, Mead Validation Guidelines	Laboratory Data Consultants, Inc.

DCE—dichloroethylene
TCE—trichloroethene
VOC—volatile organic compound

QAPP Worksheet #37 – Usability Assessment

Adapted from Draft Final Site-Wide WP, Support Services, former NOP, Mead, Nebraska, Attachment 2: QAPP (ECC 2009).

Assessment of Measurement Quality Objectives for Chemical Data

Precision:

Precision for sample data will be calculated by evaluating data from field and laboratory duplicates, and LCS/LCSD and, if analyzed, MS/MSD pairs as follows:

- Tabulate duplicate data and calculate the absolute value difference, average, and relative percent difference as shown below for each duplicate pair:

$$RPD = \frac{|x_1 - x_2|}{(x_1 + x_2)/2} \times 100$$

  Where:

  x_1 = concentration of Sample 1of duplicate pair

  x_2 = concentration of Sample 2 of duplicate pair

  RPDs will not be calculated in cases where one analyte of the duplicate pair was reported as non-detect.

- Qualitatively evaluate the significance of data that fall outside the project goals for precision. Usability of data outside of project goals for precision is dependent on the degree of QC exceedance, whether or not there is a potential high or low sample result bias, potential field heterogeneity in chemical distribution (applies to field soil samples), whether or not associated sample results are significant compared to screening levels, and if the sample is critical to the investigation findings. If data quality problems arise, the analytical laboratory will be notified for corrective action, as appropriate.

Accuracy:

Accuracy for sample data will be calculated by evaluating data from blanks and QC samples as described below:

Blanks

- Tabulate the data from the blank samples.
- Identify any blank samples in which chemicals are detected
- If contaminants are detected in the blanks, those compounds detected in associated environmental samples at less than five times the blank value (less than ten times the blank value for common laboratory contaminants) will be qualified as not detected.

Spikes

The procedure for assessing MS/MSD (if analyzed), and surrogate spike samples are as follows:

- Tabulate spike sample data and calculate the percent recovery as shown below for each sample.

$$Percent\ Recovery\,(\%R) = \frac{T - X}{A} \times 100$$

Where:

T = total concentration found in spiked sample

X = original concentration in sample matrix prior to spiking

A = actual spike concentration added to sample

- Qualitatively evaluate the significance of data that fall outside the project goals for accuracy. Usability of data outside project goals for accuracy is dependent on the degree of QC exceedance, whether or not there is a potential for high or low sample result bias, and whether or not associated sample results are significant when compared to screening levels.

Representativeness:

The representativeness of data will be qualitatively assessed by evaluating whether or not sample collection and analytical procedures described in the SAP and the WP were followed.

Completeness:

Completeness calculations will use only verified/validated data (levels as indicated in Worksheet #36). Data that are qualified as rejected (R) will be counted against completeness criteria unless acceptable data are present. QC parameters evaluated to assess completeness include holding times, surrogates, LCS/LCSD (and, if analyzed, MS/MSD) recoveries and RPDs, and field duplicate RPDs. Sample results that do not meet relevant criteria due to substantiated matrix effects, and/or are re-analyzed past holding time due to QC corrective actions and/or are "J" qualified because values are below the reporting limit will be considered usable and will not count against the completeness assessment.

Comparability:

The comparability evaluation will include a qualitative assessment of analytical techniques, data quality, and sample design as compared to previous investigations (e.g., OU-3 RI as documented in Woodward-Clyde 1997, URS 2000, USEPA Vapor Intrusion Study 2007). Specific items to be evaluated include sampling and analytical method equivalency, preservation methods, detection limits, equivalent laboratory facilities and personnel, QA/QC programs, DQOs, and precision and accuracy estimates. If the above factors are equivalent, the data sets will be considered comparable.

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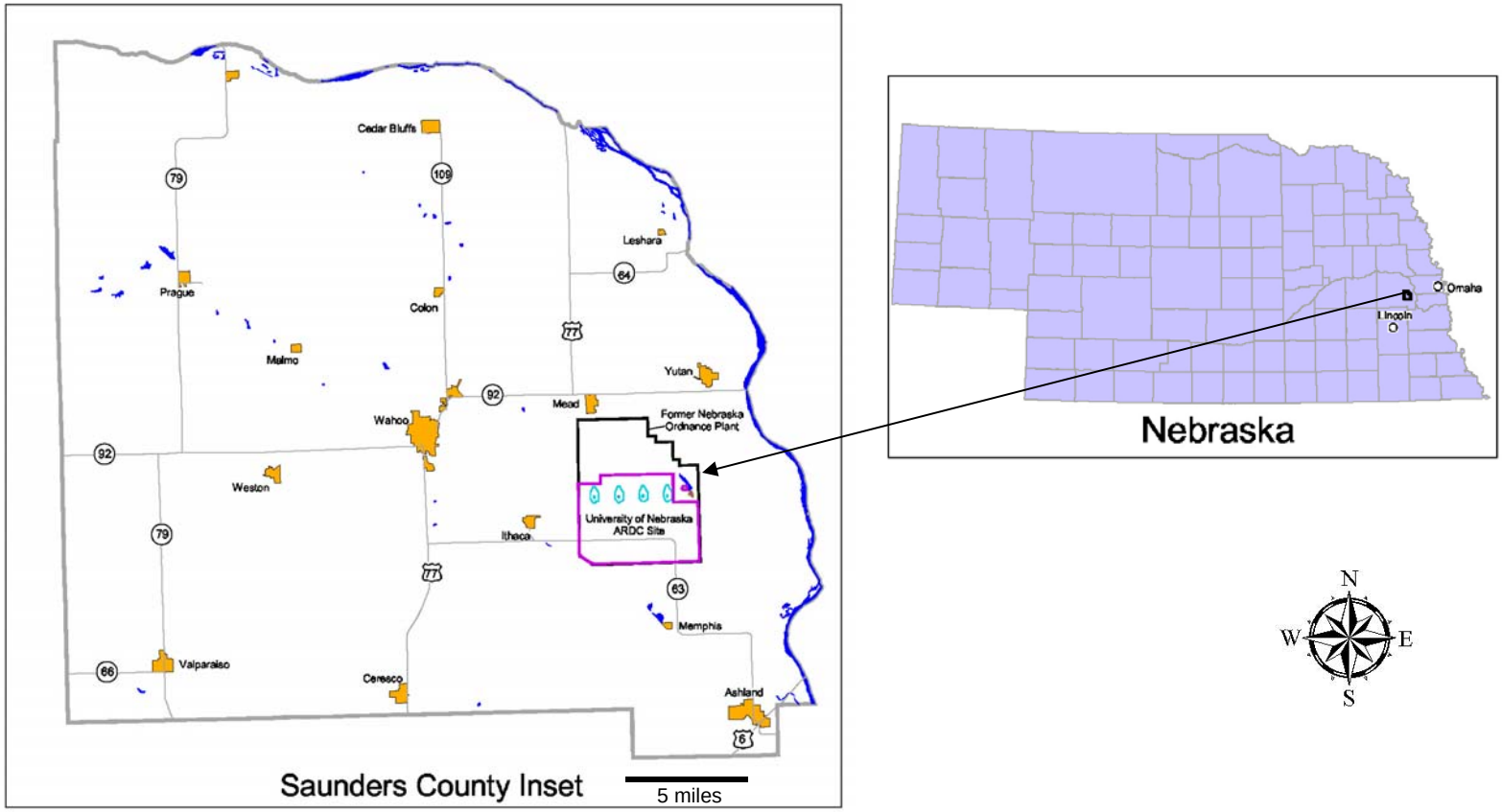
FIGURES



Source: MACTEC 2009. Final Report. Removal Action Completion Report. Former Nebraska Ordnance Plant Superfund Site, Operable Unit 5. University of Nebraska Agricultural Research and Development Center, Mead, Nebraska. MACTEC Project No. 46630700156.0

Figure A-1. Site location.

U.S. Army Corps of Engineers
Kansas City District

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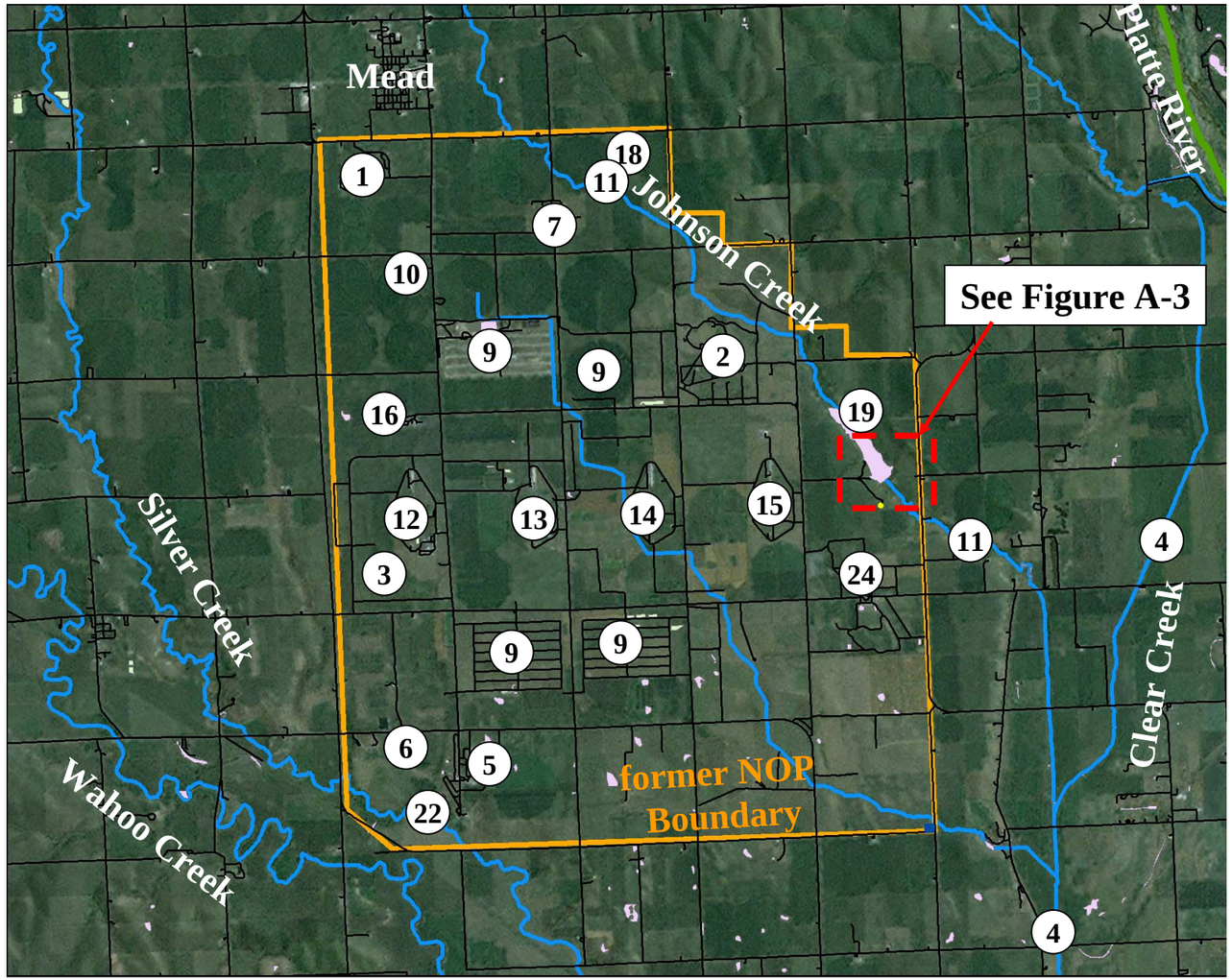
Kevil, Kentucky

Former Nebraska Ordnance Plant Mead, Nebraska



Source: ESRI 2009

0 3,000 6,000 12,000 18,000 24,000 30,000 36,000 Feet

N W E S

Legend:

Former Administration Area	1
Former Atlas Missile Area	2
Bermed Area Southwest of Load Line 1	3
Clear Creek	4
Former Demolition Ground	5
Former Detonation Craters	6
Former Ammonium Nitrate Plant	7
Former NOP Landfill Area	8
Former Raw Products Igloo Storage	9
Former Tetryl Pelleting Area / Bomb Booster Assembly	10
Johnson Creek	11
Former Load Line 1	12
Former Load Line 2	13
Former Load Line 3	14
Former Load Line 4	15
Former Nike Missile Maintenance Area	16
Former North Burning Ground	17
Northeast Boundary Area	18
NRD Reservoir	19
Potential Landfill Area	20
Former Proving Grounds	21
Silver Creek	22
Former South Burning Ground	23
Former Air Force Global Communications Area	24

Figure A-2. Site layout map showing OU-3 investigation areas.

U.S. Army Corps of Engineers
Kansas City District

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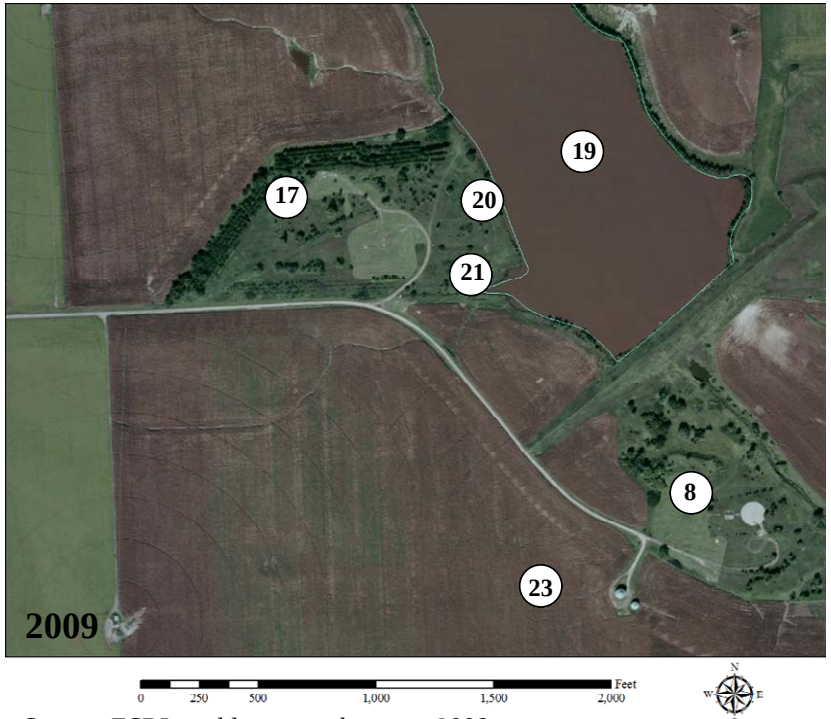
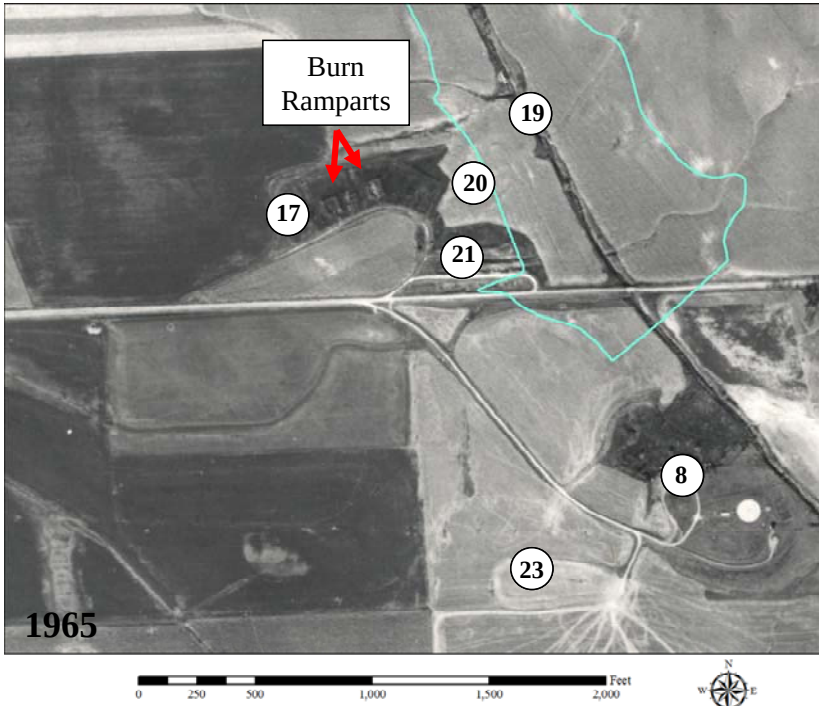
Kevil, Kentucky

Former Nebraska Ordnance Plant Mead, Nebraska



Source: ESRI world topography maps 2009



Source: University of Nebraska collection 1965

Legend:

Former NOP Landfill Area	8
North Burning Ground	17
NRD Reservoir	19
Potential Landfill Area	20
Proving Grounds	21
South Burning Ground	23

Figure A-3. OU-3 investigation areas near the Natural Resource District Reservoir.

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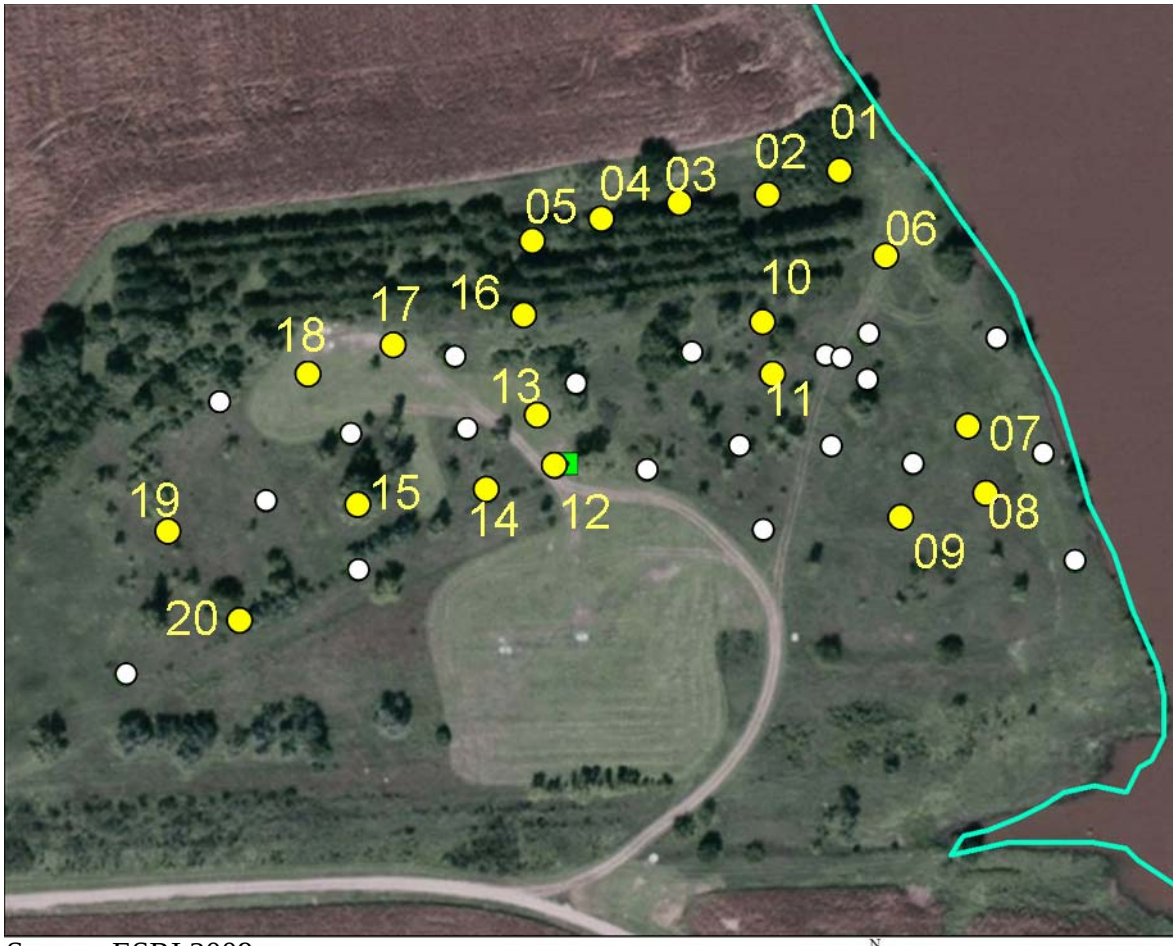

Source: ESRI 2009

0 50 100 200 300 400 500 Feet

N W E S

- **Location of burn layer found during UNL removal action (MACTEC 2009)**
- **Proposed Supplemental RI sample location**
- **Previous sample locations from Phases I and II (Woodward-Clyde 1997, URS 2000a)**

Figure A-4. Previous and proposed soil sampling locations at the former North Burning Ground and Potential Landfill Area.

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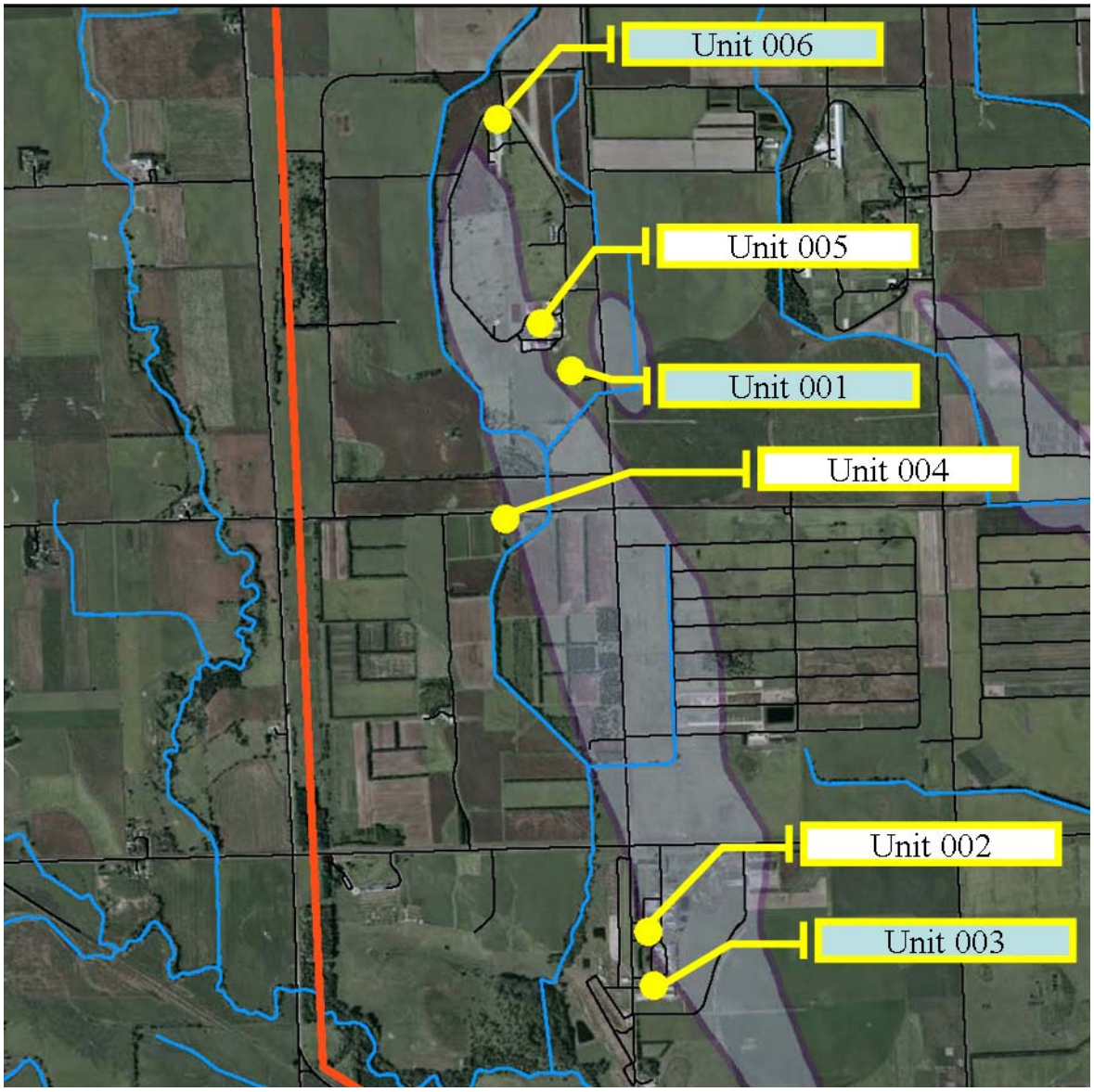

Source: ESRI 2009

Legend

- Vapor Intrusion
- Former NOP boundary
- Surface Water
- Roads
- TCE (≥5µg/L) Sept. 2009

0 1,200 2,400 4,800 7,200 9,600 Feet

N W E S

Unit 001 To be included in OU-3 Supplemental RI sampling

Figure A-5. Vapor intrusion buildings of potential concern for Load Line 1 TCE plume.

TCE plume: TCE ≥ 5 ug/L as of Sept. 2009.

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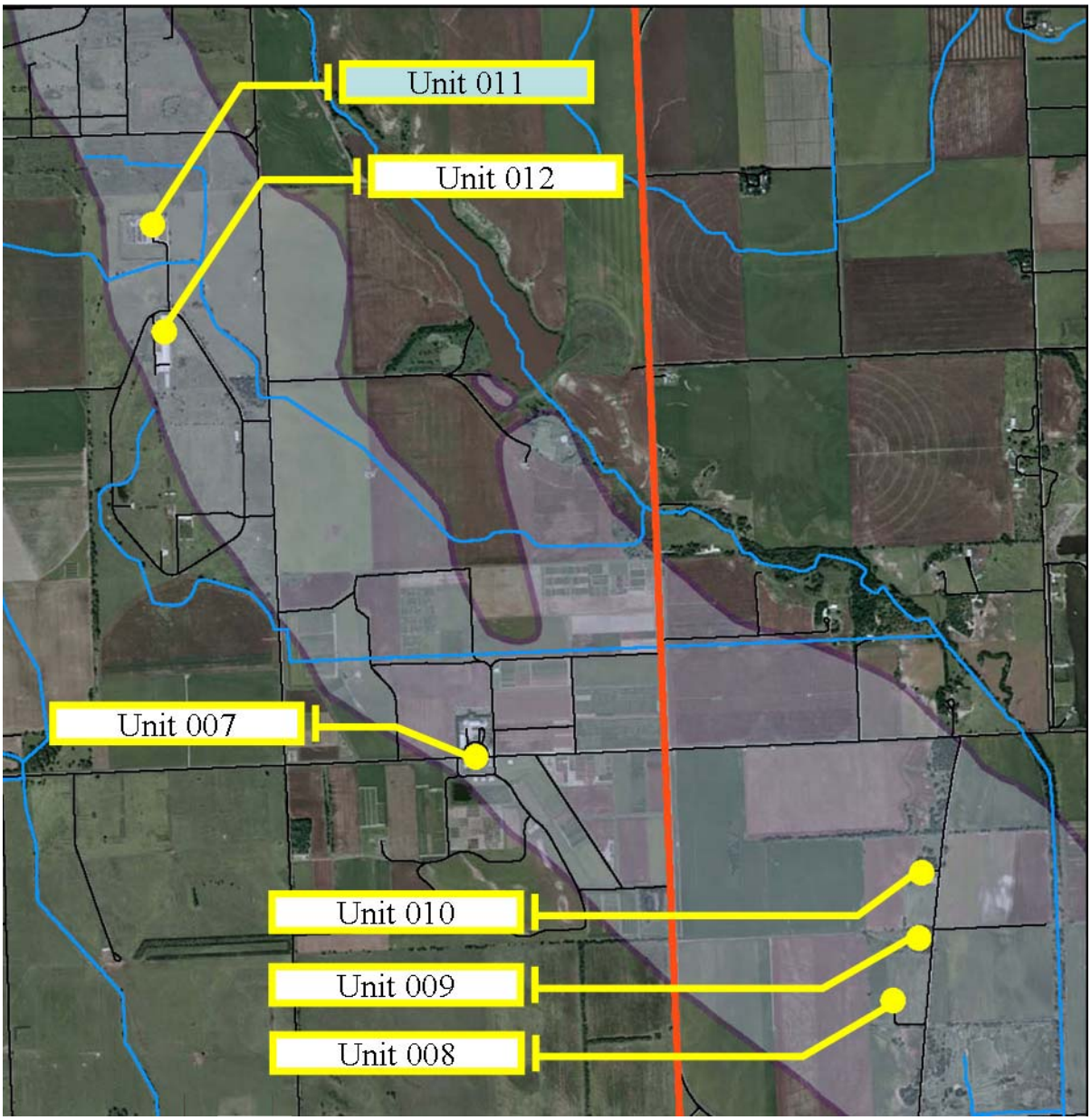

Legend

Source: ESRI 2009

- Vapor Intrusion
- Former NOP boundary
- Surface Water
- Roads
- TCE (≥5µg/L) Sept. 2009

0 950 1,900 3,800 5,700 7,600 Feet

N W E S

Unit 011 To be included in OU-3 Supplemental RI sampling

Figure A-6. Vapor intrusion buildings of potential concern for Atlas Missile Area TCE plume.

TCE plume: TCE ≥ 5 ug/L as of Sept. 2009.

U.S. Army Corps of Engineers
Kansas City District

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Kevil, Kentucky

Former Nebraska Ordnance Plant Mead, Nebraska

APPENDIX B

FIELD DOCUMENTS

APPENDIX B – FIELD DOCUMENTS

1. Test America Chain-of-Custody Form
2. Drilling Log
3. Air Sampling Log

Burlington
30 Community Drive
Suite 11
South Burlington, VT 5403
phone 802.660.1990 fax 802.660.1919

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
GEO Consultants, LLC	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
325 Kentucky Ave	**Analysis Turnaround Time**			Job No.
Kevil, KY 42053	Calendar (C) or Work Days (W) _____			
(270) 462-3882 Phone	TAT if different from Below _____			
(270) 462-3887 FAX	☐ 2 weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type**	**Matrix**	**# of Cont.**	**Filtered Sample**																			Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

HTRW DRILLING LOG

	DISTRICT:	HOLE NUMBER
1. COMPANY NAME:	2. DRILL SUBCONTRACTOR:	SHEET ____ OF ____

3. PROJECT:	4. LOCATION:
5. NAME OF DRILLER:	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION:
	9. SURFACE ELEVATION:
	10. DATE STARTED: / 11. DATE COMPLETED:
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS SCALE:

HTRW DRILLING LOG

HOLE NUMBER

PROJECT:

INSPECTOR

SHEET OF

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)

BUILDING QUESTIONNAIRE

Building Type: Residential/Commercial/Multi-Use

Owner/Tenant:_____

Address:_____

Describe Building Uses:_____
_____

Smoker(s): Y/N Product (Cigars, Pipe, Cigarettes):_____ Number Smoked/Day:___

Basement/Crawl Space: Y/N Ventilated: Y/N Living Quarters: Y/N
Basement
Acitivities:_____

Private Well: Y/N Sump: Y/N Cistern: Y/N In Use/Plugged: Y/N

Recent Remodeling: Y/N Activities (painting, new carpet, new cabinets): Y/N
_____

VOC sources (hobbies, paints, solvents, gasoline,
etc):_____
_____

Cleaning Products and
Storage:_____

Attached Garage: Y/N Garage Storage (cars, lawn mower, etc):_____

Furnace Type (Oil, Natural Gas, Propane):_____ Furnace Intake: Inside/Outside

Addidtional Heating Sources (space heater, etc):_____ Fuel Type:_____

Comments:_____
_____
_____
_____
_____

BUILDING QUESTIONNAIRE (cont.)

CHEMICAL INVENTORY

CHEMICAL NAME	DESCRIPTION	MSDS OBTAINED
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N
		Y/N

FIELD DATA AIR SAMPLING FORM

Site Name:_____ Sampler:_____

Sample Identification:_____/_____ Date Sampled:_____

Sample Location(s):_____
_____

Canister Serial #:_____/_____ Flow Regulator Serial #:_____/_____

Environmental Conditions

Outdoor Temperature:_____ Barometric Pressure:_____ Relative Humidity:_____

Wind Speed/Direction:_____ Comments:_____

Preliminary Screening

Instrumentation:_____ Calibration Date:_____ Time:_____am/pm

Field Reading(s):_____(ppm)/_____(ppm)/_____(ppm)/_____(ppm)

Location(s):_____
_____

Mechanical Leak Test

	Time	Pressure
Start:	_____am/pm	_____"Hg
Stop:	_____am/pm	_____"Hg

Chemical Leak Test

Leak Test Compound:_____

Field Reading(s):_____(ppm)/_____(ppm)/
_____(ppm)/_____(ppm)

Instrumentation Calibration Date & Time:_____

Air Sampling

	Time	Pressure	Controller Flow
Start:	_____am/pm	_____"Hg	_____
Stop:	_____am/pm	_____"Hg	_____
Start:	_____am/pm	_____"Hg	_____
Stop:	_____am/pm	_____"Hg	_____

Indoor Air Quality Building Survey

Date: _____

Address: _____

_____

Residential Contact: _____

Phone: Home: ( ) - Work: ( ) -

List of Current Occupants/Occupation:

Age (If under 18)	Sex (M/F)	Occupation

Building Construction Characteristics:

What type of building do you have? (Circle appropriate response)

Single Family	Multiple Family	School	Commercial
Ranch	2-Family		
Raised Ranch	Duplex		
Cape	Apartment House		
Colonial	#of units_____		
Split Level	Condominium		
Mobile Home	#of units_____		
Other_____	Other_____		

Address:_____
Date:_____

Sources of Chemical Contaminants:

Which of these items are present in the building? (Check all that apply)

Potential VOC Source	Location of Source	Used 48 hours prior to sampling (Yes/No/NA)	Use During Sampling (Yes/No/NA)
Paints or paint thinners			
Gas-powered equipment			
Gasoline storage cans			
Cleaning solvents			
Air fresheners			
Oven cleaners			
Carpet/upholstery cleaners			
Hairspray			
Nail polish/polish remover			
Bathroom cleaner			
Appliance cleaner			
Furniture/floor polish			
Moth balls			
Fuel tank			
Wood Stove			
Fireplace			
Perfume/colognes			
Hobby supplies (e g., solvents, paints, lacquers, glues, photographic darkroom chemicals)			
Scented trees, wreaths, potpourri,etc			
Other			
Other			

Drinking Water Usage During Sampling(check all that apply)

Showering_____ Cooking_____ Dishwashing_____ Laundry_____
Other:_____

APPENDIX C

GEO FIELD STANDARD OPERATING PROCEDURE

APPENDIX C – GEO FIELD STANDARD OPERATION PROCEDURES

1. GEO-TEC-006 Sample Chain-of-Custody
2. GEO-TEC-010 Equipment Cleaning and Decontamination
3. GEO-TEC-015 Subsurface Soil Sampling

GEO CONSULTANTS, LLC

A Geological Engineering and Environmental Services Company

Technical Operating Procedure

SAMPLE CHAIN OF CUSTODY
GEO-TEC-006
Revision 2

Prepared by: Pamela Goans

Approved by: _____ / _____
Jeff Boulton, Field Services Manager Date

Effective Date: December 1, 2006

Record of Changes

Revision No.	Affected Page(s)	Effective Date	Approval	Approval Date
0	All			
1	All			
2	All	12/1/06	J. Boulton	12/4/06

Next review required no later than: December 1, 2009

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PURPOSE

1.1 This procedure describes the requirements for completion of chain-of-custody records and the maintenance of those records to ensure the integrity of samples from collection to final disposition by documenting possession of transfers.

SCOPE

2.1 This procedure applies to all personnel who perform work activities for GEO Consultants, LLC (GEO) and its subcontractors under contract to Paducah Remediation Services (PRS) at the U.S. Department of Energy (DOE) owned Paducah Site.

2.2 No changes or deviations to this procedure are allowed unless approved in advance by the project's Subcontract Technical Representative (STR) before activity implementation.

TRAINING PREREQUISITES

3.1 Required Reading and Orientation.

OTHER DOCUMENTS NEEDED

4.1 GEO-TEC-003, "Records Management"

WHAT TO DO

NOTE: Definitions and acronyms are provided in Attachment A.

5.1 Initiation and Completion of Chain-of-Custody Form

NOTE 1: Chain-of-custody (COC) is required for analytical samples to provide traceability of possession from initial sample collection through sample transfer and/or final disposition. The field sampler is responsible for the proper handling and custody of the samples collected until they are properly and formally transferred to another person or the laboratory. To simplify the COC record, as few people, as possible should handle samples.

NOTE 2: COC procedures are **not** required for transfer of samples between field personnel or between lab personnel in same work group.

NOTE 3: All entries on COC forms shall be made using black indelible ink.

NOTE 4: COC forms are generated from the Paducah Project Environmental Measurements System (PEMS). In the event Paducah PEMS is not accessible and sampling is required, a Paducah PEMS equivalent COC shall be used.

Sample Technician or Field Sample Manager

5.1.1 Prepare and record the COC record prior to sampling with the appropriate information to uniquely identify sample.

5.1.2 Enter the following information (prior to sampling event, if possible):

- Matrix of sample
- Project number
- Unique sample identification number
- Sampling description and location
- Number of sample containers
- Storage and preservation requirements

- Type of sample collected (i.e., grab or composite)
- Parameters to be analyzed
- Sample team member
- Name of the laboratory
- Any pertinent information in “Remarks” or “Comments” section

Sample Technician

5.1.3 Complete the COC information at the time of the sampling event by recording the following information at this time:

- Date and time sampled (military time)
- Volume of sample (if required for specific analysis and calculations)

NOTE: "Positive control" requires one or more of the following:

- physical possession
- visual control/oversight tamper prevention
- secured storage (i.e., lock and key)

5.1.4 Maintain positive control of samples and forms from collection until transfer to another custodian.

5.1.5 Apply custody seals, if applicable, to each container in a manner such that it can be visibly observed if tampering has occurred.

NOTE: Some projects designate a Field Sample Manager who collects samples from the sample technicians and distributes or ships the samples to a laboratory. Other projects require the sample technician to distribute or ship the samples directly.

Field Sample Manager

5.1.6 **IF** the project has a Field Sample Manager to ship samples off-site or deliver the samples directly to an on-site lab,
THEN ensure completeness of the COC
AND proceed to Step 5.1.8.

Sample Technician

5.1.7 **IF** the project does **NOT** have a Field Sample Manager,
THEN provide the delivery and shipment support
AND proceed to Section 5.2.

5.1.8 Sign the form as "relinquished by" and enter the date and time.

5.1.9 Transfer the samples and the COC forms to the Field Sample Manager.

Field Sample Manager

5.1.10 Sign the form as "received by" and enter the date and time.

5.1.11 Maintain positive control of samples and forms from collection until transfer to another custodian.

5.2 Initiation and Completion of Sample Labels

NOTE 1: Sample labels are required for analytical samples to provide identification of samples collected.

NOTE 2: All entries on sample labels shall be made using black indelible ink.

NOTE 3: Sample labels are generated from Paducah PEMS. In the event Paducah PEMS is not accessible and sampling is required, a Paducah PEMS-equivalent sample label shall be used.

Sample Technician or Field Sample Manager

5.2.1 Prepare and record the sample labels prior to sampling with the appropriate information to uniquely identify sample.

5.2.2 Enter the following information (prior to sampling event, if possible):

- Matrix of samples
- Project number
- Unique sample identification number
- Sampling description and location
- Storage and preservation requirements
- Sample team member
- Name of the laboratory

5.2.3 Complete the COC information at the time of the sampling event by recording the following information at this time:

- Date and time sampled (military time)

5.3 Transfers of Samples and Forms to Laboratory Personnel

Sample Technician or Field Sample Manager

5.3.1 Ensure completeness of COC records.

5.3.2 Sign the form as "relinquished by" and enter the date and time.

5.3.3 **IF** the samples will be analyzed at an on-site laboratory,

THEN transfer the samples and the original COC forms to the laboratory sample custodian

THEN ensure the laboratory sample custodian assumes possession of the samples **and** signs the form as "received by" **and** enters the date and time

THEN obtain a copy of the COC record **AND** proceed to Step 5.3.7.

5.3.4 **IF** the samples require off-site shipment,

THEN place the original COC form in a plastic bag inside the secured shipping container.

5.3.5 Package samples according to Department of Transportation (DOT) requirements for shipment to the appropriate laboratory for analysis, with separate COC for each shipment.

5.3.6 Process the off-site shipment according to the applicable DOT regulations.

NOTE 1: The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via

common carrier (e.g., Federal Express), the date/time will not be the same for both signatures. Common carriers are not required to sign the COC record.

NOTE 2: When samples are shipped to an off-site laboratory, the laboratory sample custodian signs the COC record and a copy is returned/faxed to the project sample manager.

Sample Technician or Field Sample Manager

5.3.7 Fax/deliver a copy of the chain-of-custody record to the PRS Sample Manager.

5.3.8 Provide a copy of the signed COC form to the field sample manager or Project Records Coordinator (as designated by the Project Manager) for temporary retention as a working record.

5.3.9 Maintain the COC record in accordance with satellite document management center (DMC) requirements (locked in fireproof file cabinets, etc.) in accordance with GEO-TEC-003, "Records Management."

5.3.10 Periodically forward all COC records that have been retained in the satellite DMC to the project STR in accordance with GEO-TEC-003, "Records Management."

RECORDS

6.1 General Requirements

Generate and maintain records in accordance with GEO-TEC-003, "Records Management."

6.2 Quality Records

6.2.1 COC records

6.2.2 DOT shipment papers (if applicable)

6.3 Non-quality Records

None

SOURCE DOCUMENTS

7.1 *Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual*, 1996, United States Environmental Protection Agency, Region IV

7.2 GEO-TEC-005, "Logbooks"

7.3 49 Code of Federal Regulations (CFR) Part 100 to 185, *Transportation*

Attachment A
Definitions and Acronyms
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1.0 Definitions

1.1 Chain-of-Custody - A process used to document the transfer of custody of samples from one individual to another from collection until final disposition.

1.2 Custody Seal - A tape-like seal that is part of the Chain-of-Custody process and is used to prevent tampering with samples after they have been packed for shipping.

1.3 Sample Custody - A sample is under custody if:

- it is in the field personnel's possession; or
- it is in the field personnel's view, after being in their physical possession; or
- it was in the field personnel's physical possession and then it was secured to prevent tampering; or
- it is placed in a designated secure area.

2.0 Acronyms

2.1 COC – Chain of Custody

2.2 DMC - Document Management Center

2.3 DOE - Department of Energy

2.4 DOT - Department of Transportation

2.5 PEMS - Project Environmental Measurements System

2.6 PRS - Paducah Remediation Services

2.7 STR - Subcontract Technical Representative

GEO CONSULTANTS, LLC

A Geological Engineering and Environmental Services Company

Technical Operating Procedure

EQUIPMENT CLEANING AND DECONTAMINATION
GEO-TEC-010
Revision 3

Prepared by: Pamela Goans

Approved by: _____ / _____
Jeff Boulton, Field Services Manager Date

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PURPOSE

1.1 This procedure provides the methodology for cleaning sampling and other equipment in the field and at any of the Paducah Remediation Services (PRS) decontamination pads in compliance with the requirements of the Environmental Protection Agency (EPA).

SCOPE

2.1 This procedure applies to any person performing environmental sampling activities for work coordinated by GEO Consultants, LLC (GEO) and its subcontractors under contract to PRS at the U.S. Department of Energy (DOE) owned Paducah Site.

PRECAUTIONS AND LIMITATIONS

3.1 Environmental, Safety, and Health Precautions

3.1.1 Field personnel will be required to wear personal protective clothing and safety equipment as specified in the site-specific health and safety (H&S) plan. At a minimum, the following general precautions shall be taken during cleaning operations:

- Safety glasses or goggles and latex gloves (or other protective gloves as specified in the project-specific H&S Plan) will be worn during all cleaning operations.
- When cleaning heavy items, such as hollow-stem augers or other drill rig equipment, safety shoes or boots will be worn.
- All solvent rinsing operations will be conducted while wearing appropriate protective clothing under a fume hood or in the open (never in a closed room).
- No eating, smoking, drinking, chewing, **or** any hand-to-mouth contact shall be permitted during cleaning operations.

3.1.2 Nitric acid and hexane rinses should only be completed when sampling for metals or polar organics, such as pesticides, polychlorinated biphenyl (PCBs), **or** petroleum hydrocarbons, because of acid burn and ignitability hazards.

3.1.3 When solvents are substituted for a particular purpose, they must be removed completely from sampling equipment and containers to avoid analytical interferences or the creation of hazardous waste. Field sampling equipment shall be allowed to air dry a minimum of 24 hours before use so any solvents used during decontamination would not be detected in the samples collected with the equipment.

The occurrence of solvent residual is often dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, thereby reducing the potential for solvent residuals.

3.1.4 The following general precautions should be followed when using a high-pressure hot water sprayer:

- Never refuel the high-pressure hot water sprayer while it is running.
- Check wind direction when setting up and preparing for steam cleaning to prevent accidental burns from steam or hot water.

NOTE: All extension cords must have a ground fault interrupter (GFI).

- If the high-pressure hot water sprayer requires electrical power, ensure that all extension cords are not resting in water to reduce potential for shock hazard.

3.1.5 Collect hazardous solvents and rinses with water to remove these solvents for appropriate disposal. Label as "solvent for recovery" or "solvent for disposal."

NOTE: PCB-contaminated sampling waste (CSW) shall not be left unattended, but it may be placed in a designated location for temporary storage.

3.1.6 Dispose of PCB CSW in the proper waste container with the appropriate M_L labeling and date-to-storage immediately following the sampling event. An entry must be documented on the container log sheet as to the type of waste deposited.

3.1.7 Reusable PCB-contaminated sampling equipment must be decontaminated and verified clean according to TSCA specifications. (Refer to Attachment B, "PCB-Contaminated Sampling Equipment.")

3.1.8 Only personnel wearing clean latex gloves to prevent recontamination should handle cleaned equipment.

3.1.9 If cleaned sampling equipment is not to be reused immediately; it shall be wrapped in aluminum foil (shiny side out), sealed in plastic, and labeled with date cleaned. Any exceptions to these cleaning procedures shall be noted on the plastic or in logbook.

3.1.10 Transport only the amount of equipment expected to be used in a sampling event to the field.

3.2 Work Environment Limitations

3.2.1 The immediate supervisor may make determinations as to whether work may or may not be performed due to safety hazards caused by adverse weather conditions or other work environment limitations.

TRAINING

4.1 All field personnel should have access to and be knowledgeable of the following associated procedures and documents before initiating any decontamination activities:

- GEO-TEC-005, *Logbook*
- GEO-TEC-011, *Temporary Storage of Waste Materials*
- Project-specific documents, including Field Sampling Plan, Waste Management Plan, Health and Safety Plan, and Quality Assurance Project Plan
- PRS Procedure PA-3010, Rev. 1, Waste Generator Responsibilities for Temporary On-Site Storage of Regulated Waste Materials at Paducah

OTHER DOCUMENTS NEEDED

5.1 GEO-TEC-002, *Document Control*
5.2 GEO-TEC-003, *Records Management*
5.3 GEO-TEC-009, *Collection of Field Quality Control Samples*

APPROVALS, NOTIFICATIONS, AND LIMITING CONDITIONS

6.1 Obtain approval and requirements from the PRS Subcontract Technical Representative (STR) prior to using any of the following Paducah Site decontamination pads or facilities: C-416, C-752-C, and/or C-755-A.

PRE-PREFORMANCE ACTIVITIES

NOTE: Definitions and acronyms are provided in Attachment A.

7.1 Inspection of Equipment Arriving at the Paducah Site

Personnel Responsible for Decontaminating Equipment

7.1.1 Inspect incoming equipment for any contaminants to minimize the potential for cross contamination from another hazardous waste site and assure it is in safe working conditions.

7.1.2 Inspect drill rigs and similar equipment for any leaks of oil, grease, fuel, and hydraulic oils.

7.1.3 Inspect seals and gaskets to ensure they are free of fluid leaks.

7.1.4 Inspect cables (e.g., winch cables) for frays.

7.1.5 Inspect augers, drill rods, drill bits, and casing to ensure they are free of any paint, ink, or any other coatings that may wear off during drilling.

7.1.6 Inspect seals and gaskets to ensure they are free of fluid leaks.

7.1.7 Steam clean or pressure wash drilling rigs, sample equipment (e.g., split spoons), backhoes, forklifts, and other associated equipment before using for any on-site activities, regardless of the condition upon arrival at the plant site.

7.1.8 Decontaminate all on-board pumps and hoses by pumping clean, hot water through them to remove any residual contamination.

SPECIAL TOOLS, EQUIPMENT, PARTS, AND SUPPLIES

Personnel Responsible for Decontaminating Equipment

8.1 Ensure that all applicable items needed for a particular task are available for use and are in good condition:

- field logbook
- black indelible pens and markers
- lab coats and neoprene aprons
- protective gloves
- safety glasses/goggles/face shields
- other protective clothing and equipment (see the project-specific health and safety plan)
- portable gravity-fed eye wash station
- fire extinguisher (Type ABC dry chemical)
- storage cabinet for flammable materials
- plastic buckets and troughs
- folding table(s) and/or sawhorses
- 2- to 5-gal stainless steel manual pump sprayers
- Nalgene or Teflon® sprayers or wash bottles

- high-pressure hot water sprayer equipped with an automatic soap dispenser
- bottle brushes
- stiff-bristle brushes
- aluminum foil
- absorbent pads/spill kit
- duct tape
- plastic sheeting
- disposable wipes or rags
- nitric acid solutions
- isopropyl alcohol
- tap water
- deionized, analyte-free, or organic-free water
- appropriate decontamination solvents (pesticide-grade or better)
- phosphate-free detergent (Liquinox® or equivalent)
- disinfectant soap

WHAT TO DO

9.1 Decontaminate Drill Rigs, Heavy Equipment, and Downhole Equipment after Each Borehole

NOTE 1: Drilling rigs, geoprobe/terraprobe rigs, heavy equipment (forklifts and backhoes), and all downhole equipment, which includes hand-operated augers (e.g., Little Beaver), hollow-stem auger flights, drill rods, drill casing, temporary surface casings, and drill bits, will be cleaned and decontaminated between each location (as determined by the work plan) using this section of this procedure.

NOTE 2: All downhole equipment will be scanned for radiological contaminants and wrapped in plastic for transport between the drill-site and decontamination pad. All downhole equipment considered contaminated based on radiological scanning will require an initial "field" decontamination consisting of a phosphate-free detergent wash followed by potable water rinse before it can be transported to the permanent decontamination pad for more intensive cleaning.

Personnel Responsible for Decontaminating Equipment

9.2 Drive the drill rig, forklift, or backhoe onto the designated Paducah PRS decontamination pad so that all equipment is fully contained within the decontamination area.

NOTE: The Paducah PRS decontamination pad is constructed so that all decontamination water drains into a sump where it can be pumped to a tank for temporary storage before it is treated for discharge to the industrial waste treatment plant. See GEO-TEC-011, *Temporary Storage of Waste Materials*, and the project-specific waste management plan for additional details.

9.3 Pump any standing water from the sump into the designated storage container. Decontamination fluids should be segregated from rainwater and transferred to separate containers.

NOTE: For cleaning associated equipment, provide racks or sawhorses at least two feet above the ground to prevent splash back on the item being cleaned.

9.4 Setup a "clean' area upwind of the decontamination area to receive cleaned equipment for drying. At a minimum, cover the ground, tables, or other surface on which "clean' equipment is placed with clean plastic sheeting.

9.5 Clean with tap water and soap, using a brush if necessary. Drilling equipment that is steam-cleaned should be placed on racks or sawhorses at least two feet above the floor of the decontamination pad.

9.6 Clean the inside of augers, drill rods, etc., which are hollow or have holes that transmit water or drilling fluids. Clean areas that have been or will be exposed to potentially contaminated soils with a high-pressure hot water sprayer.

NOTE: Inspect equipment thoroughly (tools, rods, augers, etc.). If severe rust, corrosion, paint, or hardened grout is present, sandblast the equipment and re-clean the equipment.

9.7 Clean the entire exterior of the rig, backhoe, or forklift with a special emphasis on those areas that are over the borehole, including the Kelly bar, mast, backhoe bucket, drilling platform, hoist and chain pull-downs, spindles, cathead, and the undercarriage according.

9.8 Clean the motor, hydraulic lift, oil fill, and fuel tank.

9.9 Flush the grout pump with tap water until clean, and drain.

9.10 Wash the grout mixer with the high-pressure hot water sprayer to remove any contamination.

WHAT TO DO

10.1 Field Cleaning Procedures

10.2 Minimum Specifications for Field Decontamination Pad

10.2.1 Construct the pad in an area known or believed to be free of surface contamination.

10.2.2 Construct so that the pad does not leak.

10.2.3 When possible, construct the pad on a level, paved surface with one corner lower than the others to facilitate removal of wastewater. If this is not possible, create a lined sump or pit in one corner or along the side of the pad.

10.2.4 Construct sawhorses or racks to hold equipment while being cleaned.

NOTE: These shall be a minimum of two feet above the surface of the pad to prevent splash back.

10.2.5 Remove water from the pad frequently to prevent run over.

10.2.6 Line the pad with a seamless, water-impermeable material (this material should be easily replaceable or repairable).

10.2.7 Deactivate the pad upon completion of the activity.

10.2.8 Remove all waste/rinse water for disposal according to GEO-TEC-011, *Temporary Storage of Waste Materials.*

10.2.9 If a pit or sump has been constructed, backfill with material designated as appropriate by the PRS STR.

10.2.10 Collect all solvent rinseates in containers for disposal according to GEO-TEC-011, *Temporary Storage of Waste Materials*, or the project-specific waste management plan.

NOTE: DO NOT PLACE ANY SOLVENT RINSATES IN THE PIT.

10.2.11 If leaks develop in the pad during the decontamination process, contact the Paducah PRS STR who will determine if sampling and analyses of the soil shall be required.

10.2.12 Remove equipment from the decontamination pad and cover with clean, unused plastic. If stored overnight, secure the plastic to ensure it stays in place.

10.3 Drill Rig

10.3.1 Steam-clean between boreholes (soap and high-pressure hot water) any portion of the drill rig, backhoe, etc., that is over the borehole (Kelly bar of mast, backhoe buckets, drilling platform, hoist or chain pull-downs, spindles, cathead, etc.).

10.3.2 Rinse thoroughly with tap water.

10.4 Drilling Equipment

NOTE: This includes augers, drill stems, rods, tools, and associated equipment.

10.4.1 Place equipment that is to be steam-cleaned on racks or sawhorses at least two feet above the floor of the decontamination pad to prevent splash back.

10.4.2 Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films (steam-clean if matter is difficult to remove with the brush). Equipment may be steam-cleaned on racks or sawhorses as an alternative to brushing.

10.4.3 Vigorously brush the interior surfaces of the hollows or holes of hollow-stem augers, etc.

10.4.4 Rinse thoroughly with tap water.

CAUTION

To prevent damage, do **not** solvent rinse PVC or plastic items.

10.5 Equipment Used for the Collection of Trace Organic and Inorganic Compounds

Personnel Responsible for Decontaminating Equipment

10.5.1 Clean with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Equipment may be steam-cleaned on racks or sawhorses as an alternative to brushing.

10.5.2 Rinse thoroughly with tap water.

10.5.3 Rinse thoroughly with analyte-free water.

10.5.4 Rinse thoroughly with isopropyl alcohol.

10.5.5 Rinse thoroughly with organic/analyte-free water. If organic/analyze-free water is not available, allow equipment to completely dry.

10.5.6 Remove the equipment from the decontamination area and cover with plastic. Equipment stored overnight shall be wrapped in aluminum foil (shiny side out) and covered with clean, unused plastic.

NOTE: **IF** equipment cannot be cleaned utilizing these procedures, it shall be discarded.

10.6 "Classic Parameter" Sampling Equipment

10.6.1 Rinse flow-measuring equipment with tap water between measuring locations.

10.6.2 Rinse other sampling equipment with analyte-free water between locations, using a brush, if necessary, to remove deposits of material or sediment.

10.6.3 If rinsed with analyte-free water, flush at the next sampling location with the water to be sampled before collecting the sample.

10.7 Fultz Pump Cleaning

Use Part 12.1 of this procedure.

10.8 Goulds Pump Cleaning

Use Part 12.2 of this procedure.

10.9 Redi-Flo2 Pump Cleaning

Use Part 12.4 of this procedure.

10.10 Well Sounders, Tapes, and Depth Indicators

Use Part 14.1 of this procedure.

10.11 Automatic Sampler Tubing

10.11.1 Flush tubing with tap water and soap.

10.11.2 Rinse tubing thoroughly with tap water.

10. 11.3 Rinse tubing with analyte-free water.

WHAT TO DO

11.1 Automatic Wastewater Sampling Equipment

11.2 ISCO® and Other Automatic Sampling Equipment

Personnel Responsible for Decontaminating Equipment

11.2.1 Wash the exterior and accessible interior (excluding the waterproof timing mechanism) portions of the automatic samplers with soap and tap water then rinse with tap water.

11.2.2 Check and replace, if necessary, the desiccant in the flow meters each time the equipment is cleaned.

11.2.3 Clean the face of the timing case mechanism with a clean damp cloth.

11.2.4 **IF** dedicated tubing is used at the same sampling location for the same environmental media **AND** tubing appears to be in good condition (i.e., no algae or sludge build-up),
THEN decontaminate according to Section 10.10,
OTHERWISE discard tubing (sample intake and pump tubing) and replace with new tubing.

11.2.5 Install new pre-cleaned Silastic pump tubing (see l3.l for cleaning instructions of tubing).

11.3 ISCO® 1680, 2700, and 3700 Rotary Funnel, Distributor, and Metal Tube

Personnel Responsible for Decontaminating Equipment

11.3.1 Clean with hot tap water, soap, and a brush.

11.3.2 Rinse thoroughly with analyte-free water.

11.3.3 Replace in sampler.

11.4 All Automatic Sampler Headers

Personnel Responsible for Decontaminating Equipment

11.4.1 Disassemble header and, using a bottle brush, wash with hot tap water and soap

11.4.2 Rinse thoroughly with analyte-free water.

11.4.3 Dry thoroughly, reassemble header, and wrap with aluminum foil.

11.4.4 Seal in plastic.

11.5 Reusable Glass Composite Sample Containers

NOTE: When these containers are used to collect samples that contain oil, reuse, or other hard to remove materials, it may be necessary to rinse the containers several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials. Any bottles that have a visible film, scale, or discoloration remaining after this cleaning procedure should be discarded.

Personnel Responsible for Decontaminating Equipment

11.5.1 Wash containers thoroughly with hot tap water and a phosphate-free laboratory detergent (e.g., Liquinox), using a bottlebrush to remove particulate matter and surface film.

11.5.2 Rinse containers thoroughly with hot tap water.

11.5.3 Rinse container with at least l0% nitric acid.

11.5.4 Rinse containers thoroughly with tap water.

11.5.5 Rinse containers thoroughly with analyte-free water.

11.5.6 Rinse twice with at least 10% nitric acid.

11.5.7 Allow to air dry for a least 24 hours.

11.5.8 Cap with aluminum foil or Teflon® film.

11.6 Plastic Reusable Composite Sample Containers

NOTE: Any containers that have a visible film, scale, or other discoloration remaining after this cleaning procedure should be discarded.

Personnel Responsible for Decontaminating Equipment

11.6.1 Wash containers thoroughly with hot tap water and laboratory detergent, using a bottlebrush to remove particulate matter and surface film.

11.6.2 Rinse containers thoroughly with tap water.

11.6.3 Rinse containers with at least 10% nitric acid.

11.6.4 Rinse containers thoroughly with tap water.

11.6.5 Rinse containers thoroughly with analyte-free water.

11.6.6 Cap with aluminum foil or Teflon® film.

11.7 ISCO® 1680 Reusable Glass Sequential Sample Bottles

NOTE: For collecting samples for Gas Chromatograph/Mass Spectrometer (GC/MS) (or equivalent) analyses, use cleaning procedure in Section 15.0.

Personnel Responsible for Decontaminating Equipment

11.7.1 Rinse with 10% nitric acid.

11.7.2 Rinse thoroughly with tap water.

11.7.3 Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap analyte-free water rinse cycles.

11.7.4 Replace bottles in covered automatic sampler base.

11.7.5 Cover with aluminum foil for storage.

11.8 ISCO® 1680, 2700, and 3700 Reusable Glass Sequential Bottles for GC/MS Analyses

Personnel Responsible for Decontaminating Equipment

11.8.1 Rinse with 10% nitric acid.

11.8.2 Rinse thoroughly with tap water.

11.8.3 Wash in dishwasher at wash cycle, using laboratory detergent cycle, followed by tap and analyte-free water rinse cycles.

11.8.4 Rinse twice with 10% nitric acid.

11.8.5 Allow to air dry for at least 24 hours.

11.8.6 Replace in covered, automatic sampler case.

11.8.7 Cover with aluminum foil for storage.

11.8.8 Mark the base as follows: "Cleaned for organic analyses."

11.9 Bottle Siphons for Composite Containers

Personnel Responsible for Decontaminating Equipment

11.9.1 Before use, rinse tubing with solvent and place in drying oven overnight.

11.9.2 Cap the ends of the siphon with aluminum foil and/or Teflon® film for storage.

11.9.3 Seal the tubing in plastic and label.

11.9.4 Thoroughly flush the siphon with sample before use.

11.10 Reusable Teflon Composite Mixer Rods

11.10.1 Wash equipment thoroughly with soap and hot tap water, using a brush or scrub pad to remove any particulate matter or surface film.

11.10.2 Rinse equipment thoroughly with hot tap water.

11.10.3 Rinse equipment with at least a 10% nitric acid solution.

11.10.4 Rinse equipment thoroughly with tap water.

11.10.5 Rinse equipment thoroughly with analyte-free water.

11.10.6 Rinse equipment thoroughly with solvent.

Personnel Responsible for Decontaminating Equipment

11.10.7 Allow to air dry for at least 24 hours.

11.10.8 Wrap equipment in one layer of aluminum foil, rolling edges of foil into a "tab" to allow for easy removal.

11.10.9 Seal the foil wrapped equipment in plastic and label.

NOTE: **IF** the equipment cannot be cleaned utilizing these procedures, it shall be discarded.

WHAT TO DO

12.1 Submersible Pump and Hoses Used to Purge Groundwater Wells

CAUTION
To avoid damaging the Fultz pump, pump must not be operated when dry. Switch must be placed in the OFF position when changing from forward to reverse mode.

CAUTION
During cleaning, the pump should always be disconnected from the generator.

CAUTION
To avoid damage to equipment and seals, do **NOT** use degreasers

12.2 Fultz® Pump Cleaning Procedure

NOTE: The same procedure applies whether this equipment is cleaned at one of the Paducah PRS decontamination pads or in the field.

Personnel Responsible for Decontaminating Equipment

12.2.1 Pump a sufficient amount of soapy water through the hose to flush out any residual purge water.

12.2.2 Using a brush, scrub the exterior of the contaminated hose and pump with hot, soapy water.

12.2.3 Rinse the soap from the outside of the hose with tap water.

12.2.4 Rinse the hose with deionized water and recoil onto the spool.

12.2.5 Pump a sufficient amount of tap water through the hose to flush out soapy water.

12.2.6 Pump a sufficient amount of deionized water through the hose to flush out the tap water.

12.2.7 Purge with the pump in reverse mode.

NOTE: Do not allow the pump to run dry.

12.2.8 Rinse the outside of the pump housing and hose with deionized water (approximately 1/4 gallon).

12.2.9 Place equipment in a polyethylene bag or wrap with polyethylene film to prevent contamination during storage or transit.

12.2.10 Ensure that a set of rotors, fuses, and cables are attached to each cleaned pump.

12.3 Goulds® Pump Cleaning Procedure

Personnel Responsible for Decontaminating Equipment

12.3.1 Using a brush, scrub the exterior of the contaminated pump and hose with soapy tap water.

12.3.2 Rinse the soap from the outside of pump and hose with tap water.

12.3.3 Rinse the tap water residue from the outside of pump and hose with deionized water

12.3.4 Place equipment in a polyethylene bag or wrap with polyethylene film to prevent contamination during storage or transit.

12.4 Portable Power Augers (such as the Little Beaver)

Personnel Responsible for Decontaminating Equipment

12.4.1 Clean the engine and power head with a power washer or a high-pressure hot water sprayer or hand wash with a brush using soap to remove oil, grease, and hydraulic fluid from the exterior of the unit.

12.4.2 Rinse thoroughly with tap water.

12.4.3 Completely air dry and place equipment in a clean plastic bag.

12.5 Redi-Flo2 Pump

Personnel Responsible for Decontaminating Equipment

12.5.1 Wipe the controller box with a damp cloth to immediately remove any excess water.

12.5.2 Let the controller box dry completely.

12.5.3 Follow Section 12.0 for pump cleaning.

12.5.4 Remove garden hose or pump tubing, if attached, and ball check valve and clean these items separately.

12.5.5 Using a brush or scrub pad, scrub the exterior of the pump with tap water.

12.5.6 Rinse with tap water.

12.5.7 Rinse with analyte-free water.

12.5.8 Completely air dry.

12.5.9 Place equipment in clean plastic bag.

12.6 Redi-Flo2 Ball Check Valve Cleaning

NOTE: The analyte-free water within the pump head should be changed according to manufacturers instructions after it is returned from the field to the permanent cleaning pad.

Personnel Responsible for Decontaminating Equipment

12.6.1 Completely dismantle ball check valve.

12.6.2 Check for wear and/or corrosion and replace as needed.

12.6.3 Using a brush, scrub all components with soap and hot tap water.

12.6.4 Rinse with analyte-free water.

12.6.5 Completely air dry.

12.6.6 Reassemble the ball check valve.

12.6.7 Reattach ball check valve to the pump head.

WHAT TO DO

13.1 Cleaning Procedures for Tubing

13.2 Silastic® Pump Tubing

Personnel Responsible for Decontaminating Equipment

13.2.1 **IF** dedicated tubing is used at the same sampling location for the same environmental media **AND** tubing appears to be in good condition (i.e., no algae or sludge build-up),
THEN decontaminate according to Section 10 10,
OTHERWISE replace with new tubing in the automatic samplers and peristaltic pumps after each sampling event.

13.2.2 After installation, cap the exposed ends with clean, unused aluminum foil.

13.3 Teflon® Sample Tubing

NOTE: For the collection of groundwater samples for trace organic compounds or Inductively Coupled Argon Plasma Spectrophotometer analysis, use only new or dedicated Teflon® tubing which has been pre-cleaned as follows:

Personnel Responsible for Decontaminating Equipment

13.3.1 Rinse outside of tubing with analyte-free water.

13.3.2 Flush interior of tubing with analyte-free water.

13.3.3 **IF** excess water is present in the tubing,
THEN expel the water with air pressure using a pump equipped with a drying filter.

13.3.4 Coil tubing and cap ends with aluminum foil.

13.3.5 Seal the foil-wrapped tubing in plastic and label.

.

13.4 Stainless Steel Tubing

NOTE: For the collection of groundwater samples, equipment will be cleaned as follows between monitoring wells or parts within a monitoring well.

Personnel Responsible for Decontaminating Equipment

13.4.1 Purge two to three times the wells volume prior to collecting the next sample.

13.4.2 Once sampling is complete, repeat Step 13.3.1 dry, and cap ends with aluminum foil.

13.4.3 Wrap tubing in one layer of aluminum foil, rolling edges into a "tab" for easy removal.

13.4.4 Seal the foil-wrapped tubing in plastic and label.

NOTE: **IF** the equipment cannot be cleaned utilizing these procedures, it shall be disposed of or handled according to the sampling and analyses plan or waste management plan.

13.5 New Glass Tubing

Personnel Responsible for Decontaminating Equipment

13.5.1 Rinse thoroughly with nitric acid.

13.5.2 Air dry for at least 24 hours.

13.5.3 Wrap tubing completely with aluminum foil.

13.5.4 Seal tubing in plastic (one tube/pack) to prevent contamination during storage.

WHAT TO DO

14.1 Cleaning Procedures for Miscellaneous Equipment

NOTE: If field cleaning for immediate reuse, the equipment does not have to be air-dried as described in the following procedures.

14.2 Well Sounders, Tapes, and Depth Indicators

Personnel Responsible for Decontaminating Equipment

14.2.1 Wash with soap and tap water.

14.2.2 If possible, rinse with tap water.

14.2.3 Rinse with analyte-free water.

14.2.4 Allow to air dry overnight.

14.2.5 Wrap equipment in aluminum foil (with tab for easy removal), seal in plastic, and date.

14.3 Weirs, Staff Gages, Velocity Meters, Stream Gaging Equipment, and Miscellaneous Sampling Equipment Not Specified in Other Cleaning Procedures

NOTE: Do **not** use the following procedure for equipment to be used in the collection of samples for trace organic or inorganic analyses.

Personnel Responsible for Decontaminating Equipment

14.3.1 Wash with soap and hot tap water

NOTE: **IF** soap is not appropriate, **then** use a steam clean with analyte-free water.

14.3.2 Rinse with hot tap water.

14.3.3 Rinse thoroughly with analyte-free water.

14.3.4 Completely air dry before storing.

14.4 Field Analytical Equipment

Personnel Responsible for Decontaminating Equipment

14.4.1 Wipe instruments with a clean, damp cloth.

14.4.2 Rinse probes (pH, conductivity, DO, etc.) with analyte-free water.

14.4.3 Air dry.

14.5 Ice Chest and Shipping Containers

NOTE: If the container is severely contaminated, it shall be cleaned as thoroughly as possible, rendered unusable, and properly disposed

Personnel Responsible for Decontaminating Equipment

14.5.1 Wash interior and exterior with soap and water.

14.5.2 Rinse with clean tap water.

14.5.3 Air-dry before storage.

14.6 Pressure Field Filtration Apparatus

NOTE: When this equipment is used to collect samples that contain oil, grease, or other hard-to-remove materials, it may be necessary to rinse the containers several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials. In extreme cases, it may be necessary to steam-clean the equipment. If the equipment cannot be cleaned utilizing these procedures, it should be discarded.

Personnel Responsible for Decontaminating Equipment

14.6.1 Wash equipment thoroughly with soap and hot tap water, using a brush to remove any particulate matter or surface film**.**

14.6.2 Rinse equipment thoroughly with hot tap water.

14.6.3 Rinse equipment with l0% nitric acid solution.

14.6.4 Rinse equipment thoroughly with analyte-free water.

14.6.5 Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours.

NOTE: Pressure should be applied to the apparatus after each rinse step (water and acid) to drive the rinse material through the porous glass filter holder in the bottom of the apparatus.

14.6.6 Assemble the apparatus and cap both the pressure inlet and sample discharge lines with aluminum foil to prevent contamination during storage.

14.6.7 Wrap equipment in one layer of aluminum foil, rolling edges into a "tab" for easy removal.

14.6.8 Seal the foil-wrapped equipment in plastic with current date written on the plastic.

14.7 Organic/Analyte-Free Water Storage Containers

Personnel Responsible for Decontaminating Equipment

14.7.1 Wash containers thoroughly (interior and exterior) with hot tap water and laboratory detergent, using a bottlebrush to remove particulate matter and surface film.

CAUTION
Use only soft brushes. **Do not** use scouring pads of any type.

14.7.2 Rinse containers thoroughly with hot tap water.

14.7.3 Rinse containers with at least l0% nitric acid.

14.7.4 Rinse containers thoroughly with tap water.

14.7.5 Rinse containers thoroughly with analyte-free water.

14.7.6 Rinse containers thoroughly with solvent and allow to air dry for at least 24 hours.

14.7.7 Cap with aluminum foil or Teflon® film**.**

14.7.8 Store in plastic bags.

NOTE: When transporting organic/analyte-free water to the field, use only containers cleaned as specified above. Thoroughly rinse the interior of the container with organic/analyte-free water prior to filling. Cap with one layer of Teflon film, one layer of aluminum foil, and label the container as "organic/analyte-free water" and include the date it was prepared. Do not store the organic/analyte-free water more than three days before transporting it to the field for use.

14.8 Portable Solvent Rinse System

Personnel

14.8.1 Replace Teflon tubing, if necessary (see Section 13.1 for cleaning procedure).

Responsible for Decontaminating Equipment

14.8.2 Wash nozzle and tubing fittings with hot, soapy water.

14.8.3 Rinse with analyte-free water

14.8.4 Wrap nozzle and tubing ends with aluminum foil.

14.9 Garden Hose

Personnel Responsible for Decontaminating Equipment

14.9.1 Brush exterior with soap and tap water.

14.9.2 Rinse with tap water.

14.9.3 Flush interior with tap water until clear (minimum of one gallon).

14.9.4 Let air dry completely.

14.9.5 Coil and place in clean plastic bag.

14.10 Portable Tanks for Tap Water

Personnel Responsible for Decontaminating Equipment

14.10.1 Scrub interior and exterior with soap and tap water.

14.10.2 Rinse with tap water.

14.10.3 Let air dry completely.

14.10.4 Close.

14.11 Trace Organic and Inorganic Constituent Sampling Equipment

NOTE: When this sampling equipment is used to collect samples that contain oil, grease, or other hard-to-remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone, hexane, or petroleum ether to remove the materials before proceeding with the first steps. In extreme cases, it may be necessary to steam-clean the field equipment before proceeding with Step 14.13.1. If the equipment cannot be cleaned utilizing these procedures, it should be discarded.

Personnel Responsible for Decontaminating Equipment

14.11.1 **IF** made of Teflon® or glass,
THEN follow Steps 14.10.2 through 14.10.8;
IF NOT then go to Step 14.10.9.

14.11.2 Wash equipment thoroughly with soap and hot tap water, using a brush or scrub pad to remove any particulate matter or surface film.

14.11.3 Rinse equipment thoroughly with hot tap water.

NOTE 1: Small equipment may be soaked in the solution instead of being rinsed with it.

NOTE 2: Prepare fresh nitric acid solution for each cleaning session.

14.11.4 Rinse equipment with 10% nitric acid solution.

14.11.5 Rinse equipment thoroughly with analyte-free water.

14.11.6 Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours.

14.11.7 Wrap equipment in one layer of aluminum foil, rolling edges of foil into a "tab" for easy removal.

14.11.8 Seal the foil-wrapped equipment in plastic and label.

14.11.9 **IF** made of steel or stainless steel,
THEN follow Steps 14.10.10 through 14.10.15.

14.11.10 Wash equipment thoroughly with soap and hot tap water, using a brush or scrub pad to remove any particulate matter or surface film.

14.11.11 Rinse equipment thoroughly with hot tap water.

14.11.12 Rinse equipment thoroughly with analyte-free water.

14.11.13 Rinse equipment thoroughly with solvent and allow to air dry for at least 24 hours.

14.11.14 Wrap equipment in one layer of aluminum foil, rolling edges of foil into a "tab" for easy removal.

14.11.15 Seal the foil-wrapped equipment in plastic and label.

POST PERFORMANCE WORK ACTIVITIES

15.1 The PRS RADCON subcontractor must monitor all equipment for radioactivity before it is released from the Paducah site. This requirement includes any equipment leaving for maintenance or repairs. Radiation screening will be maintained by continuous field screening and thorough periodic wipe sampling by the Paducah PRS RADCON subcontractor (see the project-specific health and safety plan for additional details of this requirement).

Personnel Responsible for Decontaminating Equipment

15.2 Place all equipment and sample containers cleaned utilizing these procedures in a clean storage area.

15.3 If sufficient storage space is unavailable, take precautions to keep from contaminating cleaned material by covering with aluminum foil and plastic and placing in cabinets or a shielded area.

15.4 Prepare a Request for Disposal form in accordance with GEO-TEC-011, *Temporary Storage of Waste Materials*, for disposal of wastes generated.

15.5 Complete field or decontamination logbook entries to include:

- Time and date
- Location

- Name of individual performing the decontamination
- Type of QC sample submitted
- Equipment cleaned
- Deviations (if any)
- List of equipment needing repair
- Lot number of solvent used

RECORDS

16.1 Records Requirements

Generate and maintain records in accordance with requirements in GEO-TEC-002, *Document Control*, and GEO-TEC-003, *Records Management.*

16.2 Quality Records

16.2.1 Field or decontamination logbook entries

16.3 Non-quality Records

16.3.1 None

SOURCE DOCUMENTS

17.1 U.S. Environmental Protection Agency, *Superfund Field Operations Methods*, EPA/540/P-87-001.1, 1987.

17.2 U.S. Environmental Protection Agency, Region IV, Environmental Compliance Branch, *Standard Operation Procedures and Quality Assurance Manual*, May 1996.

Attachment A
Definitions and Acronyms
Page 1 of 2

1.0 Definitions

1.1 Cross Contamination - The transfer of contaminants through equipment or personnel from contamination source too less or non-contaminated samples or areas.

1.2 Decontamination - The process of rinsing or otherwise cleaning the surfaces of drilling or sampling equipment to remove potentially contaminated materials.

1.3 Deionized/Analyte Free Water - Tap water treated by passing through a standard deionizing resin column. Deionized water should contain no heavy metals or other inorganic compounds (at or above analytical detection limits) as defined by a standard Inductively Coupled Plasma Spectrophotometer (ICP) scan.

1.4 Disinfectant Soap - Standard brand of disinfectant cleaner.

1.5 Laboratory Detergent/Soap - Standard brand of phosphate-free laboratory detergent such as Liquinox **or** equivalent.

1.6 Nitric Acid Solution - 10% reagent-grade nitric acid in deionized water.

1.7 Organic/Analyte Free Water - Tap water treated with activated carbon and deionizing units or water from a Milli-Q system (or equivalent).

1.8 Other Solvents - Solvents substituted, as needed, for a particular investigation.

1.9 Polychlorinated biphenyl (PCB)-Contaminated Sampling Equipment (CSE) - Any equipment to be reused that is suspected to have come in contact with an M_L labeled PCB material and/or a PCB source >/= to 50 ppm is considered to be a PCB CSE.

1.10 PCB-Contaminated Sampling Waste (CSW) - Any sampling waste that is suspected to have come in contact with an M_L labeled PCB material and/or a PCB source >/= 50 ppm is considered to be a PCB CSW. PCB CSW can include such items as used personal protection equipment, sampling equipment, cleanup debris, cleaners, and solvents.

1.11 Pesticide Grade Solvent -Grade of solvent that, when analyzed by electron capture gas chromatography, produces no interference peaks greater than that given by 10 ppt (ng/L) of chlorinated hydrocarbons (as heptachlorepoxide).

1.12 Sample Containers - Include, but are not limited to, jars, vials, jugs, air sampling tubes, air sampling filters, soil gas tubes, soil sampling tubes, and air sampling bags.

1.13 Sampling Equipment - Equipment used to obtain actual samples or that might be logically assumed to have an effect on sample quality.

1.14 Standard ICP Scan - ICP scan for the following: Al, Ba, Be, Ca, Cd, Cr, Co, Cu, Fe, Mg, Mn, Mo, Na, Ni, P, Sb, TI, V, and Zn.

1.15 Tap Water - Treated potable water from the Paducah Gaseous Diffusion Plant water treatment plant or other drinking water source.

1.16 Volatile Scan I - A scan for the following compounds: trichloroethene, vinyl chloride, tetrachloroethene, carbon tetrachloride, chloroform, bromodichloromethane, dichloroethene, dichloroethane, and 1,1,1-trichloroethane.

Attachment A
Definitions and Acronyms
Page 2 of 2

2.0 Acronyms

2.1 **PRS** - Paducah Remediation Services

2.2 **CSE** - Contaminated Sampling Equipment

2.3 **DI -** Deionized

2.4 **DO -** Dissolved Oxygen

2.5 **DOE -** Department of Energy

2.6 **EPA -** Environmental Protection Agency

2.7 **FOP -** Field Operations Procedure

2.8 **ICP -** Inductively Coupled Argon Plasma Spectrophotometer

2.9 **PCB -** Polychlorinated Biphenyl

2.10 **pH -** Hydrogen Ion Potential

2.11 **QA -** quality assurance

2.12 **QC -** quality control

2.13 **STR -** Subcontract Technical Representative

Attachment B
PCB-Contaminated Sampling Equipment
Page 1 of 1

PCB-dedicated equipment and tools whose external surfaces come in contact with PCBs are to be decontaminated by swabbing or wiping down with a solvent which was 5% soluble for PCBs or another acceptable PCB cleaning solution such as "Penetone Power Cleaner." The equipment will remain dedicated to PCB-related activity (such as PCB spill cleanup activity for mechanical wet vacuum floor scrubbers) until it is declared a PCB Waste or verified to contain less than 10 micrograms per 100 square centimeters.

Equipment and tools that may contact PCBs during PCB management activities can be reused under the following conditions:

a. The equipment must be dedicated to PCB management activities such as spill cleanup, troughing, PCB equipment servicing, waste management, etc.

b. External surfaces which become contaminated by PCBs will be decontaminated per the requirements of movable equipment under 40 CFR 761.79(b), "Decontamination."

c. The equipment will remain dedicated to PCB related activity (such as PCB spill cleanup activity for mechanical wet vacuum floor scrubbers) until it is declared a PCB waste or verified to contain less than 10 micrograms per 100 square centimeters.

GEO CONSULTANTS, LLC

A Geological Engineering and Environmental Services Company

Technical Operating Procedure

SUBSURFACE SOIL SAMPLING
GEO-TEC-015
Revision 0

Prepared by: Todd Calhoun

Approved by: Jeff Boulton / 2-3-04
Jeff Boulton, Operations Manager Date

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PURPOSE

1.1 This procedure describes the methods and equipment necessary for collecting subsurface soil samples from the unconsolidated zone. Techniques include the use of hand augers, Shelby tubes, and split-spoon samplers (including continuous auger flight split-spoon samplers, direct-push, and microcorer).

SCOPE

2.1 The requirements of this procedure apply to work performed by GEO Consultants, LLC (GEO) and its subcontractors under contract to Bechtel Jacobs Company LLC (BJC) at the United States Department of Energy (DOE)-owned Paducah Site.

PRECAUTIONS AND LIMITATIONS

3.1 **Environmental, Safety, and Health Precautions**

3.1.1 GEO's policy is to maintain an effective program for control of employee exposure to chemical, radiological, and physical stress that is consistent with the established standards of BJC, DOE, and the Occupational Safety and Health Administration.

3.1.2 Field personnel will be required to wear the protective clothing and safety equipment specified in the site-specific health and safety plan.

3.1.2 **Work Environment Limitations**

3.1.2.1 None identified.

TRAINING PREREQUISITES

4.1 Field personnel must be familiar with project-specific documents which include health and safety plan (HSP), quality assurance project plan (QAPP), site-specific sampling and analysis plan (SAP), and waste management plan (WMP). A copy of each shall be available in the field office before the onset of any field activities. These documents should be consulted as necessary to obtain specific information regarding equipment and supplies, health and safety, sample collection and identification, sample packaging, decontamination, etc.

4.2 Field personnel must be knowledgeable of the latest version of the procedures included in the OTHER DOCUMENTS NEEDED section of this procedure before beginning any subsurface soil collection activities.

4.3 Collection of subsurface soil samples shall be limited to those individuals who are fully trained and knowledgeable of field procedures applicable to the collection of subsurface soil samples. Proper training and field surveillance will be completed to ensure that the requirements of this procedure are met.

OTHER DOCUMENTS NEEDED

5.1 DOE Order 5400.5, Radiation Protection of the Public and the Environment

5.2 GEO-TEC-004, *Quality Assured Data*

5.3 GEO-TEC-003, *Logbooks*

5.4 GEO-TEC-006, *Sample Chain of Custody*

5.5 GEO-TEC-009, *Collection of Field Quality Control Samples*

OTHER DOCUMENTS NEEDED

5.6 GEO-TEC-010, *Equipment Cleaning and Decontamination*

5.7 American Society for Testing and Materials (ASTM), Standard Method D 1586-84, Penetration Test and Split-Barrel Sampling of Soils, 1984

WHAT TO DO

6.1 Approvals, Notifications, and Limiting Conditions

Project Manager

6.1.1 Make appropriate notifications to the BJC Subcontract Technical Representative (STR) for any sampling activity to be conducted in areas of the Paducah Site leased to the United States Enrichment Corporation or in other areas of interest.

Project Manager

6.1.2 Issue any required excavation or penetration permit due to underground lines, utilities, etc.

6.1.3 Provisions for lithologic logging are not described or called for in this procedure. Should the project require lithologic logging, instructions for this activity should be described in a separate document.

Sampling Technician

6.2 Special Tools, Equipment, Parts, and Supplies

6.2.1 Ensure that the following items are available for use and are in good condition:

- Site-specific plans and procedures
- Field logbook
- Indelible black-ink pens and markers
- Measuring tape
- Labels and appropriate formal documentation for sample collection including chain-of-custody forms, custody seals, sample labels, and sampling tools and equipment
- Deionized (DI) water
- Pre-preserved sample containers
- Insulated cooler(s)
- Ice bags or "Blue Ice"
- Plastic zip-type bags
- Personal protective clothing and equipment
- Plastic sheeting
- Safety blade
- Decontamination equipment and supplies
- Health and safety monitoring equipment (calibrated)
- Two-way radio and cellular telephone
- Containers for investigation-derived wastes as specified in the site-specific WMP
- Microcorer
- Analytical balance (calibrated)

6.2.2 **IF** the manual (hand) augering method will be used,
THEN also ensure that the following items are available prior to initiating subsurface soil sampling activities:

- Hand auger: flighted-, bucket-, or tube-type auger as required by the site-specific project SAP
- Extension rods, as needed
- Tools – wrench(es) and pliers

Sampling Technician

6.2.3 **IF** either a split-spoon or a Shelby tube will be used,
THEN also ensure that the following items are available prior to initiating subsurface soil sampling activities:

- Drilling equipment capable of providing a borehole to the required depth and enough drilling rods to reach the required depth.
- Drilling equipment capable of "driving" or "pushing" the split spoon or Shelby tube as required by the site-specific SAP.
- Sufficient numbers of split-spoon or Shelby-tube samplers so that at least one is always decontaminated and available for sampling.
- Teflon or acetate liners, as appropriate.

6.2.4 **IF** either a Geoprobe or drive rod sampling tube will be used,
THEN also ensure that the following items are available prior to initiating subsurface soil sampling activities:

Sampling Technician

- Drilling equipment used to hydraulically drive a probe into the ground to collect undisturbed soil samples.

6.3 **Pre-Performance Activities**

NOTE 1: Follow the site-specific HSP for guidelines for appropriate sample area setup.

NOTE 2: A brief summary of subsurface soil collection methods is included in Attachment B, "Summary of Sample Collection Methods."

6.3.1 Obtain the designated sample containers from the Project Sample Coordinator.

6.3.2 Don the appropriate personal protective clothing as dictated by the Site-specific HSP.

6.3.3 Locate pre-surveyed and pre-staked sampling locations and determine appropriate sampling requirements.

6.3.4 Check the sampling locations against the excavation permit.

6.3.5 Place clean plastic sheeting on a flat level surface near the sampling area, if possible.

6.3.6 Place decontaminated equipment to be used on the plastic.

6.3.7 Place the sample cooler(s) near the sampling area.

6.3.8 Cover all equipment and supplies with clean plastic sheeting when not in use.

6.3.9 Set up the decontamination line required by the site-specific SAP. The decontamination line should be staged on plastic sheeting.

6.4 **Collection of Subsurface Soil Samples – General Steps**

NOTE: Follow these general steps when collecting any subsurface soil samples using any of the methods described in Sections 6.5 and 6.10:

6.4.1 **IF** sampling locations defined in the site-specific SAP cannot be sampled due to a physical obstruction,

Sampling Technician

THEN contact the project manager.

6.4.2 **WHENEVER** approval is received from the project manager,
THEN move the sampling location
AND document the change in the field logbook
AND notify the project data coordinator.

6.4.3 Document the sampling events by recording the information in the designated field logbook as defined in GEO-TEC-005, *Logbooks.*

6.4.4 Clear away any vegetation or debris from the sampling location surface.

6.4.5 Place plastic sheeting over boring location so that soil cuttings have minimal contact with the ground surface prior to containerization.

6.4.6 Place all decontaminated equipment on plastic sheeting.

6.4.7 Carefully remove the top ½ to ¾ in of exposed soil, sediment, or sludge before sample collection unless the site-specific SAP indicates otherwise.

6.4.8 First collect sample portions or aliquots for volatile analyses and/or for any other samples that would be degraded by aeration.

6.4.9 Follow applicable sampling requirements related to data quality as described in GEO-TEC-004, *Quality Assured Data.*

6.4.10 Complete chain of custody forms as described GEO-TEC-006, *Sample Chain of Custody.*

6.4.11 If applicable, collect quality control samples as defined in GEO-TEC-009, *Collection of Field Quality Control Samples*

6.5 Manual (Hand) Augering

NOTE : Follow these general steps when collecting hand-augered soil samples:

6.5.1 Auger to the depth required for sampling to obtain soil sample.

6.5.2 Remove excess cuttings from the borehole.

6.5.3 Place soil cuttings on plastic sheeting or containerize as required by the site-specific WMP or SAP.

6.5.4 Remove the auger from the borehole and complete field screening for VOC's and radionuclides as specified in the site-specific HSP.

6.5.5 Place the soil into a decontaminated stainless steel bowl and homogenize using a decontaminated stainless steel spatula or other appropriate instrument.

6.5.6 Place the soil sample into the appropriately labeled sample container(s) using a decontaminated stainless steel spatula or other appropriate instrument.

6.5.7 Seal container(s) and affix custody seal(s).

Sampling Technician

6.5.8 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove soil and/or moisture from the exterior of the liner.

6.5.9 Place the sample container(s) into the sample cooler.

6.5.10 **IF** a Teflon liner was used,
THEN remove the liner and sample from the auger bucket
AND immediately cap the ends of the tube using Teflon end-caps
AND seal the caps with waterproof tape
AND label the sealed liners as required in the site-specific SAP
AND mark the top and bottom of the sample on the outside of the liner, or top of the end caps.

NOTE: Liners of different materials may be used. If plastic end caps are used, place the caps over Teflon tape to separate the sample from the cap.

6.5.11 Wipe the liner (if necessary) with a clean Kimwipe or paper towel to remove soil and moisture from the exterior of the liner.

6.5.12 Record the sample identification number, the depth from which the sample was taken, and the analysis requested in both the field logbook and on the appropriate forms.

6.5.13 Proceed with further sampling, as required.

6.5.14 **WHENEVER** sampling is complete,
THEN dispose of cuttings and plastic sheeting as specified in the site-specific WMP.

6.5.15 Decontaminate all equipment following GEO-TEC-010, *Equipment Cleaning and Decontamination*, as applicable.

6.5.16 Complete field logbook entries and boring logs before leaving the sampling site.

6.5.17 Properly package all samples for delivery to the laboratory and complete all necessary sample documentation as specified in GEO-TEC-006, *Sample Chain of Custody*.

6.6 Split-Spoon Sampling

NOTE: The following general steps must be followed when collecting split-spoon samples using a hollow stem auger (HSA). Other drilling methods may be used to reach desired sampling depths depending on subsurface conditions and requirements of the site-specific SAP.

6.6.1 Attach the lead HSA with cutting head to the drilling rig and insert drilling rod(s) with plug.

6.6.2 Begin drilling and proceed to the first designated sample depth, adding auger flight(s) as necessary.

6.6.3 Rotate augers (without advancing) to remove cutting from the bottom of the borehole.

6.6.4 Remove the plug from the drilling rods.

6.6.5 Attach a decontaminated split spoon to the drilling rod(s).

Sampling Technician

6.6.6 **IF** sampling for VOC's,
THEN insert Teflon or acetate liners into the barrel of the split spoon.
AND insert the rod(s) and split spoon through the HSA.

6.6.7 **IF** ASTM Method D-1586-84 is to be followed,
THEN attach the drive-weight assembly to the rod
AND lightly tap the rods to seat the drive shoe into the undisturbed soil.

6.6.8 **IF** ASTM Method D-1586-84 is not specified in the site-specific SAP and conditions warrant,
THEN push the split spoon using the drill rig hydraulics.

6.6.9 Mark the drilling rod in 6-inch increments from the top of the auger flight(s).

6.6.10 Drive the split spoon with the hammer using a full 30-inch drop as specified in ASTM Method D-1586-84.

6.6.11 **IF** ASTM Method D-1586-84 is not used,
THEN advance to Step 15.

6.6.12 Record the number of blows required to drive the spoon through each 6-in increment.

6.6.13 Cease driving when the full length of the spoon has been advanced or upon refusal. ("Refusal" occurs when 50 blows are used for a single 6-inch increment or a total of 100 blows are applied.)

6.6.14 Pull the spoon free by using upswings of the hammer to loosen the sampler and pull out the rod and spoon with the winch.

6.6.15 Unscrew the split spoon assembly from the drilling rod(s) and place it on the plastic-covered sampling table.

6.6.16 Remove the drive shoe and head assembly.

6.6.17 With the drive shoe and head assembly removed, open (split) the spoon, being careful not to disturb the sample.

6.6.18 Complete field screening for VOC's and radionuclides as specified in the site-specific HSP.

6.6.19 Remove the acetate sleeve with soil from the sample tube.

6.6.20 Mark the sleeve with the appropriate depths.

6.6.21 **IF** VOC samples are NOT to be collected,
THEN advance to Step 6.6.30.

6.6.22 **IF** nonpreserved VOC samples are to be collected,
THEN advance to step 6.6.30

6.6.23 Cut the sleeve into one-foot sections using a safety blade and immediately use a Photo Ionization Detector (PID) to take measurements at the exposed surface.

6.6.24 Cut one-foot sleeve sections lengthwise.

Sampling Technician

6.6.25 Collect the soil plug with a microcorer (approx. 5 grams of soil).

6.6.26 Eject the plug into an appropriately labeled 40 mL Volatile Organic Analysis (VOA) vial, which had been prepared with 5 mL hexane or methanol and 5 mL of DI water.

6.6.27 Repeat Steps 6.6.25 and 6.6.26 for multiple vials.

6.6.28 Seal the container(s) and affix custody seal(s).

6.6.29 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel and place sample vial(s) immediately into a cooler maintained at 4°C.

6.6.30 Place the remaining soil into a decontaminated stainless steel bowl and homogenize using a decontaminated stainless steel spatula or other appropriate instrument.

6.6.31 Place the soil sample into the appropriately labeled container(s) using a decontaminated stainless steel spatula or other suitable instrument.

6.6.32 Seal the container(s) and affix custody seal(s).

6.6.33 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove excess moisture and/or soil from the exterior of the sample container. If the sample is a nonpreserved VOC sample, place sample vial(s) immediately into a cooler maintained at 4°C.

6.6.34 Record the sample identification number, the depth, and the analyses to be performed on the sample in both the field logbook and on the appropriate forms.

6.6.35 Continue to advance the borehole to the next sampling point.

6.6.36 Collect additional samples as outlined above.

6.6.37 **WHENEVER** sampling is complete,
THEN dispose of the soil cuttings and plastic sheeting as specified in the site-specific WMP or SAP.

6.6.38 Decontaminate all equipment following GEO-TEC-010, *Equipment Cleaning and Decontamination*, as applicable.

6.6.39 Complete field logbook entries and boring logs before leaving the site.

6.6.40 Properly package all samples for delivery to the laboratory and complete all necessary sample documentation as specified in GEO-TEC-006, *Sample Chain of Custody*.

6.7 Shelby Tube Sampling

NOTE: Follow these general steps when collecting Shelby tube samples using HSA. Other drilling methods may be used to reach desired sampling depths depending on subsurface conditions and requirements of the site-specific SAP.

6.7.1 Attach the lead HSA with cutting head to the drilling rig and insert drilling rod(s) with plug.

Sampling Technician

6.7.2 Begin drilling and proceed to the first designated sample depth, adding auger flight(s) as necessary.

6.7.3 Rotate augers (without advancing) to remove cutting from the bottom of the borehole.

6.7.4 Remove the plug from the drilling rods.

6.7.5 Attach a decontaminated Shelby tube to the drilling rod(s).

6.7.6 Lower the Shelby tube down to the top of the sampling interval. Make sure to leave at least 30 in of drilling rod above the lowest point of the hydraulic piston's extension.

6.7.7 Use the drilling rig's hydraulic drive to push the Shelby tube into undisturbed soil. The tube should be pushed with a steady force.

6.7.8 **WHENEVER** the Shelby tube has been advanced to its full length or to refusal,
THEN back off the hydraulic pressure
AND attach a hoisting plug to the upper drilling rod
AND twist to break off the sample
AND pull the apparatus out of the HSA with the rig winch.

6.7.9 Detach the Shelby tube from the drilling rod(s) and remove the head assembly.

6.7.10 Complete field screening for VOC's and radionuclides as specified in the site-specific HSP.

6.7.11 **IF** the intent of the Shelby-tube sampling is for geotechnical purposes and an undisturbed sample is required,
THEN cap tube ends and seal them with wax to prevent moisture loss
AND mark the top and bottom ends of the tube
AND transport the tube to the laboratory in a vertical position
THEN advance to Step 29.

6.7.12 Use the hydraulic extruder to extrude the acetate sleeve from the Shelby tube onto a clean piece of plastic sheeting.

6.7.13 Mark the sleeve with the appropriate depths.

6.7.14 **IF** VOC samples are NOT to be collected,
THEN advance to Step 6.7.23

6.7.15. **IF** nonpreserved VOC samples are to be collected,
THEN advance to Step 6.7.23.

6.7.16 Cut the sleeve into one-ft sections using a safety blade and immediately use a PID to take measurements at the exposed surface.

6.7.17 Cut the one-foot sleeve sections lengthwise.

6.7.18 Collect the soil plug with a microcorer (approx. 5 grams of soil).

6.7.19 Eject the plug into an appropriately labeled 40 mL VOA vial, which had been prepared with 5 mL hexane or methanol and 5 mL of DI water.

Sampling Technician

6.7.20 Repeat Steps 6.7.18 and 6.7.19 for multiple vials.

6.7.21 Seal the container(s) and affix custody seal(s).

6.7.22 Wipe the exterior of each sample container clean (if necessary) with a Kimwipe or paper towel and place sample vials immediately into a cooler maintained at 4°C.

6.7.23 Place the remaining soil into a decontaminated stainless steel bowl and homogenize using a decontaminated stainless steel spatula or other appropriate instrument.

6.7.24 Place the soil sample into the appropriately labeled container(s) using a decontaminated stainless steel spatula or other appropriate instrument.

6.7.25 Seal the container(s) and affix custody seal(s).

6.7.26 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove excess moisture and/or soil from the exterior of the sample container. If the sample is a nonpreserved VOC sample, place sample vial(s) immediately into a cooler maintained at 4°C.

6.7.27 Record the sample identification number, the depth, and the analyses to be performed on the sample in both the field logbook and on the appropriate forms.

6.7.28 Continue to advance the borehole to the next sampling point.

6.7.29 Collect additional samples as outlined above.

6.7.30 **WHENEVER** sampling is complete,
THEN dispose of the soil cuttings and plastic sheeting as specified in the site-specific WMP or SAP.

6.7.31 Decontaminate all equipment according to GEO-TEC-010, *Equipment Cleaning and Decontamination*, as applicable.

6.7.32 Complete field logbook entries and boring logs before leaving the site.

6.7.33 Properly package all samples for delivery to the laboratory and complete all necessary sample documentation as specified in GEO-TEC-006, *Sample Chain of Custody*.

6.8 **Continuous Soil Sampler**

NOTE: Follow these general steps when collecting continuous split-spoon samples with HSA.

6.8.1 Insert the 5-foot sampler into the HSA flight (typical HSA flights are 5 feet in length).

6.8.2 Attach the HSA and sampler to the drill stem.

6.8.3 Begin normal HSA drilling.

6.8.4 **WHENEVER** the first 5-foot interval is complete,
THEN detach the drill rig from the HSA
AND withdraw the sampler.

6.8.5 Unscrew the sampler from the drilling rod(s) and place it on the sample table.

Sampling Technician

6.8.6 Remove the drive shoe and head assembly.

6.8.7 Remove the acetate sleeve with soil from the sample tube.

6.8.8 Mark the sleeve with the appropriate depths.

6.8.9 Open (split) the spoon, being careful not to disturb the sample.

6.8.10 Complete field screening for VOC's and radionuclides as specified in the site-specific HSP. Mark the sleeve with the appropriate depths.

6.8.11 **IF** VOC samples are NOT to be collected,
THEN advance to Step 6.8.20.

6.8.12 **IF** nonpreserved VOC samples are to be collected,
THEN advance to Step 6.8.20.

6.8.13 Cut the sleeve into one-foot sections using a safety blade and immediately use a PID to take measurements at the exposed surface.

6.8.14 Cut the one-foot sleeve sections lengthwise.

6.8.15 Collect the soil plug with a microcorer (approx. 5 grams of soil).

6.8.16 Eject the plug into an appropriately labeled 40 mL VOA vial, which had been prepared with 5 mL hexane or methanol and 5 mL of DI water.

6.8.17 Repeat Steps 6.8.15 and 6.8.16 for multiple vials.

6.8.18 Seal the container(s) and affix custody seal(s).

6.8.19 Wipe the exterior of each sample container (if necessary) clean with a Kimwipe or paper towel and place sample vial(s) immediately into a cooler maintained at 4°C.

6.8.20 Place the remaining soil into a decontaminated stainless steel bowl and homogenize using a decontaminated stainless steel spatula or other appropriate instrument.

6.8.21 Place the soil sample into the appropriately labeled container(s) using decontaminated stainless steel spatula or other suitable instrument.

6.8.22 Seal the container(s) and affix custody seal(s).

6.8.23 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove excess moisture and/or soil from the exterior of the sample container. If the sample is a nonpreserved VOC sample, place sample vial(s) immediately into a cooler maintained at 4°C.

6.8.24 Record the sample identification number, the depth, and the analyses to be performed on the sample in both the field logbook and on the appropriate forms.

6.8.25 Continue sampling as outlined above until the final borehole depth is reached.

6.8.26 **WHENEVER** sampling is complete,
THEN dispose of the soil cuttings and plastic sheeting as specified in the site-specific WMP or SAP.

Sampling Technician

6.8.27 Decontaminate all equipment following GEO-TEC-010, *Equipment Cleaning and Decontamination*, as applicable.

6.8.28 Complete field logbook entries and boring logs before leaving the site.

6.8.29 Properly package all samples for delivery to the laboratory and complete all necessary sample documentation as specified in GEO-TEC-006, *Sample Chain of Custody*.

6.9 Geoprobe or Drive Sampling Tubes

Drill Rig Operator/Sampling Technician

6.9.1 Prepare the Geoprobe for sampling.

6.9.2 Lift the latch and insert the hammer anvil into the Geoprobe.

6.9.3 Push the latch back in order to hold in the hammer anvil.

NOTE: In certain conditions such as hard soils, a drive point may be used instead of a soil sample tube as described below.

6.9.4 Assemble the soil sample tube in the following way:

6.9.4.1 Thread the piston rod onto the point.

6.9.4.2 Slide the piston rod and point into the sample tube.

6.9.4.3 Thread the sample tube adapter into the soil sample tube and thread (reverse thread) the piston stop pin into the sample tube adapter.

6.9.5 Prepare the rods for sampling in the following way:

6.9.5.1 Thread a section of probe rod onto the sample tube and Install the drive cap.

6.9.5.2 Position the sampling rod assembly below the hammer anvil.

6.9.5.3 Lower the drive rod and sub until the hammer anvil makes contact with the drive cap.

6.9.5.4 Push the sampling rod assembly into the ground and increase the hydraulic pressure and/or the hydraulic hammer as needed.

6.9.5.5 Raise the drive rod and sub and connect a second Geoprobe rod.

6.9.5.6 Continue with this procedure until the desired depth is reached.

6.9.6. Extract the piston stop pin in the following way:

6.9.6.1. Slide the drill rig mast forward to allow more working room, if possible.

6.9.6.2. Remove the drive cap.

6.9.6.3. Using the necessary sections of threaded extension rods; remove the sampler piston stop pin by rotating the extension rods until the pin is free.

6.9.7. Collect the soil sample and remove it from the ground in the following way:

6.9.7.1 Slide the drill rig mast back over the probe rods.

Drill Rig Operator/Sampling Technician

6.9.7.2 Replace the drive cap and advance the Geoprobe rods the length of the sampler less 3 inches (7.6 cm) to compensate for the length of the sampler adapter and the piston point.

6.9.7.3 Raise the drive rod and remove the hammer anvil.

6.9.7.4 Thread the probe rod puller cap onto the probe rod.

6.9.7.5 Lower the drive rod so that it is sitting directly on top of the rod puller cap.

6.9.7.6 Latch the drive rod to the puller cap.

6.9.7.7 Stack wooden blocks under the derrick feet or lower the "outriggers" on the Geoprobe rig, if needed.

6.9.7.8 Slowly raise the drive rod & pull the probe rods from the ground.

6.9.7.9 Unthread each probe rod and lay each to the side to avoid tripping hazard.

6.9.7.10 Install the probe rod puller cap.

6.9.7.11 Repeat the steps above until the sample tube has been retrieved to the surface.

6.9.8 Collect the sample in the following way:

6.9.8.1 Remove the sample tube from the probe rods.

6.9.8.2 Remove the piston rod, point, and sample tube adapter from the sample tube.

6.9.8.3 Extract the sample from the sample tube using a ¾ inch (1.0 cm) diameter steel rod or wooden dowel and the drive rod from the Geoprobe rig. Other methods for extruding the sample may be used.

Sampling Technician

6.9.9 Complete field screening for VOC's and radionuclides as specified in site-specific HSP.

6.9.10 **IF** VOC samples are NOT to be collected,
THEN advance to Step 6.9.17.

6.9.11 **IF** nonpreserved VOC samples are to be collected,
THEN advance to Step 6.9.17.

6.9.12 Collect the soil plug with a microcorer (approx. 5 grams of soil).

6.9.13 Eject the plug into an appropriately labeled 40 mL VOA vial, which had been prepared with 5 mL hexane or methanol and 5 mL of DI water.

6.9.14 Repeat Steps 6.9.12 and 6.9.13 for multiple vials.

6.9.15 Seal the container(s) and affix custody seal(s)

6.9.16 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel and place sample vial(s) immediately into a cooler maintained at 4°C.

6.9.17 Place the remaining soil sample into the appropriately labeled container(s) using a decontaminated stainless steel spatula or other suitable instrument.

6.9.18 Seal the container(s) and affix custody seal(s).

Sampling Technician

6.9.19 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove excess moisture and/or soil from the exterior of the sample container. If the sample is a nonpreserved VOC sample, place sample vial(s) immediately into a cooler maintained at 4°C.

6.9.20 Record the sample identification number, the depth, and the analyses to be performed on the sample in both the field logbook and on the appropriate forms.

6.9.21 Continue sampling as outlined above until the final borehole depth is reached.

6.9.22 **WHENEVER** sampling is complete,
THEN dispose of the soil cuttings and plastic sheeting as specified in the site-specific WMP or SAP.

6.9.23 Decontaminate all equipment following GEO-TEC-010, *Equipment Cleaning and Decontamination*, as applicable.

6.9.24 Complete field logbook entries and boring logs before leaving the site.

6.9.25 Properly package all samples for delivery to the laboratory and complete all necessary sample documentation as specified in GEO-TEC-006, *Sample Chain of Custody*. .

6.10 Subsampling with Microcorer (VOC Analysis)

6.10.1 Clean and decontaminate all equipment and materials that will be used during sampling according to GEO-TEC-010, *Equipment Cleaning and Decontamination.*

6.10.2 Determine an appropriate sampling point for VOC's as directed by the site-specific SAP or the Project Manager.

6.10.3 **IF** nonpreserved VOC samples are to collected,
THEN advance to Step 6.10.7

6.10.4 Introduce 5 mL of hexane or methanol and 5 mL of DI water using a pipette into a precleaned 40 mL glass vial, depending upon what is called for in the site-specific SAP.

6.10.5 Cap and weigh the vial.

6.10.6 Record the weight on the vial label and/or chain of custody form as directed by the site-specific SAP or the Project Manager.

6.10.7 Set the microcorer for the desired sample size in the following way:

NOTE: Each line inscribed on the barrel indicates approximately 1 gram, depending upon the soil type to be sampled.

6.10.7.1 Loosen the set screw.

6.10.7.2 Slide the stop to the desired line.

6.10.7.3 Tighten the screw.

6.10.8 Insert the microcorer into the soil to be sampled, ensuring that soil fills the barrel to the stop.

Sampling Technician

6.10.9 Extrude the soil from the microcorer into the appropriately labeled 40 mL VOA vial or nonpreserved vial if nonpreserved VOC samples are collected.

NOTE: If nonpreserved VOC sample, weigh vial and soil only.

6.10.10 Weigh the vial, including hexane or methanol, DI water, and soil.

6.10.11 Record the weight on the vial label and/or chain of custody form.

6.10.12 Wipe the exterior of each sample container (if necessary) with a Kimwipe or paper towel to remove excess moisture and/or soil from the exterior of the sample container. If sample is a nonpreserved VOC sample, place sample vial(s) immediately into a cooler maintained a 4°C.

6.10.13 Decontaminate the microcorer according to GEO-TEC-010, *Equipment Cleaning and Decontamination.*

6.11 Post-Performance Activities

6.11.1 Handle and secure logbooks and field forms according to GEO-TEC-005, *Logbooks* and GEO-TEC-003, *Records Management* or the other project-specific plans.

6.11.2 Dispose of excess sample media, personnel protective equipment, plastic, and other waste materials as specified by the site-specific WMP, Statement of Work, or other applicable documents.

RECORDS

7.1 General Requirements

Records generated as a result of this procedure shall be processed and maintained in accordance with requirements in GEO-TEC-003, *Records Management.*

7.2 Quality Records

7.2.1 Field Logbook

7.2.2 Boring logs

7.2.3 Chain-of-custody form

7.3 Non-quality Records

None

SOURCE DOCUMENTS

8.1 Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods,* EPA/540/P-87/001, OSWER Directive 9355.0-14, December 1987

8.2 *Hazardous Waste Remedial Actions Program, Standard Operating Procedures for Site Characterization,* DOE/HWP-100, July 1990

8.3 U.S. Environmental Protection Agency, Region IV, Environmental Compliance Branch, *Standard Operation Procedures and Quality Assurance Mutual,* 1996

SOURCE DOCUMENTS

8.4 Department of Energy, *Environmental Survey Manual,* DOE/EH-00053, October 1987

8.5 American Society for Testing and Materials ASTM Standard Method D 1587-83, *Thin Walled Tube Sampling of Soils.*

Attachment A
Definitions and Acronyms
Page 1 of 2

1.0 Definitions

1.1 **Extension Rods** – Rods that fit inside the probe rods, the ends of which tread into piston stop pins, allowing the pin to be removed at the proper sample depth.

1.2 **Geoprobe** – A system for hydraulically driving rods and various sampling devices into the subsurface.

1.3 **Geoprobe Adapter Assembly** – A device that adapts the drive rod to the Geoprobe system.

1.4 **Grab Sample** – A discrete portion or aliquot taken from a specific location at a given point in time.

1.5 **Hammer Anvil** – A device that fits into the Geoprobe adapter assembly and is used for pushing and hammering rods into the ground.

1.6 **Hand Auger** – A stainless steel cylinder (bucket) approximately 3 to 4 inches in diameter and 1 ft in length. Open at both ends, and with the bottom edge designed to twist into the soil and cut out a cylinder. The bucket collects the soil sample. The auger has a T-shaped handle (for hand operations), which is attached to the top of the bucket by an extendable stainless steel rod.

1.7 **Latch** – A device that attaches to the adapter assembly to pull the Geoprobe rod out of the ground.

1.8 **Microcorer** – A small hand-held sampler used to collect a soil sample that will fit inside a 40 mL glass vial.

1.9 **Piston Rod and Point** – A point and attached rod that slides into the soil sample tube. When held in place by the piston stop in, the point and rod slide up into the sampling tube allowing soil to enter the tube.

1.10 **Piston Stop Pin – A** pin that threads (reverse) into the sample tube adapter and holds the piston rod and point in place.

1.11 **Sample Tube Auger** – An adapter from soil sample tube to probe rods

1.12 **Shelby Tube** – A cylindrical sampling device, generally made of stainless steel or brass, which is pushed into the subsurface soil. Once the tube is retrieved, the sample may be removed by a rig-mounted extruder or capped and sealed for extrusion in the laboratory before analysis.

1.13 **Split Spoon** – A cylindrical sampling device of varying diameters and lengths, generally made of stainless steel. The spoon is hinged lengthwise, which allows the sample to be retrieved by opening ("splitting") the spoon. The most common split-spoon samplers have a 2 in to 5 in outer diameter and a length of 2 ft or 5 ft...

1.14 **Subsurface Soil** – The material that exists deeper than approximately 1 ft (30 centimeters) from the surface, but above bedrock or any other consolidated material.

1.15 **Unconsolidated Zone** – The layer of material above bedrock that exists in a relatively loose (non-cemented) state.

Attachment A
Definitions and Acronyms
Page 2 of 2

2.0 Acronyms

2.1 **ASTM** - American Society for Testing and Materials

2.2 **BJC** - Bechtel Jacobs Company LLC

2.3 **DOE** - Department of Energy

2.4 **DI** - Deionized

2.5 **HSP** - Health and Safety Plan

2.6 **HAS** - Hollow Stem Auger

2.7 **PID** - Photo Ionization Detector

2.8 **SAP** - Sampling and Analysis Plan

2.9 **SPT** - Standard Penetration Test

2.10 **STR** - Subcontract Technical Representative

2.11 **VOA** - Volatile Organic Analysis

2.12 **VOC** - Volatile Organic Compound

2.13 **WMP** - Waste Management Plan

Attachment B
Summary of Sample Collection Methods
Page 1 of 5

A variety of sampling devices are available for subsurface soil sampling including bucket augers, split-barrel samplers, Shelby-tube samplers and solid-barrel samplers. Each of these sampling devices comes in a variety of diameters and lengths. Typically, the site geologic conditions, drilling methods, and sample needs determine which sampling method is best for a given project. All of the listed sampling devices may be used to obtain physical, chemical, or radiological data. All sampling equipment used to collect environmental samples for chemical or radiological testing must be constructed of stainless steel. Teflon liners may also be required for insertion into the sampling device. The most commonly used subsurface soil sample collection methods are described below.

Hand Auger

The hand auger consists of a stainless steel cylinder or bucket, approximately 3 to 4 inches in diameter and 1 ft in length, open at both ends, with the bottom edge designed to twist into the soil and cut out a soil core. The auger has a T-shaped handle for manual operation attached to the top of the bucket by an extendable stainless steel rod. Additional sections or flights can be attached to the auger to extend the length, as necessary.

Hand augers are designed to collect surface or shallow subsurface soil samples. The use of hand augers is applicable to a variety of soil conditions including sands, clays, and silts. The use of hand augers in soils having substantial quantities of rock or gravel is limited. Hand auger buckets are available tin diameters ranging from 1.75 by 12 in to 4 by 12 in. There are several different styles of hand augers that are suitable for coring in different soil types. Two of these styles are illustrated in Figure 1 (see page 3of 5 in this atachment).

Hand augers have some advantages over other subsurface sampling devices. Hand augering does not require expensive drilling equipment to advance a borehole to the desired sampling depth, and hand augers are relatively inexpensive. For sampling areas with limited access (including sites with trees, buildings, and subsurface utilities), hand augering may be the only viable option.

There are several disadvantages to hand augering. The maximum sampling depth is limited, regardless of subsurface conditions. Typically 20 ft below ground surface is the maximum obtainable with a hand auger. Hand augering also provides a soil sample that can be very disturbed, increasing the potential of VOC loss. Hand augering is NOT to be used for the collection of VOC samples, although a hand auger may be used to advance the hole. A slide hammer or other similar device can be used to drive the sampling rod into the ground for the collection of a soil sample.

Split-Barrel Sample Spoons

The split-barrel sample spoon or "split-spoon" consists of a carbon or stainless steel cylindrical barrel and a hardened steel drive shoe, and ball check valve head which thread on to either end of the barrel. The barrel is split longitudinally. The ball check valve head is threaded for attachment to the drilling rods. Split-spoon samplers come in a variety of diameters and lengths. Diameters range from 2 in to 4.5 inches in outer diameter, and in lengths from 18 to 60 in. The 2-ft long, 2-in diameter split spoon samplers are the most commonly used, but all sizes have advantages depending on sample needs. A split spoon is illustrated in Figure 2 (see page 4 of 5 in this attachment).

Split spoons can be used in a variety of subsurface soil sample acquisitions. They can be used in sands, clays, silts, and gravels. They are also useful for obtaining samples in semi consolidated deposits and from very soft rocks where traditional rock coring methods with water tend to wash away the sample.

The most commonly used method for obtaining soil samples using a split-spoon is the Standard Penetration Test (SPT). Originally conceived for use in geotechnical engineering, the SPT has recently been used in conjunction with subsurface environmental investigations. The method requires that the split spoon be driven using a 140 $\pm$ 2 pounds hammer falling 30 inches. The blow counts are recorded for each 6-in split spoon advancement. This information is used to determine general density and compactness of the media being sampled.

Split spoons can also be pushed. This method of sample acquisition is generally confined to use in clay, silt, and fine sand deposits. There is an advantage to pushing split spoons, when possible, because sampling time can be shortened. Some advantages of subsurface soil sampling using split spoons include:

- Increased sampling depths
- Dependent on sampling media, relatively undisturbed sample can be obtained
- Several different sizes of split spoons are available for use depending on sampling requirements
- Teflon liners can be inserted in the split spoon barrel to minimize VOC loss
- Split spoons are very durable

Some disadvantages of subsurface soil sampling using split spoons include:

- Method can be expensive because drilling equipment is needed to advance boreholes to required sampling depth, and sampling time is increased requiring more professional hours
- Use of drilling equipment limits sampling activities to areas with easy access

Shelby Thin-Walled Tube Samplers (Shelby Tubes)

The Shelby tube consists of a thin-walled solid cylinder that is threaded to a sampler head containing a check valve. The sampler head is then connected to the drilling rods. The Shelby tube can be made of brass, carbon steel, or stainless steel. Like split spoons, Shelby tubes come in a variety of diameters and lengths, the most common being 3-in diameter, 2 ft long. A Shelby tube is illustrated in Figure 3 (see page 5 of 5 in this attachment).

Shelby tubes are most often used for obtaining "undisturbed" soil samples for in-situ permeability testing or other physical soil testing. Under the right circumstances, Shelby tubes can be used as a general subsurface soil sampler. Unlike split spoons, Shelby tubes are generally pushed to minimize disturbance to the sample.

Some advantages of subsurface soil sampling using Shelby tubes include:

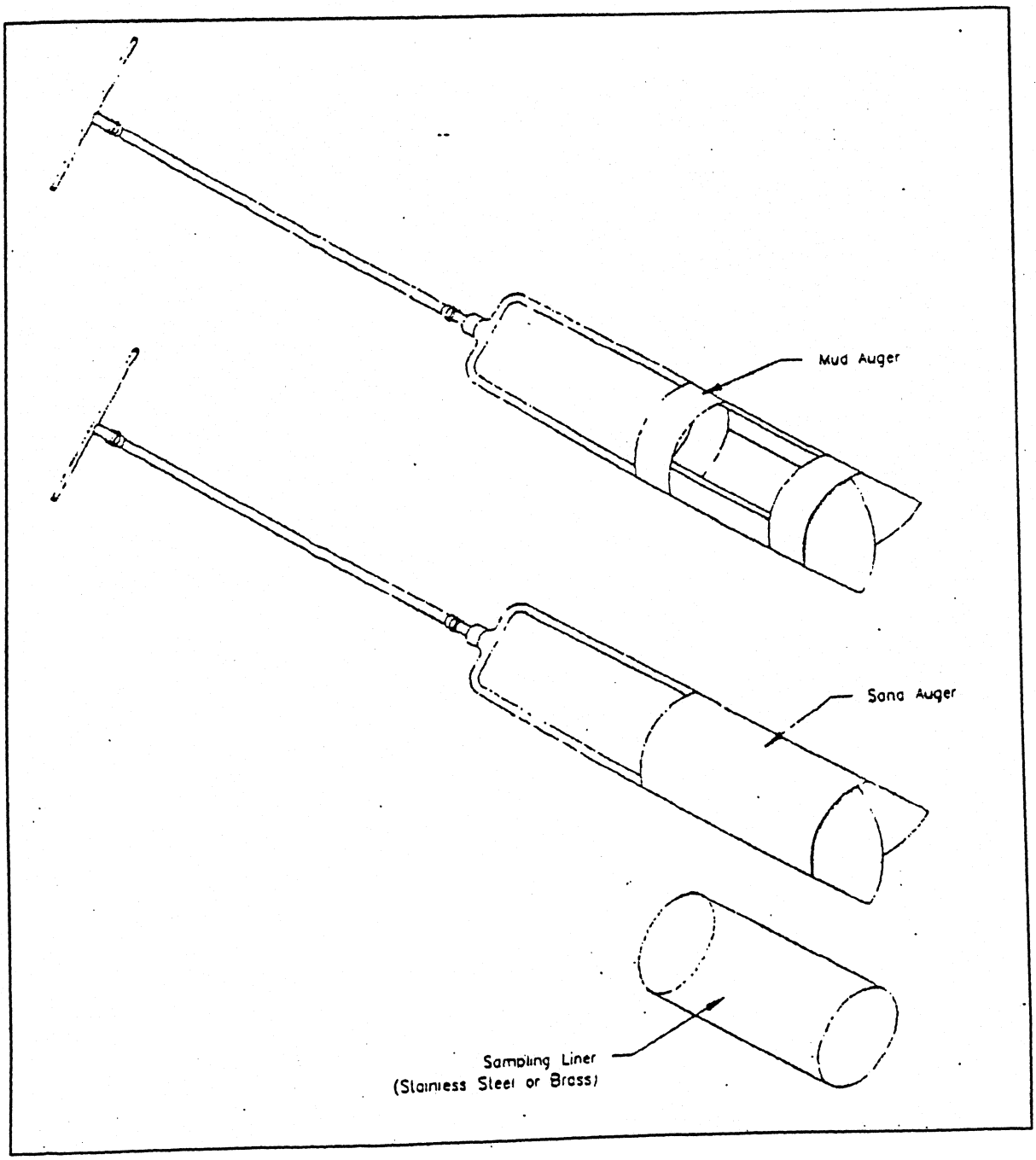
- Increased sample depths
- "undisturbed" soil samples may be obtained
- Different sizes are available for use depending on sampling requirements
- Teflon liners can be inserted in the Shelby tube to minimize VOC loss

Some disadvantages of subsurface soil sampling using Shelby tubes include:

- Shelby tube use is limited to fine-grained and cohesive deposits (clay and silt)
- Shelby tubes are not very durable and are typically used only once
- Shelby tubes can be expensive because drilling equipment is needed to advance boreholes to the required sampling Depth
- Use of drilling equipment limits sampling activities to areas with easy access.

Attachment B
Summary of Sample Collection Methods
Page 3 of 5

Figure 1. Standard Hand Augers



Attachment B
Summary of Sample Collection Methods
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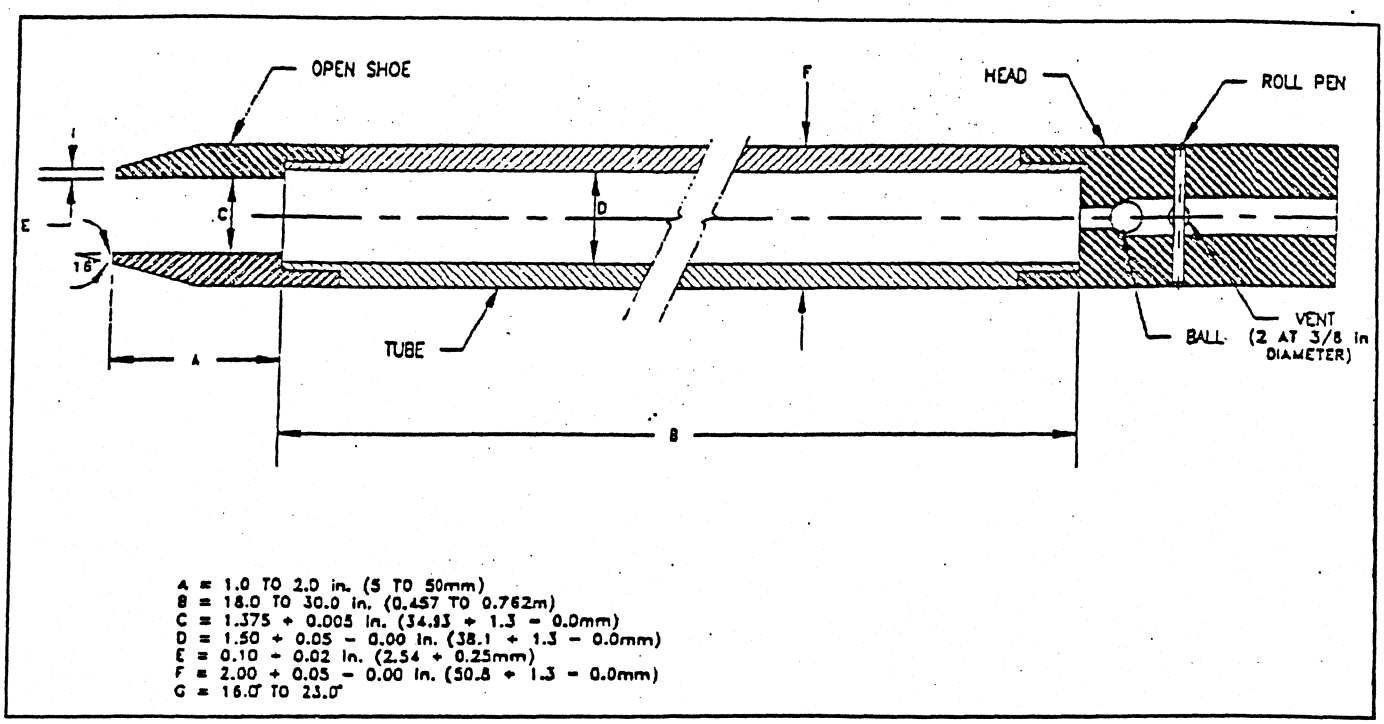
Figure 2. Split Spoon Sampler



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Summary of Sample Collection Methods
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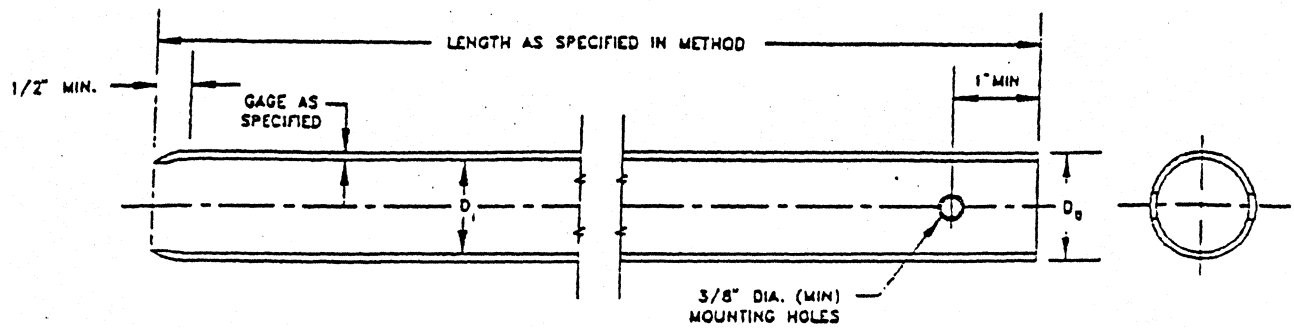
Figure 3. Thin-Walled "Shelby" Tube



INSIDE CLEARANCE RATIO = $\frac{D_i - D_o}{D_o}$

NOTE 1 - MINIMUM OF TWO MOUNTING HOLES ON OPPOSITE SIDES FOR 2 TO 3 1/2 in. SAMPLER.
NOTE 2 - MINIMUM OF FOUR MOUNTING HOLES SPACED AT 90 FOR SAMPLERS 4 in. AND LARGER.
NOTE 3 - TUBE HELD WITH HARDENED SCREWS.
NOTE 4 - TWO-INCH OUTSIDE-DIAMETER TUBES ARE SPECIFIED WITH AN 18-GAGE WALL THICKNESS TO COMPLY WITH AREA RATIO CRITERIA ACCEPTED FOR "UNDISTURBED SAMPLES." USERS ARE ADVISED THAT SUCH TUBING IS DIFFICULT TO LOCATE AND CAN BE EXTREMELY EXPENSIVE IN SMALL QUANTITES. SIXTEEN-GAGE TUBES ARE GENERALLY READILY AVAILABLE.

APPENDIX D

TEST AMERICA STANDARD OPERATING PROCEDURES

Appendix D – Test America Standard Operating Procedures

1. Determination of VOCs in Ambient Air, EPA Compendium Methods TO14 and TO15 [BR-AT-004, Rev. 7 09/25/09]

2. Mercury by CVAA (SW846 7471A) [BR-ME-004, Rev. 12, 03/05/10]

3. Metals by ICP-OES (SW-846 6010B) [BR-ME-005, Rev. 11, 03/05/10]

4. Acid Digestion of Sediments, Sludges, and Soils (SW-846 3050A) [BR-ME-011, Rev. 10, 3/22/10

Title: Determination of VOCs in Ambient Air EPA Compendium Methods TO14 and TO15

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1.0 Scope and Application

This SOP describes the laboratory procedure for the analysis of polar and non-polar volatile organic compounds (VOCs) in ambient air. The procedure is applicable to those VOCs that have been evaluated by the laboratory for their consistent performance in meeting the control criteria put forth in Compendium Method TO-15. While the compendium method is specifically written for the analysis of samples collected in leak-free passivated stainless steel canisters, it may be applied to the analysis of samples that have employed the use of other collection devices such as Tedlar bags and solid absorbents.

1.1 Analytes, Matrix(s), and Reporting Limits

The target compound list and reporting limits for each compound are provided in Table 1.

2.0 Summary of Method

An aliquot of sample is pulled from the canister through a solid multi sorbent bed trap which reduces the water content of the sample. The sample is thermally desorbed and the VOCs are carried onto a GC column coupled to a mass spectrometer. Compounds are identified by comparison of the mass spectra for individual peaks in the total ion chromatogram to the fragmentation patterns of ions corresponding to VOCs including the intensity of primary and secondary ions as well as the patterns of stored spectra acquired under similar conditions. The concentration of the target compound is calculated by internal standard technique using the average response factor of that compound as determined by the initial calibration.

This procedure is based on EPA Compendium Method TO-15 "Determination of Volatile Organic Compounds in Ambient Air using Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry", US EPA, January, 1999.

If the laboratory has modified the method, a list of these modifications may be found in Section 16.0.

3.0 Definitions

A list of terms and definitions are provided in Appendix A.

4.0 Interferences

Contamination may occur if canisters or other equipment is not properly cleaned before use. The laboratory procedures for canister and flow controller cleaning procedures are provided in Appendices C and D.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples

and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

The analytical system contains zones with elevated or depressed temperatures that are capable of causing injury upon direct contact. The analyst needs to be aware of the locations of those zones, and allow them to return to room temperature prior to maintenance activities or take measures to avoid contact with hot and/or cold surfaces. There are areas of high voltage in the analytical system. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

Liquid nitrogen (LN2) is used for cryogenic purposes. In addition to avoiding contact with LN2 cooled surfaces, analysts must be aware of the potential for oxygen depletion in a confined space in the event of an unexpected large release of the product. Users should evacuate a confined space in which large amounts of LN2 have been released.

Sample canisters are occasionally pressurized for cleaning or sample dilution purposes. Lab systems are designed to ensure that the cans are not pressurized above 32 psi. Eye protection must be worn when cans are pressurized in the event of a canister failure.

5.2 Primary Materials Used

There are no materials used in this method which have a serious or significant hazard rating **NOTE: This list does not include all materials used in the method.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

6.0 Equipment and Supplies

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts are cautioned to be sure equipment meets the specification of this SOP.

6.1 Sampling Equipment

- 6L, 3L, and 1L SUMMA® Canisters: Leak-Free, Passivated Stainless Steel, with Swagelok DSS4 Valves, or equivalent.

- 6L SUMMA® Canisters: Silicon lined-Leak-Free, Passivated Stainless Steel, with Swagelok DSS4 valves or equivalent.

- Flow Controllers: Restek Catalog #24239 or equivalent.

- Flow Controller Orifice: Various sizes ranging from 0.008” to 0.060”, Restek or equivalent.

- Flow Controller Vacuum Gauges: Capable of measuring vacuum to an absolute vacuum of -30” of HG, and pressure up to 30 psi, Grainger Catalog #5WZ37 or equivalent.

- Rain Guard: Stainless Steel Tubing ¼", 10ft. Grainger or Equivalent. Cut 8" and bend into a J shape using a pipe bender.

- Stainless Steel Pre-Filter (7 um): Swagelok Catalog# SS-4F-T7-7 or equivalent.

- Teflon Tape: Home Depot Brand or equivalent.

6.2 Analytical System

- Mass Spectrometer: Agilent 5973 or 5972 MSD or equivalent.
- Gas Chromatograph: Agilent 6890 or equivalent.
- VOC Autosampler: Entech 7016CA or equivalent.
- Cryogenic Concentrator: Equipped with an electronic mass flow controller that maintains a constant flow for carrier gas and sample over a range of 0-200 cc/min. Entech 7100A or equivalent.
- Low Pressure Liquid Nitrogen: Air Gas or equivalent.
- Glass Bead Cryotrap: Capable of effectively removing water while trapping polar and non-polar compounds. Entech catalog# 01-04-11320.
- TENAX Sorbent Trap: Capable of removing CO2 and trapping the polar and non-polar compounds. Entech catalog # 01-04-11330.Primary Column: Fused silica capillary column (60 m x 0.32 mm x 1.8 μm), Restek RTX-624 or equivalent.
- Data System: PC software for Entech instrumentation. Hewlett-Packard ChemStation data acquisition software and Hewlett-Packard ChemServer, Target 3.5 data processing software.

6.3 Cleaning System

- Canister Cleaner Module and Software: Capable of filling canisters with humidified air and evacuating canisters to 50 mtorr, Entech Model 3100A or equivalent.

- Vacuum Pump: Capable of evacuating sample canisters to full vacuum. Vacuubrand or equivalent.

- Cleaning Manifold: Equipped with stainless steel and Teflon transfer lines and connections for cleaning up to twelve canisters simultaneously.

- Heating Belts: Individual thermal-stated heating belts used to heat canisters to 100ºC during the manifolds cleaning cycles. Entech or equivalent.

- Cleaning oven: Capable of cleaning 6 Summa Cans simultaneously at a temperature of 100ºC. Entech or equivalent.

- Flow Controller Cleaning Manifold: Capable of flushing hot Nitrogen through 24 flow controllers simultaneously for cleaning.

6.4 Miscellaneous Supplies

- Mass Flow Controller, NIST Traceable: Capable of flow rate of 70 mL/min, McMillan Company 80SD or equivalent. Use for the preparation of calibration and working standards.

- Zero Air Generator: Ballston Model HPZA-3000 or equivalent.
- Syringes: Gas tight with a Luer-Lok tip, assorted sizes ranging from 1.0 mL to 1.0 L, SGE or equivalent.

- Digital Pressure Gauges, NIST Traceable: Capable of measuring pressure in the range of -30" Hg to 100 psi, Dwyer Models DPGA-12 and 67100 or equivalent.

- Digital Flow Meter, NIST Traceable: Alltech or equivalent.

7.0 Reagents and Standards

7.1 Reagents

- Ultra Pure Humidified Zero Air - Pass ambient laboratory air through a zero air generator. The zero air generator humidifies the air to a relative humidity of >20 percent.

7.2 Standards

Purchase the following stock standard mixtures from commercial vendors:

- Mixed Gas Stock Standard: - Commercially prepared standard that includes internal standard and tune standard compounds: Bromofluorobenzene, Bromochloromethane, 1,4-Difluorobenzene, and Chlorobenzene-d5, and at a concentration of 100 ppbv each. Spectra Gas or equivalent.

- Calibration Stock Standard: - Commercially prepared custom gaseous stock standard used by all network facilities that includes all target analytes at a concentration of 1.0 ppmv. Spectra Gases or equivalent.

- ICV / LCS Stock Standard: - Custom made gaseous stock standard prepared from a different lot(s) of the source material(s) used to manufacture the calibration stock standard. The ICV/LCS stock standard includes all target analytes at a concentration of 1.0 ppmv. Spectra Gases.

Prepare calibration and working standards mixtures by diluting a known volume of the stock standard in humidified ultra pure zero air to a specified volume. The formulations for standard preparation are provided in Appendix B along with recommended expiration dates and storage conditions.

Each stock standard is assigned a 1 year expiration date from manufacture and recertified annually.

The recertification procedure is as follows:

Internal Standard Mixed Gas Stock: Assay the active internal standard cylinders against a new, vendor certified cylinder purchased from Spectra Gas. Verify that the % difference between

new, vendor certified cylinder and the active cylinder is within 20%. If this criterion is not met, replace the cylinder.

Calibration Stock Standard and the ICV/LCS Stock Standard: Return one of the cylinders to Spectra for recertification (rotate a different cylinder each year). When the re-certified stock standard cylinder is returned, assay against all active cylinders. The difference between the recertified value and the assay values should be within 15%. If these criteria are not met, return the cylinder that was not re-certified to the vendor for recertification or purchase a new stock standard.

8.0 Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection so these procedures are not included in this SOP. Sampling requirements may be found in the published reference method.

Matrix	Sample Container	Minimum Sample Size	Preservation	Holding Time	Reference
Air	1L ,3L or 6L Passivated Summa Canister	1L	NA	30 days from collection	EPA TO-15

All samples should be collected in passivated stainless steel canisters that have been certified clean prior to sampling. The laboratory will provide certified clean canisters to the client upon request. The procedures for clean canister certification are provided in Laboratory SOP BR-AT-011.

The laboratory can also provide flow controllers set to the appropriate flow rate for the sampling time required by the client.

The laboratory ships air canisters in custom made boxes. The boxes are equipped with custom-made foam inserts to hold the pre-set flow-controllers. The custom shipping materials are designed to prevent damage of equipment to and from the sampling site. The laboratory checks the equipment to ensure it is in proper working order before shipment to the client and additional checks are performed on return of the equipment to the laboratory. Sampling instructions are provided with each sampling kit. The sampling crew is advised to handle the sampling equipment using the instructions provided by the laboratory to ensure optimum performance.

Samples should be stored at ambient temperature.

The analytical holding time is 30 days from the date of sample collection.

9.0 Quality Control

9.1 Sample QC

The following quality control samples are prepared with each batch of samples.

QC Item	Frequency	Acceptance Criteria
Method Blank (MB)	1 in 20 or fewer samples	See Table 3
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	See Table 3
Internal Standard (ISTD)	Every Sample	See Table 3
Laboratory Control Sample Duplicate (LCSD)	Client request	See Table 3
Sample Duplicate (SD)	Client Request	See Table 3
Trip Blank (TB)	Client Request	See Table 3

NOTE: The compendium reference method does not require the analysis of a laboratory control sample (LCS) or provide criteria for the evaluation of an LCS. The laboratory performs an LCS at the above mentioned frequency as an evaluation of percent recovery in a blank matrix. The control limits set by the laboratory for the LCS (70-130) are those specified in Section 11.4 of the reference method for the audit accuracy evaluation.

The compendium method does not require analysis of a LCSD. Evaluations for precision should be derived from field samples. Duplicate precision should be measured by the analysis of a sample duplicate. Replicate precision should be measured from separate aliquots taken from the same sample canister. The laboratory will perform an LCSD to measure precision only per client request and analysis of the LCSD is considered a billable. The acceptance criteria for duplicate and replicate precision is <25%. Unless otherwise specified by the client during project initiation, the LCSD will be used to measure precision only. The LCS will be used for evaluations for percent recovery and to determine if corrective action is necessary.

9.2 Instrument QC

The following instrument QC is performed:

QC Item	Frequency	Acceptance Criteria
Tune Standard (BFB)	Each Analytical Window	See Section 10.0
Initial Calibration (ICAL)	Initially; when ICV or CCV fail	See Section 10.0
Initial Calibration Verification (ICV)	Once, after each ICAL	See Section 10.0
RT Window Establishment	Once per ICAL	See Section 10.0
Relative Retention Time (RRT)	With each sample	See Section 10.0
Continuing Calibration Verification (CCV)	Daily, after each BFB	See Section 10.0

10.0 <u>Procedure</u>

10.1 Support Equipment Calibration

Verify the calibration of the mass flow controller used to prepare standards, the calibration of the digital flow meter used to set and check the flow rates of the FC(s) used for sample collection, and the calibration of the digital pressure gauges used to check return canister pressure is current to the year. Immediately notify the QA department if the calibration is not current and

wait for further instruction. Equipment whose calibration has expired may not be used without documented approval from the QA department.

NOTE: The QA department schedules the annual calibrations of the support equipment and maintains all Certificates of Calibration. The flow controllers are checked against a NIST traceable standard. This check is performed by the manufacturer of the equipment, when possible, or by an approved vendor that provides certification service.

10.2 Instrument Calibration

10.2.1 Tune Standard

Analyze a tune standard (BFB) prior at the beginning of each analytical window. The tune standard is a commercially prepared mixed gas stock standard that includes bromofluorobenzene (BFB) at a concentration of 100 ppbv.

To analyze the tune standard:

1) Establish the instrument operating conditions specified in Section 10.4.1.
2) Attach the mixed gas stock standard to the Entech concentrator by attaching the cylinder to the line dedicated for introduction of the internal standard (ISTD). The concentrator directly injects 20 mL of the 100 ppbv stock standard onto the instrument to yield an on column concentration of 10 ppbv.

3) Acquire the data and evaluate the results against the acceptance criteria given in Table 2. Criteria must be met prior to further analysis. The official start time of the 24 hour analytical window is the injection time of a passing tune standard. All samples must be injected within 24 hours of that time.

NOTE: The data processing system averages three scans (apex scan, scan prior, and scan following) and performs background subtraction of the single scan prior to the elution of BFB.

10.2.2 Initial Calibration (ICAL)

The instrument must be calibrated with a minimum of five calibration standards for each target analyte at concentrations that span the working range of the method. The laboratory routinely analyzes seven standards at the recommended concentrations of 0.20, 0.50, 5.0, 10.0, 15.0, 20.0 and 40.0 ppbv in order to derive an appropriate working range for the complete target analyte list. Even though seven calibration standards are routinely analyzed not every calibration standard is used for each analyte. Each analyte has been assigned to an analyte group that includes a calibration range of at least five levels. The analyte group associations for each target analyte are provided in Table 1. The calibration range for each analyte group is as follows:

- Group A: This analyte group is associated with a six point calibration curve. The calibration range is 0.20 to 40 ppbv with the15 ppbv standard routinely excluded. The limit of quantitation (LOQ) for this group of analytes is 0.20 ppbv

- Group B: This analyte group is associated with a five point calibration curve. The calibration range is 0.50 to 40 ppbv with the 0.20 and the 15 ppbv standards routinely excluded. The limit of quantitation (LOQ) for this group of analytes is 0.50 ppbv.

- Group C: This analyte group is associated with a five point calibration curve. The calibration range is 5.0 to 40 ppbv with the 0.20 and the 0.50 ppbv standards routinely excluded. The limit of quantitation (LOQ) for this group of analytes is 5.0 ppbv.

Refer to corporate policy CA-Q-S-005 for additional information of procedures to establish calibration curves.

Prepare the calibration standards using the formulations provided in Appendix B.

Analyze the standards in a sequence from lowest to highest concentration using the instructions provided in Section 10.4.2.

The data processing system calculates a relative response factor (RRF), for each analyte and isomer pair using the assigned internal standard. The internal standard associations for each target analyte are provided in Table 1. The data processing system also calculates a mean relative response factor, relative standard deviation (RSD), relative retention time (RRT) and the mean RRT.

The following criteria must be met for a calibration to be considered acceptable:

- The RSD for each target analyte must be <30% with at most 2 exceptions up to a limit of 40%.

- The area response for the primary quantitation ion for the internal standard for each ICAL standard must be within 40% of the mean area response over the calibration range for each internal standard.

- The RRT for each target compound at each calibration level must be within 0.06 RRT units of the mean RRT for the compound. The retention time shift for each of the internal standards at each calibration level must be within 20 seconds of the mean retention time over the initial calibration range for each internal standard.

If these criteria are not met inspect the system for problems and perform corrective action. Recommended corrective actions are provided in Section 10.2.5 and in Table 3.

Repeat initial calibration whenever instrument operating conditions are changed, a new column is installed, when significant instrument maintenance has been performed, and when the result of the CCV indicate the calibration is no longer valid.

10.2.3 Second Source Calibration Verification (ICV)

Immediately following an acceptable initial calibration verify the accuracy of the calibration by the analysis of the second source calibration verification standard (ICV).

Prepare the ICV following the formulation provided in Appendix B.

Analyze the ICV following the instructions provided in Section 10.4.2.

The percent recovery (%R) for each target analyte must be within 70-130%. If criteria are not met, perform corrective action. Recommended corrective actions are provided in Table 3. If corrective action is not successful, remake your standards and recalibrate.

If after successful analysis of the ICV, time remains in the 24-hour analytical window, QC and field samples may be analyzed without analysis of a continuing calibration verification check standard. If time does not remain in the analytical window, a new analytical sequence must be initiated with a Tune Standard followed by daily calibration (CCV).

10.2.4 Continuing Calibration Verification (CCV)

Analyze the CCV immediately after the tune standard unless the analytical window includes ICAL, in which case, a CCV is not required.

Prepare the CCV standard using the formulation given in Appendix B. The recommended concentration of the CCV for each target analyte is 10.0 ppbv.

Analyze the CCV following the instructions provided in Section 10.4.2. The data system calculates a response factor for each analyte and calculates the percent difference (%D) of the RRF relative to the mean RRF in the most recent initial calibration.

- The %D for each target analyte must be within ±30%. If the above criteria are not met, repeat the analysis of the CCV once. If the second CCV meets criteria, continue with the analytical sequence. If it fails, evaluate the data to determine if one of the following conditions is met. If these conditions are not met corrective action must be taken. Guidance for troubleshooting is provided in Section 10.2.5. After corrective action the analytical sequence may be continued only if two immediate, consecutive CCVs at different concentrations are within acceptance criteria. If these two CCVs do not meet the criteria, recalibration is required prior to further analysis.

  - If the CCV criteria are exceeded high, indicating a high bias, and the associated samples have non-detects for those analytes, the analytical data may be considered usable. In the absence of instructions otherwise, proceed with analysis.

  - If the CCV criteria are exceeded low, indicating a low bias, analytical results may be reported if those results exceed the project's regulatory decision level. In other words, if the analytical results are sufficiently high to counter the low bias, results may be reported. Consult with the project manager to determine if the exception is allowable for each project.

10.2.5 Troubleshooting

Check the following items in case of calibration failures:

- Loss of sensitivity or unstable ISTD recoveries are usually the result of a leak. Check the union between the GC column and Entech transfer line.

- Loss of sensitivity for individual compounds may be a result of either an active site in a transfer line or a bad trap. Troubleshoot and perform maintenance as necessary.

- Poor chromatography usually requires GC column maintenance, perform as necessary.

- Carryover is usually caused by excessive amounts of analyte introduced to the system. Analyze blanks until the system is cleaned or replace the traps and transfer lines if necessary.

10.3 Sample Preparation

10.3.1 Post Sampling Canister Pressure Check Procedure

Perform the post-sampling canister pressure check within 1 business day of receipt of canisters in the laboratory so that any problems found are quickly identified and communicated to the client. Record the date and time the post-receipt check is performed is in the analytical record.

To perform the post- sampling canister pressure check:

1) Inspect the condition of equipment for signs of damage. If damage is observed, immediately notify the PM and await further instruction.

2) Initiate an Air Canister Post-Sampling Pressure Check Record for each set of client samples by ETR or SDG-whichever grouping is appropriate.

3) Check to see if the sampling FC(s) were returned with the canister(s). If so, check the paperwork (Canister ID Tag, Field Test Data Sheet or Chain of Custody (COC) to determine if the sampling record identifies which FC was used for each canister. If the paperwork does not include this information, record the anomaly on the post-sampling check record.

   NOTE: The laboratory's sample acceptance policy for air samples requires that the sampling crew record the ID of the FC used for sample collection in the sampling record, ideally on the tag attached to each canister, but the association may also be recorded on the Field Test Data Sheet or a COC. With this information the laboratory can review the history of use of the FC as needed to troubleshoot potential equipment problems. Without the association, the history of use of the FC is unknown. The laboratory strongly recommends that field samplers be instructed to provide this information for each sampling event.

4) Record the following information of the pressure check record: the room's barometric pressure and temperature and date and time check is performed.

5) Check the pressure of each canister using a calibrated digital pressure gauge.

   Attach a calibrated digital pressure gauge to the canister inlet. Check for the presence of burr or thread damage when attaching the pressure gauge to the canister inlet. If damage is observed, record the anomaly on the post-sampling check record

   Open the canister valve and record the pressure reading.

The pressure should be between -10" Hg to -1"Hg, except for "grab" samples and samples whose sampling time is <200 mL/min, which do not have a return pressure criteria range.

NOTE: The return canister pressure criteria of -10"Hg to -1"Hg was established based on the recommendations provided in Section V of Appendix I of the Vapor Intrusion Guidance Document prepared by the New Jersey Department of Environmental Protection (NJDEP). These sections of this document describe canister and quality assurance requirements for USEPA Methods TO-15 and TO-17. This document explains that due to recent advances in technology in concentrator units, such as with the Entech concentrators used by the laboratory, it is now possible to remove sample from canisters with a negative pressure of -10"Hg without having to add makeup air. Previous models of concentrators (such as NuTechs) required a pressure of at least -5"Hg. When the return negative pressure of a canister is greater than -10"Hg, the laboratory may need to add makeup air to the canister in order to provide a sufficient amount of sample for analysis. The need for the addition of makeup air depends on the concentrator unit. Some concentrator units used by the laboratory can pull sample without the addition of make-up air when the return negative pressure is up to -15"Hg. The amount of air added to the canister depends on the return pressure reading and will vary with each canister. See section 10.3 for the procedure of the determination of amount of makeup air needed. Except for "grab" samples and samples whose sampling time is set for <200 mL/min, the return pressure of a canister should never be zero negative pressure or a pressure equal to ambient pressure. If it is, the PM must consult with the client and obtain authorization for the laboratory to proceed with analysis.

6) If the return pressure is within range for all samples, photocopy the post-sampling canister pressure check record and attach the record to the screen worksheet.

   If the return pressure is not within range, initiate an anomaly report and perform one of the following actions:

   - Action 1: If the FC was not returned with the canister, attach a copy of the post-sampling pressure check record to the anomaly report and forward the paperwork to the PM who will notify the client of the situation and request further instruction. The PM will record any decisions made regarding the sample on the anomaly report and return the packet to you. Attach a photocopy of the complete anomaly report to the screen worksheet and forward the original anomaly report to the QA department.

   - Action 2: If the FC was with the canister, perform a leak check on the FC gauge and re-check the FC's flow rate as follows. Record all measurements on the original Flow Controller Set Flow Rate & Leak Check Record. The protective sticker on the back of the FC will provide the page number that corresponds to the logbook record.

   To check the flow rate and check the FC gauge for leaks:

   1) Remove the stem from the FC.

   2) Attach a dust cap where the stem was, and attach the FC to the control gauge/vacuum manifold.

3) Turn the calibrated digital flow meter on and zero the meter.

4) Turn on the vacuum pump and read the vacuum of the control gauge and the FC gauge and record these readings.

5) Turn off the vacuum. Wait ~30 seconds and read the vacuum of the control gauge and the FC gauge and record these readings.

6) The difference between the initial and final readings for the control gauge should be zero. If it is not, there is a leak in the manifold system. Stop work and correct the problem.

7) The difference between the initial and final readings for the FC gauge should be zero. If it is not, there is a leak in the FC assembly. Record the presence of a leak in the record and set aside the FC for service and repair.

8) Remove the dust cap from the FC and re-attach the stem.

9) Attach the flow meter tube to the stem of the FC.

10) Measure the flow rate. The flow rate should be within the ranges specified in the Set Flow Rate Table (See Table 4) for the sampling time requested. If the flow rate is not within range, record the situation on the anomaly report.

11) Attach a photocopy of the Flow Controller Set Flow Rate & Leak Check Record and a photocopy of the post sampling check record to the anomaly report and forward the paperwork to the PM who will notify the client of the situation and request further instruction. The PM will record any decisions made regarding the sample on the anomaly report and return the packet to you. Attach a photocopy of the complete anomaly report to the screen worksheets and forward the original anomaly report to the QA department.

10.3.2 Sample Screening

At the laboratory's discretion unknown samples may be screened prior to initial analysis to determine if the sample requires dilution. Unless otherwise requested by the client the laboratory does not provide screen data with the data package report even when primary dilutions are performed based on the results of the screen analysis.

To prepare a sample for screen analysis connect the sample canister to the autosampler connected to screening instrument and analyze 20 mL of sample. Acquire and evaluate the results. If the results of screen analysis indicate that a target compound is above its upper range of calibration. Calculate a recommended dilution factor (DF) by dividing the concentration of analyte found by 30. Record the recommended DF on the screen worksheet.

NOTE: Samples are screened on a GC/MS instrument that is programmed with the operating conditions given in Section 10.4.1 of this SOP. The calibration is checked weekly with a single point calibration standard at a concentration of 10 ppbv for all target analytes. The calibration is

checked more frequently when the results of instrument analysis do not correlate well with the results of the screen analysis.

10.3.3 Sample Dilutions & Pressure Adjustment

Field samples should be diluted prior to initial analysis when the screen results indicate that the concentrations are above calibration range and when the laboratory has sufficient knowledge of the sample (history) to know that the sample will require dilution. Field samples must be reanalyzed at a dilution initial analysis when the concentration of target compounds in initial analysis exceed of the upper range of calibration.

When the return negative pressure of a canister is greater than -15”Hg, make-up air is added to provide sufficient volume of make-up air in order to have an adequate sample volume for analysis. The addition of make-up air is considered a canister dilution.

To dilute the sample:

1) Attach the sample canister to the zero air line equipped with a pressure gauge that reads negative pressure in (“Hg) and positive pressure in (psig).

2) Ensure the valve of the zero air line is closed then open the valve of the sample canister. Record the negative pressure reading in the Canister Dilution Worksheet or on the canister’s tag.

3) Slowly open the valve of the zero air line and fill the canister until canister pressure gauge reads -10”Hg. Do not open the valve to such an extent that the zero air line pressure drops below 15 psig and do not allow the zero air line to reach equilibrium otherwise you will contaminate the zero air line.

4) When the desired pressure is achieved, close the canister valve and the valve on the zero air line; wait 15 seconds.

5) Open the canister valve and record the final pressure reading in psig.

6) Close the canister valve and remove the valve from the zero air line.

7) Record the initial and final pressure readings in a Canister Dilution Spreadsheet. The EXCEL spreadsheet uses these values to calculate the dilution factor (DF). NOTE: To accurately calculate the dilution factor, the final pressure reading in “Hg must be converted to psig. To do so, multiply the final negative pressure reading in “Hg by 0.5. The resulting value is the pressure in psig. For example, if the final negative pressure reading is -10” Hg, the corresponding pressure in psig is -5 psig. (Multiply -10 by 0.5). Record this value in the Canister Dilution Worksheet to determine the DF.

When the return pressure of a canister is positive, the pressure must be adjusted to near ambient (0”Hg) prior to analysis. To adjust the pressure to ambient, vent the canister to ambient in a fume hood by opening the canister value for ~4-5 seconds, close the valve. For higher pressure canisters, open the valve and listen for a release of air then close the valve when the sound recedes.

If a trip blank is provided, pressurize the trip blank canister to 10 psig. The pressurization of the trip blank is not considered a dilution.

10.3.4 QC Sample Preparation

To prepare the method blank (MB): Fill a clean canister that has never been used to collect environmental samples and has never left the laboratory to 20 psig with zero air. Continue to use this canister as the MB until the pressure of the canister reaches 0 psig, at which time, recharge with zero air to 20 psig and reuse.

To prepare the LCS: Follow the instructions provided in Appendix B for preparation of the working ICV/LCS standard. If an LCSD and replicate precision is requested, the aliquot for the LCSD must be taken from the LCS canister. If an LCSD and duplicate precision is requested, prepare another LCS in a separate canister to serve as the LCSD.

10.4 Sample Analysis

10.4.1 Instrument Operating Conditions

Optimize the GC and MS conditions for compound separation and sensitivity.

The recommended operating conditions are as follows:

Thermal Desorb:	Initial Trap #1 Temperature: -110ºC
	Desorb Temperature from Trap #1 to #2: 0 ºC
	Total Volume Transfer by Mass Flow Controller: 40 mL
	Initial Trap #2 Temperature: -15 ºC
	Desorb Temperature from Trap #2 to #3: 200ºC
	Transfer time 3.5 minutes
	Initial Trap #3 Temperature: -165 ºC
	Injection Trap #3 Temperature: 70ºC
	Injection Time: 1.5 minutes
	Trap #3 Temperature after Injection: -165 ºC
Carrier Gas:	Helium, Ultra High Purity
Cryogenic Focusing Gas:	Liquid Nitrogen
Flow Rate:	~1.5 mL/min
Temperature Program:	Initial Temperature: 40ºC
	Initial Hold Time: 4 minutes
	Ramp1 Rate: 20ºC/min. to 200ºC.
	Ramp 2 Rate: 40ºC/min. to 220ºC
	Final Temperature: 220ºC
	Final Hold Time: 6.5 minutes
Electron Energy:	70 electron volts
Mass Range:	35-265 amu
Scan Time:	≥1 scan per second

These operating conditions may be changed but once the operating conditions are established for initial calibration the same conditions must be used until a new calibration is performed.

10.4.2 Analytical Sequence

An example analytical sequence that includes initial calibration (ICAL) is provided below. When ICAL is not performed, the sequence begins with the tune standard and is followed by the CCV, LCS, LCSD, and method blank. If sufficient time remains in the 24 hours analytical window after initial calibration, QC and field samples may be analyzed without the CCV and the ICV will serve as the LCS for the sequence. The MB, LCS and LSCD must be analyzed at a frequency of every 20 samples or with each analytical sequence whichever is more frequent.

1. Tune Standard (BFB)
2. ICAL
3. ICV
4. CCV
5. LCS (repeat every 20 samples)
6. LCSD (when requested)
7. MB (repeat every 20 samples)
8. Field Samples (including trip blanks)

Attach the canisters to the autosampler inlet in the order of the analytical sequence then initiate the analytical sequence. The autosampler introduces 200 mL of sample volume from each canister to the instrument system and adds 20 mL of the mixed gas standard to each sample.

Acquire the data and evaluate the results to confirm qualitative identification and quantification.

11.0 Calculations / Data Reduction

11.1 Qualitative Identification

The data processing system tentatively identifies target analytes by comparing the retention time of the peaks to the window set around the continuing calibration standard, and searches in that area for the primary ion and up to two secondary ions characteristic of the target analyte.

All tentative identifications made by the computer are reviewed and either accepted or rejected by the primary analyst and/or the analyst that performs secondary data review. The identification made by the system is accepted by these analysts when the following criteria are met:

- The target analyte is identified by comparison of its background subtracted mass spectrum to a reference spectrum in the user-created database. In general, all ions that are present above 10% relative abundance in the mass spectrum of the standard should be present in the mass spectrum of the sample component and their relative abundances should agree within 20%. For example, if an ion has a relative abundance of 30% in the standard spectrum, its abundance in the sample spectrum should be in the range of 10-50%. Some ions, particularly the molecular ion, are of special importance if a tentative identification is to be made, and should be evaluated even if they are below 10% relative abundance.

- The GC retention time for the target analyte should be within 0.06 RRT units of the daily standard.

Identification requires expert judgment when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When GC peaks obviously represent more than one sample component (i.e., broadened peak with shoulder(s) or valley between two or more maxima), appropriate analyte spectra and background spectra can be selected by examining plots of characteristic ions for tentatively identified components. When analytes coelute (i.e., only one GC peak is apparent), the identification criteria can be met but each analyte spectrum will contain extraneous ions contributed by the coeluting compound.

11.2 Quantification of Target Analytes

After a compound has been identified, the data system quantifies the concentration of the target compound based on the integrated abundance of the characteristic ion from the EICP. If there is matrix interference with the primary ion, a secondary ion may be used for quantification by calculating a mean RF factor for that ion and using that ion to quantify the analyte in the sample. When secondary ion calculations are required, include this information in the non-conformance report and project narrative.

If the data system does not properly integrate a peak, perform manual integration. All manual integration must be performed and documented in accordance with laboratory SOP BR-QA-006 *Manual Integration*.

11.3 Calculations

Analytical results are calculated as follows:

- **Dilution Factor**

$$DF = \frac{V_2}{V_1} x \frac{V_4}{V_3}$$

Where:
V_1 = Pre-Dilution Canister Volume
V_2 = Post-Dilution Canister Volume
V_3 = Sample Amount (mL)
V_4 = Base Sample Amount (200 mL)

- **Relative Response Factor (RRF)**

$$RRF = \frac{(A_x)(C_{is})}{(A_{is})(C_x)}$$

Where:
A_x = Area of the quantitation ion of the analyte
A_{is} = Area of the quantitation ion of the internal standard
C_x = Concentration of analyte in concentration units (ppbv)
C_{is} = Concentration of internal standard in concentration units (ppbv)

- **Percent Relative Standard Deviation (%RSD)**

$$\%RSD = \frac{SD}{Mean} x100$$

Where:
SD = Standard deviation individual response factors
Mean = Average of five response factors

- **Sample Concentration**

$$C_x = \frac{(A_x)(C_{IS})}{(A_{IS})(\overline{RRF})}(DF)$$

Where:
C_x = Compound concentration (ppbv)
C_{IS} = Concentration of associated internal standard (ppbv)
A_{IS} = Area of quantitation ion for associated internal standard
A_x = Area of quantitation ion for compound
DF = Dilution Factor
Mean RRF = Average Relative Response Factor from initial calibration.

- **Unit Conversion from ppbv to ugm3**

$$\text{Analytical Result (ug/m3)} = \text{Result(ppbv)} \times \left(\frac{mw}{24.45}\right)$$

Where:
mw = molecular Weight

Example:
Benzene Result = 56 ppbv
Benzene mw = 78.108

$$\text{Analytical Result (ug/m3)} = 56\ \text{ppbv} \times \left(\frac{78.108}{24.45}\right)$$

Result(ug/m3) = 178.9 ug/m3 reported as 180 ug/m3

- **Percent Recovery (%R)**

$$\%R = \frac{C_s}{C_n} \times 100\%$$

Where:
C_s = Concentration of the spiked sample (ppbv)
C_n = Nominal concentration of spike added (ppbv)

- **Precision (%RPD)**

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100$$

Where:
C_1 = Measured concentration of the first sample aliquot
C_2 = Measured concentration of the second sample aliquot

11.4 Data Review

11.4.1 Primary Review

Review project documents such as the environmental test request (ETR) analytical worksheets, Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Confirm qualitative and quantitative identification criteria using the criteria provided in Section 11.1 and Section 11.2. If the data system does not properly integrate a peak, perform manual integration in accordance with laboratory SOP BR-QA-006 *Manual Integration.*

Review the instrument QC against the acceptance criteria given in Section 10.0 and summarized in Table 3. If the results do not fall within acceptance criteria, perform the recommended corrective action. If corrective action is not taken, document the situation with a nonconformance report (NCR) and provide technical justification for the decision to proceed with analysis in the NCR. If corrective action is not successful, provide explanation as appropriate in the NCR.

Review the method blank against the acceptance criteria given in Table 3. If criteria are not met, investigate the source of contamination, eliminate the problem and re-prepare and reanalyze the MB along with associated samples if the concentration of the MB is above the RL and is greater than 1/10 the concentration measured in any sample. If the concentration of the MB is less than 1/10 the concentration measured in any sample, corrective action is not required unless otherwise specified on a project basis.

In the absence of project-specific control limits, use the in-house control limits for the evaluation of the LCS. If results are outside control limits initiate a nonconformance report (NCR) or correct the problem and re-prepare and reanalyze the LCS along with associated samples. If corrective action is not taken provide technical justification for the decision to proceed with analysis in the NCR.

Dilute and reanalyze samples whose results exceed the calibration range. The diluted analysis should result in a determination within the upper half of the calibration curve. If a primary dilution is performed based on screen data, the diluted analysis should result in a determination within the upper half of the calibration curve. A more concentrated analysis is not necessary unless

the result is not within the upper half of the calibration range or when the project requires that all samples be analyzed undiluted or more concentrated regardless of screen results.

In the event that a high concentration sample is analyzed the analyses following the high concentration must be evaluated for carry over. Analytes detected above the RL will be considered for potential carry over. All samples that are suspected of having carry over must be reanalyzed. If carry over occurred on all samples that were run after the high concentration analysis instrument blanks should be analyzed until no more carry over is detected.

11.4.2 Secondary Data Review

Review project documents such as the environmental test request (ETR) analytical worksheets, Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Check each qualitative identification and spot check quantitative values using the criteria provided in Section 11.1 and Section 11.2.

If manual integrations were performed:

- Review each manual integration to verify that the integration is consistent and compliant with the requirements specified in laboratory SOP BR-QA-005 *Determination of LOD, LOQ and RL*. If a problem is found, immediately consult with the primary analyst or notify the Technical Director or QA Manager. Check that each manual integration is included in the manual integration summary and that each instance has an associated manual integration code. Also, check to ensure that a “before and after” report is present for each manual integration of calibration standards, ICV, CCV, and QC sample as well as surrogates. Provide the same documentation for each reported analyte upon client request.

- Reintegration (by secondary data reviewers) should not be performed except in limited circumstances such as when the primary analyst who performed the initial integration is not available to correct any errors found during secondary review. If reintegration is performed, a peer analyst must review each integration performed by the secondary reviewer or the department supervisor to verify the integration is consistent and compliant with the requirements specified in laboratory SOP BR-QA-006 *Manual Integration*.

Verify that the performance criteria for the QC items listed in Table 3 were met. If the results do not fall within the established limits verify the recommended corrective actions were performed. If corrective action was not taken or is unsuccessful, ensure the situation is documented with a nonconformance report (NCR) and ensure data is qualified accordingly. Report the nonconformance in the narrative note program.

Review records (these records include but are not limited to the Pre-Shipment Clean Canister Certification Report, Flow Controller Set Flow Rate and Leak Check Record, Field Test Data Sheets, and the Air Canister Return Pressure Check Record) associated with release and return of air sampling equipment to ensure all anomalies are properly recorded. Compare any problems noted in these documents with the analytical results and record any findings in the

narrative note program or otherwise communicate your findings to the PM for inclusion in the project narrative.

11.5 Data Reporting

Review project documents such as the environmental test request (ETR) analytical worksheets, Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to determine if there are any unique reporting requirements:

Unless otherwise specified on a project basis, report data as follows:

- The laboratory offers two reporting lists for this method. These lists are called standard and extended and the analytes associated with each list are provided in Table 1. Unless otherwise specified, report the standard list.

- Report target compound concentrations above the reporting limit (RL) as the value found without data qualifier(s). The unadjusted RLs are provided in Table 1.

- Report concentrations less than the MDL to the adjusted RL with a “U” data qualifier. Adjust the RL as needed to account for dilution or concentration.

NOTE: The laboratory does not report estimated values (results between the MDL and RL) for this test method.

- Evaluate the results of the MB and apply “B” flags to the sample data if any target analyte is detected in the MB greater than the RL, apply a “B” flag to all sample results.

When multiple dilutions are performed, report the result from the appropriate diluted run (i.e. no target analyte above calibration range and the result for the analyte for which the dilution was performed is in the upper half of the calibration range). Undiluted and lesser dilutions are not routinely provided unless specifically requested by the client.

Generate the summary forms and compile with the data report in the appropriate format, create an electronic deliverable file, and provide the report to the report management group.

Retain, manage and archive electronic and hardcopy data as specified in laboratory SOP BR-QA-014 *Laboratory Records*.

12.0 <u>Method Performance</u>

12.1 Method Detection Limit Study (MDL)

Perform a method detection limit (MDL) study at initial method set-up following the procedures specified in laboratory SOP BR-QA-005 *Determination of LOD, LOQ and RL*..

12.2 Demonstration of Capabilities (DOC)

Perform a method demonstration of capability at initial set-up and when there is a significant change in instrumentation or procedure.

Each analyst that performs the analytical procedure must complete an initial demonstration of capability (IDOC) prior to independent analysis of client samples. Each analyst must demonstrate on-going proficiency (ODOC) annually thereafter. DOC procedures are further described in the laboratory's quality system manual (QAM) and in the laboratory SOP for employee training.

12.3 Training Requirements

Any employee that performs any portion of the procedure described in this SOP must have documentation in their employee training file that they have read this version of this SOP.

Instrument analysts, prior to independent analysis of client samples, must also have documentation of demonstration of initial proficiency (IDOC) and annual on-going proficiency (ODOC) in their employee training files.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to BR-EH-001 *Hazardous Waste*.

The following waste streams are produced when this method is carried out:

- None

15.0 References / Cross-References

- EPA Compendium Method TO-15, "Determination of Volatile Organic Compounds in Ambient Air using Specially Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry", US EPA, January, 1999.
- Laboratory SOP BR-QA-005, Procedures for the Determination of Limits of Detection (LOD), Limits of Quantitation (LOQ) and Reporting Limits (RL).
- Laboratory SOP BR-QA-011 Employee Training
- Laboratory SOP BR-EH-001 Hazardous Waste
- Laboratory SOP BR-QA-014 Laboratory Records
- Laboratory SOP BR-QA-006 Procedures & Documentation Requirements for Manual Integration
- Laboratory Quality Assurance Manual (QAM)

16.0 Method Modifications

Not Applicable.

17.0 Attachments

- Table 1: Target Compound List, RL, Internal Standard and Ion Assignments
- Table 2: Ion Abundance Criteria (BFB)
- Table 3: QC Summary & Recommended Corrective Action
- Appendix A: Terms and Definitions
- Appendix B: Standard Preparation Tables

18.0 Revision History

Revision 7:

Section 11.4.1: Expanded on discussion of carry over.
Appendix C: Removed.
Appendix D: Removed.
Appendix E: Removed.

Table 1: Routine Compound List, Reporting Limit, Internal Standard and Ion Assignments

Analyte	CAS No.	6L RL (ppbv)	1L RL (ppbv)	Quantifier Mass	Qualifier Mass	Qualifier Mass	ISTD Group	Analyte Group	Reporting List	
									Standard	Extended
Dichlorodifluoromethane	75-71-8	0.5	5	85	87		1	B	X	X
Freon-22	75-45-6	0.5	5	51	67	69	1	B	X	X
1,2-Dichlorotetrafluoroethane	76-14-2	0.2	2	85	135	87	1	A	X	X
Chloromethane	74-87-3	0.5	5	50	52		1	B	X	X
n-Butane	106-97-8	0.5	5	43	41	58	1	B	X	X
Vinyl Chloride	75-01-4	0.2	2	62	64		1	A	X	X
1,3-Butadiene	106-99-0	0.5	5	54			1	B	X	X
Bromomethane	74-83-9	0.2	2	94	96		1	A	X	X
Chloroethane	75-00-3	0.5	5	64	66		1	B	X	X
Isopentane	78-78-4	0.2	2	43	57	56	1	A		X
Bromoethene (Vinyl Bromide)	593-60-2	0.2	2	106	108	81	1	A	X	X
Trichlorofluoromethane	75-69-4	0.2	2	101	103		1	A	X	X
Pentane	109-66-0	0.5	5	43	57	72	1	B		X
Ethyl Ether	60-29-7	0.2	2	59	45	74	1	A		X
Acrolein	107-02-8	5	50	56	55	37	1	C		X
Freon TF	76-13-1	0.2	2	101	151	103	1	A		
1,1-Dichloroethene	75-35-4	0.2	2	96	61	63	1	A	X	X
Acetone	67-64-1	5	50	43	58		1	C	X	X
Isopropyl Alcohol	67-63-0	5	50	45	43		1	C	X	X
Carbon Disulfide	75-15-0	0.5	5	76			1	B	X	X
3-Chloropropene (Allyl Chloride)	107-05-1	0.5	5	41	76		1	B	X	X
Acetonitrile	75-05-8	5	50	41	40	39	1	C		X
Methylene Chloride	75-09-2	0.5	5	49	84	86	1	B	X	X
tert-Butyl Alcohol	75-65-0	5	50	59	41	43	1	C	X	X
Methyl tert-Butyl Ether	1634-04-4	0.5	5	73	43		1	B	X	X
trans-1,2-Dichloroethene	156-60-5	0.2	2	61	96		1	A	X	X
n-Hexane	110-54-3	0.5	5	57	86		1	B	X	X
1,1-Dichloroethane	75-34-3	0.2	2	63	65	83	1	A	X	X
Methyl Ethyl Ketone	78-93-3	0.5	5	72	43		1	B	X	X
cis-1,2-Dichloroethene	156-59-2	0.2	2	96	98		1	A	X	X
Tetrahydrofuran	109-99-9	5	50	42	72		2	C	X	X
Chloroform	67-66-3	0.2	2	83	85		1	A	X	X
1,1,1-Trichloroethane	71-55-6	0.2	2	97	99	61	2	A	X	X
Cyclohexane	110-82-7	0.2	2	84	56		2	A	X	X

Analyte	CAS No.	6L RL (ppbv)	1L RL (ppbv)	Quantifier Mass	Qualifier Mass	Qualifier Mass	ISTD Group	Analyte Group	Reporting List	
									Standard	Extended
Carbon Tetrachloride	56-23-5	0.2	2	117	119		2	A	X	X
2,2,4-Trimethylpentane	540-84-1	0.2	2	57	41	43	2	A	X	X
1,2-Dichloroethene (total)	540-59-0	0.2	2	61	96		1	A	X	X
Benzene	71-43-2	0.2	2	78	77		2	A	X	X
1,2-Dichloroethane	107-06-2	0.2	2	62	98		2	A	X	X
n-Heptane	142-82-5	0.2	2	43	71		2	A	X	X
Trichloroethene	79-01-6	0.2	2	95	130	132	2	A	X	X
Methyl Methacrylate	80-62-6	0.5	5	69	41	39	2	B	X	X
1,2-Dichloropropane	78-87-5	0.2	2	63	41		2	A	X	X
1,4-Dioxane	123-91-1	5	50	88	58		2	C	X	X
Dibromomethane	74-95-3	0.2	2	174	93	172	2	A		
Bromodichloromethane	75-27-4	0.2	2	83	85		2	A	X	X
cis-1,3-Dichloropropene	10061-01-5	0.2	2	75	110		2	A	X	X
Methyl Isobutyl Ketone	108-10-1	0.5	5	43	58		2	B	X	X
n-Octane	111-65-9	0.2	2	43	57	114	2	A		X
Toluene	108-88-3	0.2	2	92	91		3	A	X	X
trans-1,3-Dichloropropene	10061-02-6	0.2	2	75	110		2	A	X	X
1,1,2-Trichloroethane	79-00-5	0.2	2	83	97	85	3	A	X	X
Tetrachloroethene	127-18-4	0.2	2	166	168	129	3	A	X	X
Methyl Butyl Ketone	591-78-6	0.5	5	43	58		3	B	X	X
Dibromochloromethane	124-48-1	0.2	2	129	127		3	A	X	X
1,2-Dibromoethane	106-93-4	0.2	2	107	109		3	A	X	X
Nonane	111-84-2	0.2	2	57	71	128	3	A		X
Chlorobenzene	108-90-7	0.2	2	112	77	114	3	A	X	X
Ethylbenzene	100-41-4	0.2	2	91	106		3	A	X	X
Xylene (m,p)	1330-20-7	0.5	5	106	91		3	A	X	X
Xylene (o)	95-47-6	0.2	2	106	91		3	A	X	X
Styrene	100-42-5	0.2	2	104	78		3	A	X	X
Bromoform	75-25-2	0.2	2	173	175	171	3	A	X	X
Cumene	98-82-8	0.2	2	105	120	77	3	A	X	X
1,1,2,2-Tetrachloroethane	79-34-5	0.2	2	83	131	85	3	A	X	X
Xylene (total)	1330-20-7	0.2	2	106	91		3	A	X	X
n-Decane	124-18-5	0.5	5	57	71	142	3	B		X
n-Propylbenzene	103-65-1	0.2	2	91	120	92	3	A		X

Analyte	CAS No.	6L RL (ppbv)	1L RL (ppbv)	Quantifier Mass	Qualifier Mass	Qualifier Mass	ISTD Group	Analyte Group	Reporting List	
									Standard	Extended
1,2,3-Trichoropropane	96-18-4	0.5	5	75	110	112	3	B	X	X
4-Ethyltoluene	622-96-8	0.2	2	105	120		3	A	X	X
1,3,5-Trimethylbenzene	108-67-8	0.2	2	105	120		3	A	X	X
2-Chlorotoluene	95-49-8	0.2	2	91	63		3	A	X	X
tert-Butylbenzene	98-06-6	0.2	2	119	91	134	3	A	X	X
1,2,4-Trimethylbenzene	95-63-6	0.2	2	105	120		3	A	X	X
sec-Butylbenzene	135-98-8	0.2	2	105	134	91	3	A	X	X
4-Isopropyltoluene	99-87-6	0.2	2	119	134	91	3	A	X	X
1,3-Dichlorobenzene	541-73-1	0.2	2	146	111	148	3	A	X	X
1,4-Dichlorobenzene	106-46-7	0.2	2	146	111	148	3	A	X	X
n-Undecane	1120-21-4	5	50	57	71	156	3	C		X
Benzyl Chloride	100-44-7	0.2	2	91	126	65	3	A	X	X
n-Butylbenzene	104-51-8	0.2	2	91	134	92	3	A	X	X
1,2-Dichlorobenzene	95-50-1	0.2	2	146	111	148	3	A	X	X
n-Dodecane	112-40-3	5	50	57	71	170	3	C		X
1,2,4-Trichlorobenzene	120-82-1	0.5	5	180	182		3	B	X	X
1,3-Hexachlorobutadiene	87-68-3	0.2	2	225	223		3	A	X	X
Naphthalene	91-20-3	0.5	5	128			3	B	X	X
1,2,3-Trichlorobenzene	87-61-6	0.2	2	180	182	145	3	A		X
Propylene	115-07-1	5	50	41	42	39	1	C		X
Vinyl Acetate	108-05-4	5	50	43	86		1	C		X
Ethyl Acetate	141-78-6	5	50	43	74		1	C		X
Ethanol	64-17-5	5	50	46	45		1	C		X
Internal Standards										
Bromochloromethane	74-97-5	NA	NA	128	49	130	1	NA	NA	NA
1,4-Difluorobenzene	540-36-3	NA	NA	114			2	NA	NA	NA
Chlorobenzene-d5	3114-55-4	NA	NA	117			3	NA	NA	NA

Table 2: Tune Standard Criteria

Mass	Ion Abundance Criteria
50	8.0 to 40.0 percent of mass 95
75	30.0 to 66.0 percent of mass 95
95	Base Peak, 100 percent relative abundance
96	5.0 to 9.0 percent of mass 95
173	Less than 2.0 percent of mass 174
174	50.0 to 120.0 percent of mass 95
175	4.0 to 9.0 percent of mass 174
176	93.0 to 101.0 percent of mass 174
177	5.0 to 9.0 percent of mass 176

Table 3: TO15 QC Summary & Recommended Corrective Action

QC Check	Frequency	Acceptance Critera	Recommended Corrective Action
Tune Standard	Prior to calibration and every 24 hours	See Table 2	Correct Problem. Reanalyze. No samples may be analyzed without a valid tune.
ICAL	Prior to sample analysis and when CCV fails	RSD for each analyte ≤ 30% with 2 exceptions up to 40%	Correct problem and repeat calibration
ICV	Once after each ICAL	%R for all analytes within 70-130	Correct Problem. Reanalyze, re-make, re-verify & re-analyze. If that fails, re-make all standards and repeat calibration.
Retention Time Window	Once per ICAL	NA	NA
RRT	With each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct Problem. Repeat ICAL
CCV	Daily before sample analysis after tune standard	%D ≤ 30	Correct Problem. Reanalyze once. If that fails, see section 10.2.5 for instruction.
LCS	Each batch or every 20 samples, whichever is sooner.	%R for all analytes within 70-130	Reanalyze LCS, re-prep and reanalyze LCS and all associated samples if sufficient sample volume is available. If corrective action not successful, initiate nonconformance report and qualify sample results.
LCSD	Per Client Request	RPD ≤ 25	Reanalyze LCSD, re-prep and reanalyze LCSD and all associated samples if sufficient sample volume is available. If corrective action is not successful, initiate nonconformance report and qualify sample results.
Method Blank	Each batch or every 20 samples, whichever is sooner.	No analytes detected above RL	Reanalyze along with associated samples, unless detects for same compounds found in blank are greater than 10X the concentration found in the blank.
Internal Standard	All standards, field and QC samples	+/- 40% area response from last acceptable calibration. RT +/- 0.33 min (20 seconds) from last acceptable calibration.	Inspect system for malfunction. Reanalyze samples. Qualify data.
Sample Duplicate	Per Client Request	RPD ≤ 25	Consult with PM. Reanalyze or qualify data.

Appendix A: Terms and Definitions

Acceptance Criteria: Specified limits placed on characteristics of an item, process or service defined in requirement documents.

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyte: The specific chemicals or components for which a sample is analyzed. (EPA Risk Assessment Guide for Superfund, OSHA Glossary).

Batch: Environmental samples that are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria. An analytical batch is composed of prepared environmental samples (extracts, digestates and concentrates), which are analyzed together as a group.

Calibration: a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values realized by the standards.

Calibration Curve: the graphical relationship between the known values or a series of calibration standards and their instrument response.

Calibration Standard: A substance or reference used to calibrate an instrument.

Continuing Calibration Verification (CCV): An analytical standard gas mixture containing all target analytes and internal standard compounds that is used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

Corrective Action: the action taken to eliminate the cause of an existing nonconformity, defect or other undesirable occurrence in order to prevent recurrence.

Cryogen: A refrigerant used to obtain very low temperatures in the cryogenic trap of the analytical system. A typical cryogen is liquid nitrogen (bp -195.8°C) or liquid argon (bp -185.7°C).

Data Qualifier: a letter designation or symbol appended to an analytical result used to convey information to the data user. (Laboratory)

The qualifiers that are routinely used for this test method are:

U: Compound analyzed for but not detected at a concentration above the reporting limit.
B: Compound is found in the sample and the associated method blank.
E: Compound whose concentration exceeds the upper limit of the calibration range.
D: Concentration identified from a dilution analysis.

X,Y,Z: Laboratory defined flags that may be used alone or combined as needed. If used, provide a description of the flag in the project narrative.

Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.

Initial Calibration Verification (ICV): An analytical standard mixture containing all target analytes and internal standard compounds that are prepared from a source independent of the source of the initial calibration standards. The purpose of the ICV is to verify that the initial calibration is in control.

Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.

Internal Standards (IS): Non-target analytes that are similar to the target analytes but are not expected to be found in environmental media (generally, isotopically labeled target analytes are used for this purpose). IS are added to every standard, quality control sample, and field sample at a known concentration prior to analysis. IS responses are used as the basis for quantitation of target analytes.

Laboratory Control Sample (LCS) – A QC sample of known composition spiked with analytes of interest. The LCS evaluates method performance and ability to successfully recover target analytes from a clean matrix. LCS recovery is typically expressed as percent recovery and provides a measure of accuracy. A LCSD is a duplicate LCS prepared and analyzed from a separate canister to provide a measure of replicate precision.

Method Blank (MB): A canister of humidified ultra pure zero air that is treated exactly as a sample. The MBLK is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a <u>range</u> where qualitative detection occurs. Quantitative results are not produced in this range.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.

Quality Control Sample (QC): a sample used to assess the performance of all or a portion of the measurement system.

Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample.

Stock Gas Mixture: A Commercially purchased concentrated gas mixture containing one or more method analytes

Appendix B: Standard Preparation Tables

The standard formulations contained in this Appendix are recommended and are subject to change. If the concentration or volume of any of the stock standard changes, the standard preparation instructions must be adjusted accordingly. See laboratory SOP LP-QA-002 *Standard Preparation* for further guidance on the preparation of standard solutions.

Prepare all standards using the McMillan Company 80SD mass flow controller. Prepare the standard in zero air, demonstrated to be analyte free. Store the standard at ambient temperature. Unless otherwise specified, assign an expiration date of 30 days from date of preparation unless the parent standard expires earlier, in which case, use the earliest expiration date.

Intermediate Calibration Standard

Parent Standard	Vendor	Stock Standard Concentration (ppmv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Custom Calibration Stock Standard	Spectra Gases Custom Made	1.0	7500	37.5	200

Prepare in 15 L Summa Canister Expiration Period 3months
This standard contains all the target analytes listed in table 1.

Working Calibration Standards

Parent Standard	Calibration Standard	Parent Standard Concentration (ppbv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Cal Standard 20 ppbv	Cal Standard 0.2 ppbv	20	155	15.46	0.2
Cal Standard 20 ppbv	Cal Standard 0.5 ppbv	20	386	15.46	0.5
Intermediate Calibration Standard	Cal Standard 5 ppbv	200	386	15.46	5
Intermediate Calibration Standard	Cal Standard 10 ppbv	200	773	15.46	10
Intermediate Calibration Standard	Cal Standard 15 ppbv	200	1160	15.46	15
Intermediate Calibration Standard	Cal Standard 20 ppbv	200	1546	15.46	20
Intermediate Calibration Standard	Cal Standard 40 ppbv	200	3092	15.46	40

Prepare in 6 L Summa Canister Expiration Period 3 months
Each calibration standard contains all the analytes listed in table 1 at the above concentrations.

Initial Calibration Levels

Calibration Level	Working Calibration Standard	Volume Analyzed (mL)	Concentration on Column (ppbv)
Calibration Level 1	Cal Standard 0.2 ppbv	200	0.2
Calibration Level 2	Cal Standard 0.5 ppbv	200	0.5
Calibration Level 3	Cal Standard 5 ppbv	200	5
Calibration Level 4	Cal Standard 10 ppbv	200	10
Calibration Level 5	Cal Standard 15 ppbv	200	15
Calibration Level 6	Cal Standard 20 ppbv	200	20
Calibration Level 7	Cal Standard 40 ppbv	200	40

Prepare in 6L Summa Canister

Intermediate ICV/LCS Standard

Parent Standard	Vendor	Stock Standard Concentration (ppmv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
ICV Stock Standard	Spectra Gases	1.0	7500	37.5	200

	Custom Made				

Prepare in 15L Summa Canister Expiration period 3 months
This standard contains all target analytes listed in table 1.

Working ICV/LCS Standard

Parent Standard	Calibration Standard	Stock Standard Concentration (ppbv)	Volume Added (mL)	Final Volume (L)	Final Concentration (ppbv)
Intermediate ICV/LCS Standard	ICV Standard 10 ppbv	200	773	15.46	10

Prepare in 6L Summa Canister Expiration period 3 months
This standard contains all target analytes listed in table 1.

Title: Mercury by CVAA (SW-846 7471A)

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1.0 Scope and Application

This SOP describes the laboratory procedure for determining of total mercury using cold vapor technique with atomic absorption (AA).

1.1 Analytes, Matrix(s), and Reporting Limits

This procedure may be used for a variety of matrices including: soils, sediments, bottom deposits, and sludge-type materials.

The routine RL for solid samples is 0.033 mg/Kg based on a sample digestion weight of 0.3 grams and a final volume of 50 mL.

2.0 Summary of Method

A portion of solid sample is acid digested for 2 minutes at a temperature of 95°C then digested with potassium permanganate and potassium persulfate for 30 minutes at a temperature of 95°C. Hydroxylamine hydrochloride is added to each digestate in order to reduce excess permanganate. The digestate is placed on a closed-system mercury autoanalyzer and stannous chloride is added to each sample. The elemental mercury released is measured spectrophotometrically at a wavelength of 253.7 nm. The concentration is calculated from the response of the sample absorbance applied against the calibration curve.

This procedure is based on the following reference method:

- SW-846 Method 7471A, Revision 1, September 1994.

If the laboratory's procedure is modified from the reference method, a list of such modifications will be provided in Section 16.0

3.0 Definitions

A list of terms and definitions are provided in Appendix A.

4.0 Interferences

Potassium permanganate is added to the samples to eliminate possible interference from sulfide. Copper has also been noted as an interferent but per reference method SW-846 7471A concentrations as high as 10mg/Kg had no effect on recovery of mercury from spiked samples.

Samples high in chlorides may require additional permanganate because during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation of 253nm. Care must be taken to ensure free chlorine is not present and this is accomplished by the addition of hydroxylamine hydrochloride and stannous chloride.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.2 Primary Materials Used

Table 1 lists those materials used in this procedure that have a serious or significant hazard rating along with the exposure limits and primary hazards associated with that material as identified in the MSDS. **NOTE: This list does not include all materials used in the method.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

6.0 Equipment and Supplies

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts are cautioned to be sure equipment used meets the specification of this SOP.

6.1 Miscellaneous

- Block Digester: Environmental Express or equivalent: able to maintain digestates at a temperature of 95°C.
- Polyethylene Digestion Vessels with Volumetric Indicators.
- Volumetric Pipettes: Calibrated daily.
- Top Loading Balance: capable of measuring to 0.01 grams.

6.2 Analytical System

- Leeman Labs Hydra AA.

7.0 Reagents and Standards

7.1 Reagents

- Reagent Water
- Aqua Regia: Prepare by carefully adding 3 volumes of concentrated hydrochloric acid to one volume of concentrated nitric acid.
- Nitric Acid (HNO_3): concentrated, reagent grade: J.T. Baker or equivalent.
- Hydrochloric Acid (HCl): concentrated, reagent grade: J.T. Baker or equivalent.
- Stannous Chloride: reagent grade: J.T. Baker or equivalent.
- Potassium Permanganate ($KMNO_4$): reagent grade: J.T. Baker or equivalent.

HCl Solution (10% v/v): Add 100 mL of concentrated HCl to a 1 L volumetric flask containing ~800 mL of reagent water. Bring final volume of solution up to 1 L with reagent water. Assign an

expiration date of 1 year from opened date and store this solution at ambient temperature.

Stannous Chloride Solution: Add 100 g of $SnCl_2 \cdot H_2O$ to 1 L of 10% hydrochloric acid. Assign an expiration date of 6 months from date prepared and store this solution at ambient temperature.

Hydroxylamine Hydrochloride Solution: Dissolve 240 g of Hydroxylamine Hydrochloride in 2 L of reagent water. Assign an expiration date of 6 months from date prepared and store this solution at ambient temperature.

Potassium Permanganate Solution ($KMNO_4$) (5% w/v): Dissolve 100g of $KMNO_4$ in 2 L of reagent water. Assign an expiration date of 6 months from date prepared and store this solution at ambient temperature.

7.2 Standards

- Hg Stock Standard Solution (1000 mg/L): Purchase from Spex or equivalent.

Mercury Intermediate Standard (10,000 ug/L): Add 1 mL of 1000 mg/L Hg Stock Standard Solution and 0.15 mL of concentrated HNO_3 to a 100 mL volumetric flask that contains approximately 80 mL reagent water. Adjust to volume with reagent water. Assign an expiration date of six months from the date made, or the manufacturers date, whichever is sooner.

Mercury Working Standard (100 ug/L): Add 1.0 mL of the Hg Intermediate Standard Solution and 0.15 mL of concentrated HNO_3 to a 100 mL volumetric flask that contains approximately 80 mL reagent water. Adjust to volume with reagent water. Use this standard to prepare the calibration standards (ICAL & CCV). Prepare this standard each day of use.

- ICV Stock Standard Solution (1000 mg/L): Purchase from Inorganic Ventures or equivalent so long as the manufacturer is different than the primary source standard.

ICV Intermediate Standard Solution (10,000 ug/L): Add 1 mL of the 1000 mg/L ICV Stock Standard Solution and 0.15 mL of concentrated HNO_3 to a 100 mL volumetric flask that contains approximately 80 mL reagent water. Adjust to volume with reagent water. Assign an expiration date of six months from the date made, or the manufacturers date, whichever is sooner.

ICV Working Standard Solution (30 ug/L): Add 1.5 mL of the ICV Intermediate Standard Solution and 0.75 mL of concentrated HNO_3 into a 500 mL volumetric flask that contains approximately 300 mL reagent water. Adjust to volume with reagent water. Assign an expiration date of six months from the date made, or the manufacturers date, whichever is sooner.

8.0 Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection so these procedures are not included in this SOP. Sampling requirements may be found in the published reference method.

Listed below are minimum sample size, preservation and holding time requirements:

Matrix	Sample Container	Minimum Sample Size	Preservation	Holding Time	Reference
Solid	glass or polyethylene	100 mL	4^oC ±2	28 days from collection	SW-846 7471A

Unless otherwise specified by client or regulatory program, after analysis, samples and extracts are retained for a minimum of 30 days after provision of the project report and then disposed of in accordance with applicable regulations.

9.0 Quality Control

9.1 Sample QC

The laboratory prepares the following quality control samples with each batch of samples:

QC Item	Frequency	Acceptance Criteria
Method Blank (MB)	1 in 20 or fewer samples	See Table 2
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	See Table 2
Matrix Spike(s) MS	1 in 20 or fewer samples	See Table 2
Sample Duplicate (SD)	1 in 20 or fewer samples	See Table 2

9.2 Instrument QC

The following instrument QC is performed:

QC Item	Frequency	Acceptance Criteria
Initial Calibration (ICAL)	Initially; when ICV or CCV fail	See Section 10.0
Second Source Calibration Verification (ICV)	Once, after each ICAL	See Section 10.0
Continuing Calibration Verification (CCV)	Daily, every 10 samples, end of sequence	See Section 10.0

10.0 Procedure

10.1 Instrument Operating Conditions

Turn on the instrument lamp, gas and pump. Allow 15 minutes for the instrument to warm up. Fill the rinse bath with 10% hydrochloric acid solution. Check all tubing connections and reset the calibration curve. Check the stannous chloride reductant reservoir and fill as necessary. Check and record the 0.2ug/L standard intensity. This value must be >2500. When applicable, record sample intensity and reference intensities and verify against previous day. Perform maintenance to increase intensities if needed.

On the PC connected to the instrument, select the autosampler template and enter the sample IDs in the order of analysis. Place the samples, calibration blanks, calibration standards, and performance check standards in the position on the autosampler rack that corresponds to their assigned position in the autosampler template. Place the autosampler rack in the autosampler tray and initiate the software macro to begin analysis.

10.2 Determination of MDLs and IDLs

Determine the sensitivity (MDL), instrument detection limits (IDL), linear dynamic range and interference effects for each individual analyte line. Refer to laboratory SOP BR-QA-005 for additional guidance on the procedures for MDL and laboratory SOP BR-ME-017 for additional guidance on the procedures for IDL studies. Determine MDLs annually and IDLs every 3 months.

10.3 Instrument Calibration

10.3.1 Initial Calibration (ICAL)

The mercury autoanalyzers are calibrated with five calibration standards and a blank at the beginning of each analytical sequence using the instrument operating conditions established by the manufacturer of the instrument. Operating instructions for the instrument are described in the instrument manual(s) located in the laboratory.

The calibration standards are prepared daily by making successive dilutions of the working standard (100ug/L). The final concentration of the prepared calibration standards is given in the standard formulation tables in appendix A.

The calibration standards are digested and analyzed following the procedures given in Section 10.3. After analysis, the data system prepares a standard curve by plotting the instrument response of the calibration standards against the true value concentration and using linear regression calculates the correlation coefficient. The correlation coefficient must be greater than or equal to 0.995.

10.3.2 Second Source Calibration Verification (ICV)

Immediately after the instrument is calibrated, the accuracy of calibration is verified with analysis of the ICV standard. The ICV standard solution is prepared, digested and analyzed with the samples following the procedures given in Section 10.3. The percent recovery of the ICV must be within 90-110%. If this criterion is not met the analysis is stopped the instrument is recalibrated and a new analytical sequence is initiated.

10.3.3 Continuing Calibration Verification (CCV)

To ensure the accuracy of the calibration during the analysis run, a CCV standard is analyzed at the beginning and end of each analytical run, every 10 samples or every 2 hours, whichever is more frequent. The concentration of the CCV standard should be at or near the mid point of the calibration curve and must be different than the concentration of the ICV. The CCV standard is prepared, digested and analyzed with the samples following the procedure given in Section 10.3. The percent recovery of the CCV must be within 80-120%. If this criterion is not met the analysis is stopped, the problem is corrected, the instrument is recalibrated and verified and all samples analyzed since the last compliant CCV are reanalyzed.

10.3.4 Initial and Continuing Calibration Blanks (ICB/CCB)

Calibration blanks are analyzed at each wavelength after every ICV and CCV, at a frequency of every 10 samples or every 2 hours, whichever is more frequent. The blanks are also analyzed at the beginning of the run and after the last sample (after the last CCV). The ICB/CCB are prepared, digested and analyzed with the samples following the procedure given in Section 10.3. The absolute value of the ICB/CCB must be less than the CRQL. If it is not, the analysis is stopped, the problem is corrected, the instrument is recalibrated and verified and all samples analyzed since the last compliant ICB/CCB are reanalyzed.

10.3.5 Low Level Standard (CRI)

At a client's request, to verify linearity near the RL, a low level standard may be analyzed at the beginning of each analytical run following the ICB. The CRI standard is the same (0.2ug/L) solution used as the second level of the calibration curve. The CRI is prepared, digested and analyzed with the samples following the procedure given in Section 10.3.

10.3.6 Calibration Acceptance Summary Table

Calibration Item	Calibration Type	Frequency	Criteria
ICAL	Linear Regression	Prior to each analytical sequence	0.995 or better.
ICV	Initial calibration verification	Once per analytical sequence immediately following ICAL.	90-110%
ICB	Initial calibration blank	Once per analytical sequence immediately following ICV.	<RL
CCV	Continuing calibration verification	At the beginning of each run, every 10 samples or every 2 hours, whichever is more frequent, and at the end of the analytical sequence.	80-120%
CCB	Continuing calibration blank	At the beginning of each run, every 10 samples or every 2 hours, whichever is more frequent, and at the end of the analytical sequence, always following a CCV.	<RL
CRI	RL Check standard	Per client request. Inset at the beginning of each run following the ICB.	Client specified.

Troubleshooting:

Check the following items in case of calibration failures:

- ICAL Failure – Perform instrument maintenance, change pump tubing, adjust the lamp, clean the sipper tip, replace the drying tube, clean or replace the optical cell. Re-pour curve standards and restart calibration.
- CCV/CRI Failure – Perform instrument maintenance, change pump tubing, adjust the lamp, clean the sipper tip, replace the drying tube, clean or replace the optical cell. Re-pour CCV or CRI standards and restart calibration and analytical sequence.

10.4 Sample Preparation

Weigh 0.3 g of sample into a polyethylene digestion vessel. Add 5 mL of reagent water. Weigh 0.3 g of Teflon chips and use reagent water for the method blank and the laboratory control sample (LCS). Use reagent water for each calibration blank. Add 0.50 mL of the Hg working standard solution (100 ug/L) to the LCS and the matrix spike.

To prepare the ICV, transfer 5 mL of the ICV working standard solution (30 ug/L) to a labeled polyethylene digestion vessel and add 45 mL of reagent water.

For each CCV, transfer 2.5 mL of the Hg working standard solution (100 ug/L) to a labeled polyethylene digestion vessel and add 47.5 mL of reagent water.

If analysis of a low-level standard is requested, transfer 0.1 mL of the Hg working standard solution (100ug/L) to a labeled polyethylene digestion vessel and adjust the volume to 50 mL with reagent water.

To each sample, standard, and blank add 2.5 mL of aqua regia. Heat for 2 minutes in a digestion block at 95°C. Allow the samples to cool then add 20 mL of reagent water, 7.5 mL of potassium permanganate, and swirl to mix. Return to the block for 30 minutes. Cool and, when ready to analyze, add 3 mL of hydroxylamine hydrochloride to reduce the excess permanganate. Swirl each vessel to ensure that any soluble residue dissolves back into solution. If the color of any sample is still purple, add hydroxylamine hydrochloride in 3 mL increments until the purple color disappears. Add 25 mL of reagent water to each vessel and transfer the digestate to individual autoanalyzer tubes for analysis.

10.5 Sample Analysis

Load the autoanalyzer tubes onto the instrument. An example analytical sequence that includes initial calibration (ICAL) is provided below.

Injection Number	Lab Description
1	Calibration Blank
2	0.2 Calibration Standard
3	0.5 Calibration Standard
4	1.0 Calibration Standard
5	5.0 Calibration Standard
6	10.0 Calibration Standard
7	ICV
8	ICB
9	CRI (if client requested)
10	CCV
11	CCB
12-21	10 Samples*
22	CCV
23	CCB
24-33	10 Samples*
34	CCV
35	CCB
	Repeat until ending with CCV/CCB

**The number of samples between each CCB/CCV (10) includes the method blank, laboratory control sample, matrix spikes, and sample duplicates.*

11.0 <u>Calculations / Data Reduction</u>

11.1 Quantitative Identification

During analysis, the data processing system constructs a calibration curve by plotting the absorbance of standards versus units of mercury and sample concentrations are determined from the calibration curve. For each sample one replicate is acquired and the data system presents the sample result in concentration (ppb).

11.2 Calculations

See Appendix C.

11.3 Data Review

11.3.1 Primary Review

Review project documents such as the environmental test request (ETR) analytical worksheets, Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Review the instrument QC against the acceptance criteria given in Section 10.0 and summarized in Table 2. If the results do not fall within acceptance criteria, perform the recommended corrective action.

Upload the data files from the data processing system to the laboratory information management system (LIMS). Enter batch information and standards and reagents into the LIMS batch. Review the data in LIMS and set results to primary, secondary, acceptable or rejected as appropriate. Initiate a nonconformance memo for QC outside established acceptance criteria then set samples in batch to 1st level review.

11.3.2 Secondary Review

Review project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Check the batch editor and worksheet to verify the batch is complete and any outages are documented with an NCM along with the results of any corrective actions taken. Spot check results and when complete, set the status of the batch to second level review.

Run the QC Checker, investigate and correct any problems found. Run and review the deliverable. Fix any problems found then set the method chain to lab complete.

11.3.3 Data Reporting

Data reporting and creation of the data deliverable is performed by the LIMS using the formatters set by the project manager during project initiation.

Electronic and hardcopy data are maintained as described in laboratory SOP BR-QA-014 Laboratory Records.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

Perform a method detection limit (MDL) study at initial method set-up following the procedures specified in laboratory SOP BR-QA-005. An MDL study is performed annually after initial method set-up.

12.2 Demonstration of Capabilities (DOC)

Perform a method demonstration of capability at initial set-up and when time there is a significant change in instrumentation or procedure.

Each analyst that performs the analytical procedure must complete an initial demonstration of capability (IDOC) prior to independent analysis of client samples. Each analyst must demonstrate on-going proficiency (ODOC) annually thereafter. DOC procedures are further described in the laboratory's quality system manual (QAM) and in the laboratory SOP for employee training.

12.3 Training Requirements

Any employee that performs any portion of the procedure described in this SOP must have documentation in their employee training file that they have read this version of this SOP.

Instrument analysts, prior to independent analysis of client samples, must also have documentation of demonstration of initial proficiency (IDOC) and annual on-going proficiency (ODOC) in their employee training files.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to laboratory SOP BR-LP-001.

15.0 References / Cross-References

- Method 7471A Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique), Revision 1, September 1994. Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986.
- Laboratory SOP BR-QA-005, Procedures for the Determination of Limits of Detection (LOD), Limits of Quantitation (LOQ) and Reporting Limits (RL).
- Laboratory SOP BR-QA-011 Employee Training
- Laboratory SOP BR-LP-011 Hazardous Waste
- Laboratory SOP BR-QA-014 Laboratory Records

- Laboratory Quality Assurance Manual (QAM)

16.0 Method Modifications

None

17.0 Attachments

- Table 1: Primary Materials Used
- Table 2: QC Summary & Recommended Corrective Action
- Appendix A: Terms and Definitions
- Appendix B: Standard Preparation Tables
- Appendix C: Equations

18.0 Revision History

BR-ME-004, Revision 12:

- Title Page: Updated approval signatures
- Section 11.0: Updated procedure to be consistent with TALS process.
- All Sections: Removed references to DoD and DoD criteria. DoD protocol is specified in a controlled document separate from laboratory SOPs.

Table 1: Primary Materials Used

Material[1]	Hazards	Exposure Limit[2]	Signs and symptoms of exposure
Mercury (1,000 PPM in Reagent)	Oxidizer Corrosive Poison	0.1 Mg/M3 Ceiling (Mercury Compounds)	Extremely toxic. Causes irritation to the respiratory tract. Causes irritation. Symptoms include redness and pain. May cause burns. May cause sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. May affect the central nervous system. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 PPM-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Permanganate	Oxidizer	5 Mg/M3 for Mn Compounds	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Dry crystals and concentrated solutions are caustic causing redness, pain, severe burns, brown stains in the contact area and possible hardening of outer skin layer. Diluted solutions are only mildly irritating to the skin. Eye contact with crystals (dusts) and concentrated solutions causes severe irritation, redness, and blurred vision and can cause severe damage, possibly permanent.
Potassium Persulfate	Oxidizer	None	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Causes irritation to skin and eyes. Symptoms include redness, itching, and pain. May cause dermatitis, burns, and moderate skin necrosis.

[1] *Always add acid to water to prevent violent reactions.*
[2] *Exposure limit refers to the OSHA regulatory exposure limit.*

Table 2: QC Summary, Frequency, Acceptance Criteria and Recommended Corrective Action

QC Item	Frequency	Acceptance Criteria	Recommended Corrective Action[1]
ICAL	Daily prior to sample analysis	Linear Regression: r ≥ 0.995	Correct problem, repeat calibration.
ICV	After each calibration, prior to sample analysis.	(% R) 90-110	Correct problem and verify second source standard. If that fails, repeat initial calibration.
ICB	Beginning of analytical sequence after ICV	Routine: No analytes ≥ RL	Correct problem and reanalyze.
CCV	Beginning of sequence, after every 10 samples and at the end of the analytical sequence	±20% of expected value	Correct problem, reanalyze CCV. If that fails, repeat calibration and reanalyze all samples since last successful calibration.
CCB	After every 10 samples and at end of the sequence (i.e. after each IPC)	Routine: No analytes ≥ RL	Correct problem and reanalyze the calibration blank and previous 10 samples.
MB	One per digestion batch of 20 or less samples	Routine: No analytes ≥ RL	Correct problem, redigest and reanalyze MB and associated samples.
LCS	One per digestion batch of 20 or less samples	%R (85-115)	Correct problem, redigest and reanalyze LCS, MB and associated samples for failed analytes if sufficient sample volume is available.
MS	One per batch of twenty samples or less	%R (85-115)	Examine project DQO's with Project Manager. Evaluate data to determine if outage is related to analytical error or matrix effect.
DP	One per batch of twenty samples or less	RPD ≤ 20	Examine project DQO's with Project Manager. Evaluate data to determine source of difference between results

[1]*The recommended corrective action may include some or all of the items listed in this column. The corrective action taken may be dependent on project data quality objectives and/or analyst judgment but must be sufficient to ensure that results will be valid. If corrective action is not taken or is not successful, data must be flagged with appropriate qualifiers.*

Table 2: QC Summary, Frequency, Acceptance Criteria and Recommended Corrective Action for Routine and DoD v3.0

QC Item	Frequency	Acceptance Criteria	Recommended Corrective Action[1]
ICAL	Daily prior to sample analysis	Linear Regression: r ≥ 0.995	Correct problem, repeat calibration.
ICV	After each calibration, prior to sample analysis.	(%R) 90-110	Correct problem and verify second source standard. If that fails, repeat initial calibration.
ICB	Beginning of analytical sequence after ICV	No analytes > LOD	Correct problem and reanalyze.
CCV	Beginning of sequence, after every 10 samples and at the end of the analytical sequence	±20% of expected value	Correct problem, reanalyze CCV. If that fails, repeat calibration and reanalyze all samples since last successful calibration.
CCB	After every 10 samples and at end of the sequence (i.e. after each CCV)	No analytes > LOD	Correct problem and reanalyze the calibration blank and previous 10 samples.
MB	One per digestion batch of 20 or less samples	No analytes detected > ½ RL (common lab contaminants > RL) **and** >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	Correct problem, redigest and reanalyze MB and associated samples.
LCS	One per digestion batch of 20 or less samples	(%R) 80-120	Correct problem, redigest and reanalyze LCS, MB and associated samples for failed analytes if sufficient sample volume is available.
MS	One per batch of twenty samples or less	(%R) 80-120	Examine project DQO's with Project Manager. Evaluate data to determine if outage is related to analytical error or matrix effect.
DP	One per batch of twenty samples or less	RPD < 20	Examine project DQO's with Project Manager. Evaluate data to determine source of difference between results.

[1]*The recommended corrective action may include some or all of the items listed in this column. The corrective action taken may be dependent on project data quality objectives and/or analyst judgment but must be sufficient to ensure that results will be valid. If corrective action is not taken or is not successful, data must be flagged with appropriate qualifiers.*

Appendix A: Terms and Definitions

Acceptance Criteria: specified limits placed on characteristics of an item, process or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyte: The specific chemicals or components for which a sample is analyzed. (EPA Risk Assessment Guide for Superfund, OSHA Glossary).

Batch: environmental samples that are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria. An analytical batch is composed of prepared environmental samples (extracts, digestates and concentrates), which are analyzed together as a group.

Calibration: a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values realized by the standards.

Calibration Curve: the graphical relationship between the known values or a series of calibration standards and their instrument response.

Calibration Standard: A substance or reference used to calibrate an instrument.

Continuing Calibration Verification (CCV): a single or multi-parameter calibration standard used to verify the stability of the method over time. Usually from the same source as the calibration curve.

Corrective Action: the action taken to eliminate the cause of an existing nonconformity, defect or other undesirable occurrence in order to prevent recurrence.

Data Qualifier: a letter designation or symbol appended to an analytical result used to convey information to the data user. (Laboratory)

Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.

Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s) processed simultaneously with and under the same conditions as samples through all steps of the procedure.

Matrix Spike (MS): a field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a second replicate matrix spike

Method Blank (MB): a blank matrix processed simultaneously with and under the same conditions as samples through all steps of the procedure. Also known as the preparation blank (PB).

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs. Quantitative results are not produced in this range.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical, and/or biological integrity of the sample.

Quality Control Sample (QC): a sample used to assess the performance of all or a portion of the measurement system.

Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample.

Stock Standard: a solution made with one or more neat standards usually with a high concentration. Also known as a primary standard. Stock standards may be certified solutions purchased from a vendor.

Appendix B: Standard Preparation Tables

The standard formulations contained in this Appendix are recommended and are subject to change. If the concentration of the stock standard is different than those noted in this table, adjust the standard preparation formulation accordingly. Unless otherwise specified, prepare the standard solutions in hexane using Class A volumetric glassware and Hamilton syringes. Unless otherwise specified for a standard solution, assign an expiration date of 6 months from date of preparation unless the parent standard expires sooner in which case use the earliest expiration date. See laboratory SOP BR-QA-002 *Standard Preparation* for further guidance.

Intermediate Calibration Standards (10,000 ug/L)

Parent Standard	Vendor	Stock Standard Concentration (mg/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Mercury	SPEX	1000	1.0	100	10000

Add the mercury standard and 0.15 mL of concentrated HNO_3 to a 100 mL volumetric flask that contains approximately 80 mL of reagent water. Adjust to final volume with reagent water.

Working Calibration Standards (100 ug/L)

Parent Standard	Vendor	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Intermediate Calibration	Laboratory Prepared	10000	10.0	1000	100

Add the mercury standard and 1.5 mL of concentrated HNO_3 to a 1000 mL volumetric flask that contains approximately 800 mL of reagent water. Adjust to final volume with reagent water.

Intermediate ICV Standard (10,000 ug/L)

Parent Standard	Vendor	Stock Standard Concentration (mg/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Mercury	Inorganic Ventures	1000	1.0	100	10000

Add the mercury standard and 0.15 mL of concentrated HNO_3 to a 100 mL volumetric flask that contains approximately 80 mL of reagent water. Adjust to final volume with reagent water.

Working ICV Standard (30 ug/L)

Parent Standard	Vendor	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Intermediate ICV	Laboratory Prepared	10000	1.5	500	30

Add the mercury standard and 0.75 mL of concentrated HNO_3 to a 500 mL volumetric flask that contains approximately 300 mL of reagent water. Adjust to final volume with reagent water.

Mercury Calibration Standard(s): CAL Levels 1- 6

Parent Standard	Calibration Standard	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration* (ug/L)
Reagent Water	Blank	0	50	50	0
Intermediate Calibration	Level 1	100	0.1	50	0.2
Intermediate Calibration	Level 2	100	0.25	50	0.5
Intermediate Calibration	Level 3	100	0.5	50	1
Intermediate Calibration	Level 4	100	2.5	50	5
Intermediate Calibration	Level 5	100	5.0	50	10

**The final concentration is achieved after digestion.*

Appendix C: Equations

Percent Recovery (%R)

$$\%R = \frac{C_s}{C_n} \times 100\%$$

Where:
C_s = Concentration of the Spiked Field or QC Sample
C_n = Nominal Concentration of Spike Added

Percent Recovery (%R) for MS

$$\%R \text{ for MS} = \frac{C_s - C_u}{C_n} \times 100\%$$

Where:
C_s = Concentration of the Spiked Sample
C_u = Concentration of the Unspiked Sample
C_n = Nominal Concentration of Spike Added

Relative Percent Difference (%RPD)

$$\%RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100\%$$

Where:
C_1 = Measured Concentration of First Sample
C_2 = Measured Concentration of Second Sample

Solid Sample Concentration

$$C_{(mg/Kg\ \ drywt.)} = \frac{\mu g}{L_{dig}} * \frac{V_{dig}}{g_{samp}} * \frac{100}{\%\ \ solids}$$

Where:
$\mu g/L_{dig}$ = Instrument result adjusted for dilution factors
V_{dig} = Final digestate volume in liters
g_{samp} = Sample weight in grams
% Solids = Percent solids to nearest 0.1%

Title: Metals by ICP-OES (SW-846 Method 6010B)

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1.0 Scope and Application

This SOP describes the laboratory procedure used to determine trace elements and metals in solution using Inductively Coupled Plasma-Atomic Emission Spectrometry.

1.1 Analytes, Matrix(s), and Reporting Limits

This procedure may be used for a variety of matrices including: non-potable water, soil, sediment, sludge, tissue and air.

Table 1, Section 18.0 lists the elements for which this SOP is applicable along with the laboratory established reporting limit (RL).

2.0 Summary of Method

Prior to analysis samples are digested using an appropriate preparation method following laboratory SOPs BR-ME-009 (SW-846 3010), BR-ME-010 (SW-846 3005) or BR-ME-011 (SW-846 3050).

The digested samples are introduced to the ICP-AES, which measures characteristic emission spectra by optical spectrometry. An aliquot of sample is nebulized and the resulting aerosol is transported to a plasma torch. Element-specific emission spectra are produced by radio-frequency inductively coupled plasma. The spectra are dispersed by a spectrometric grating and the intensities of the emission lines are monitored by photosensitive devices. Background correction is performed with the background measured adjacent to analyte lines on samples during analysis. The sample is analyzed by multiple integrations (2) and the average integration is converted to a concentration from a calibration curve.

This procedure is based on the following reference method:

- SW-846 Method 6010B, Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 2, December 1996.

If the laboratory's procedure is modified from the reference method, a list of modifications will be provided in Section 16.0.

3.0 Definitions

- Total Recoverable Metals: The concentration of metals in an unfiltered sample following treatment with hot dilute mineral acid. (SW-846 Method 3005).

- Dissolved Metals: The concentration of metals determined in a sample after the sample is filtered through a 0.45 µm filter. (SW-846 Method 3005).

- Total Metals: The concentration of metals determined in a sample following digestion by Methods 3010 or 3050.

A list of general laboratory terms and definitions are provided in Appendix A.

4.0 Interferences

Spectral interferences are caused by background emission from continuous or recombination phenomena, stray light from the line emission of high concentration elements, overlap of a spectral line from another element, or unresolved overlap of molecular band spectra. These effects are compensated by using computer correction of the raw data by monitoring and measurement of the interfering element and/or background correction adjacent to the analyte line.

Physical interferences are effects associated with sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies especially in samples that contain high dissolved solids and/or acid concentrations. The use of a peristalitic pump or sample dilution should minimize these interferences.

Chemical interferences such as molecular compound formation, ionization effects and solute vaporization effects are highly dependent on matrix type and specific analyte elements. These interferences are not typical with ICP-AES analysis but if observed, can be minimized by matrix matching, buffering the sample and careful selection of instrument operating conditions.

Memory interferences result when analytes in a previous sample contribute to the signals measured in a new sample.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

The ICP plasma emits strong UV light and is harmful to vision. All analysts must avoid looking directly at the plasma.

5.2 Primary Materials Used

Table 2, Section 18.0 lists those materials used in this procedure that have a serious or significant hazard rating along with the exposure limits and primary hazards associated with that material as identified in the MSDS. **NOTE: This list does not include all materials used in the method.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

6.0 Equipment and Supplies

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts are cautioned to be sure equipment used meets the specification of this SOP.

6.1 Miscellaneous

- Volumetric Pipettes: Size 0.10-1.00 mL & 1.00-5.00 mL, Finpipette or equivalent.
- Volumetric Flasks, Class A: Size 50, 100, 500, and 1000 mL.

6.2 Analytical System

- Inductively Coupled Argon Plasma Optical Emission Spectrometer (ICP-OES), Thermo Electron Corporation, ICAP Duo 6500 or equivalent.

7.0 Reagents and Standards

7.1 Reagents

Hydrochloric Acid (HCl), Concentrated: Reagent Grade, J.T. Baker or equivalent

Nitric Acid (HNO_3), Concentrated: Reagent Grade, J.T. Baker or equivalent

7.2 Standards

Purchase stock standard solutions from commercial vendors and store according to the manufacturer's recommendation. From these, prepare intermediate and working standard solutions as needed and unless otherwise noted, assign an expiration date of 6 months from date of preparation unless the parent standard expires sooner, in which case, use the earliest expiration date is used. The recommended formulations for standards used in this procedure along with the recommended source materials, expiration dates and storage conditions are provided in Appendix A.

8.0 Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection so these procedures are not included in this SOP. Sampling requirements may be found in the published reference method.

Listed below are minimum sample size, preservation and holding time requirements:

Matrix	Sample Container	Minimum Sample Size	Preservation	Holding Time	Reference
Solid	Glass or plastic	5 grams	NA	180 days from collection	SW-846 6010B
Aqueous	Glass or plastic	500 mL	pH<2 with Nitric Acid	180 days from collection	SW-846 6010B

NOTE: Samples for measurement of dissolved metals should be filtered immediately after sample collection.

Unless otherwise specified by client or regulatory program, samples and digestates are retained for a minimum of 30 days after provision of the project report and then disposed of in accordance with applicable regulations.

9.0 Quality Control

9.1 Sample QC

The laboratory prepares the following quality control samples with each batch of samples.

QC Item	Frequency	Acceptance Criteria
Method Blank (MB)	1 in 20 or fewer samples	See Table 3
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	See Table 3
Matrix Spike (MS)	1 in 20 or fewer samples	See Table 3
Matrix Spike Duplicate (MSD)	Per client request	See Table 3
Sample Duplicate (DP)	1 in 20 or fewer samples	See Table 3
Post Digestion Spike (A)	Performed with every MS	See Table 3

9.2 Instrument QC

The following instrument QC is performed:

QC Item	Frequency	Acceptance Criteria
Initial Calibration (ICAL)	Initially; when ICV or CCV fail	See Table 3
Second Source Calibration Verification (ICV)	Once, after each ICAL	See Table 3
Initial Calibration Blank (ICB)	Once, following ICV	See Table 3
Interference Check Standards (ICSA/ICSAB)	Once, following ICB	See Table 3
Low Level Standard (CRI)	Once, following ICSA/ICSAB	See Table 3
Continuing Calibration Verification (CCV)	At the beginning of each sequence, following the ICSA/ICSAB, every 10 samples, end of sequence	See Table 3
Continuing Calibration Blank (CCB)	At the beginning of each sequence, following the ICSA/ICSAB, every 10 samples, end of sequence, following CCV	See Table 3

10.0 Procedure

10.1 Instrument Operating Conditions

Set up the instrument with the proper operating conditions using the instructions provided by the instrument manufacturer. Operating manuals for each instrument are located in the metals laboratory.

Perform plasma optimization per the manufacturer's instructions when a new instrument is set up or when there is a significant change in operating conditions. The optimization is performed to provide a maximum signal to background ratio for some of the least sensitive elements in the analytical array.

Establish and verify the interelement spectral interference correction routine (IECs) used during sample analysis. To determine the IECs analyze a single element standard for each element at 3 successive concentrations and document the presence of a positive or negative value of any other element whose absolute value exceeds the RL (interfering element). Calculate a "K" factor for each element by dividing the concentration found by the concentration of the interfering element. Take the average of the three "K" values for each interfering element and enter this value (IEC) into the software system. Verify the IECs quarterly.

Establish the upper limit of the linear dynamic range (LDR) for each wavelength used by determining the signal responses from a minimum of 2 different concentration standards across the range. One of the standards should be near the upper limit. The %R should be within ± 10% of the known value. Establish new dynamic ranges when there is a significant change in instrument response and check the range every 3 months.

Profile the instrument by running an ICV standard. Visually inspect the peaks for proper peak alignment for each element. If adjustments to the peaks are necessary follow the steps to perform an Auto-peak adjustment in the iTEVA software. This will fine-tune the peak positions for optimum conditions. Profile the instrument again after the Auto-peak adjustment to ensure peak alignment is good.

10.2 Instrument Calibration

10.2.1 Initial Calibration (ICAL)

Calibrate the instrument with each analytical sequence using a a blank and one calibration standard for each element.

Prepare the calibration blank and standards using the formulations provided in Appendix A.

Analyze the standards following the procedure that begins in Section 10.4.

10.2.2 Second Source Calibration Verification (ICV)

Immediately after calibration verify the accuracy of the calibration with a second source standard (ICV). Prepare the ICV using the formulation provided in Appendix A and analyze the ICV following the procedure that begins in Section 10.4 The percent recovery of the ICV must be within 90-100% (%D ± 10%). If criteria are not met, correct the problem and rerun the ICV. If the reanalysis fails, correct problem and repeat initial calibration.

10.2.3 Continuing Calibration Verification (CCV)

Analyze a CCV every 10 samples and at the end of the analytical sequence or every 2 hours whichever is more frequent.

The percent recovery of the CCV must be within 90-100% (%D ± 10%). If criteria are not met, correct the problem and rerun the ICV. If the reanalysis fails, correct problem and repeat initial calibration.

10.2.4 Calibration Blanks (ICB/CCB)

Analyze a calibration blank at the beginning of the run (ICB) after each CCV (CCB). The result of the calibration blanks should be less than the RL. If it is not correct the problem and reprep and reanalyze the blank and all samples bracketed by the blank.

10.2.5 Interference Check Standards (ICSA/ICSAB)

The ICS consists of two solutions (ICSA/ICSAB) that are analyzed consecutively starting with the ICSA. The ICSA solution includes the interferents, and the ICSAB includes the analytes mixed with the interferents.

Analyze ICS solutions at the beginning and end of each analytical sequence immediately after each CCV/CCB at a minimum frequency of once per 20 samples per analytical run.

The result of the ICSA should be within ±2 times the RL of the analyte's true value or ±20% of the analyte's true value in the ICSA, whichever is greater assuming the true value is zero unless otherwise stated. For analytes with an RL less than 5000 ug/L, the ICSA results should be reported from the undiluted sample analysis.

The results of the ICSAB solution should be within ±2 times the RL or ±20% of the analyte's true value, whichever is greater. If the results are not within control limits, the analysis is stopped and the problem is investigated and corrected. The instrument is recalibrated and all samples analyzed since the last compliant ICSA/ICSAB are reanalyzed.

10.2.6 Low Level Standard (CRI)

To verify linearity near the RL, analyze a CRI at the beginning of each analytical after the ICSA/ICSAB. The CRI shall be run for every wavelength used for analysis.

10.2.7 Internal Standard (IS)

For the ICP-OES yttirium and indium are used as internal standards. Indium is associated with lead and thallium only. Check the response of the internal standard (IS) in every field and QC sample. The raw average should not vary by ± 30% from the raw average result of the ICB. If the IS response is outside this range, dilute 1:2 and reanalyze the sample. If the IS is still outside of range report the original result and narrative note the IS failure.

Troubleshooting:

Check the following items in case of calibration failures:

- Change the peristaltic pump tubing and replace the transition tubing pieces if the tubing appears cloudy or discolored.
- Recheck the profile to determine if maintenance performed was sufficient to correct the problem.
- Remake standards if solutions are running low.
- Replace the peristaltic pump tubing.

10.3 Standard and Sample Preparation

Transfer ~25 mL of each prepared standard (CAL #7, 4, 8, ICV, CCV, ICSA, ICSAB, CRI) into individual, labeled autosampler tubes. Use 25 mL of mixed acid solution (5%HCl / 2%HNO3) for each calibration blank.

Transfer approximately 8 mL of each digestate to individual autosampler tubes. Prepare a serial dilution and post digestion spike using aliquots of the digestate of the parent sample used for the matrix spike.

- To prepare the serial dilution, transfer 1.4 mL of parent sample to an autosampler tube and add 5.6 mL of the mixed acid solution (5%HCl / 2%HNO3).

- To prepare the post digestion spike, transfer 7.92 mL of parent sample to an autosampler tube and spike with 0.08 mL of the matrix spike solution.

10.4 Sample Analysis

Allow the instrument to become thermally stable prior to analysis. Create a new autosampler template on the instrument PC and enter the sample IDs in the order of analysis. Place the samples, serial dilution, post-digestion spike, calibration blanks, mixed calibration standards, and performance check standards in the position on the autosampler rack that corresponds to their assigned position in the autosampler template.

An example analytical sequence that includes initial calibration (ICAL) is provided below.

Injection Number	Lab Description
1	Calibration Blank
2	Calibration Standard #7
3	Calibration Standard #8
4	Calibration Standard #4
5	ICV
6	ICB
7	ICSA
8	ICSAB
9	CRI
10	CCV
11	CCB
12-21	10 Samples*
22	CCV
23	CCB
24-33	10 Samples*
34-35	Repeat until ending with CCV/CCB

*The number of samples between each CCB/CCV (10) includes the method blank, laboratory control sample, matrix spike, sample duplicate, serial dilution and the post digestion spike.

Place the autosampler rack in the autosampler tray and initiate the software macro to begin analysis. The ICP-AES software is configured to acquire a minimum of two replicate exposures for all analyses and to use the average result of multiple exposures for standardization. The data

processing software calculates results and adjusts for appropriate factors such as dilution and dry weight. Equations used are provided in the next section.

11.0 Calculations / Data Reduction

The sample is quantified by multiple integrations (2) and the average integration is converted to a concentration (ppb) from a calibration curve. S

11.1 Calculations

See Appendix C.

11.2 Data Reduction

11.2.1 Primary Review

Review project documents such as the environmental test request (ETR) analytical worksheets, Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Review the instrument QC against the acceptance criteria given in Section 10.0 and summarized in Table 2. If the results do not fall within acceptance criteria, perform the recommended corrective action.

Upload the data files from the data processing system to the laboratory information management system (LIMS). Enter batch information and standards and reagents into the LIMS batch. Review the data in LIMS and set results to primary, secondary, acceptable or rejected as appropriate. Initiate a nonconformance memor for QC outside established acceptance criteria then set samples in batch to 1st level review.

11.2.2 Secondary Review

Review project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Check the batch editor and worksheet to verify the batch is complete and any outages are documented with an NCM along with the results of any corrective actions taken. Spot check results and when complete, set the status of the batch to second level review.

Run the QC Checker, investigate and correct any problems found. Run and review the deliverable. Fix any problems found then set the method chain to lab complete.

11.2.3 Data Reporting

Data reporting and creation of the data deliverable is performed by the LIMS using the formatters set by the project manager during project initiation.

The following sections describe the default reporting scheme for this method:

Analytical results above the reporting limit (RL) are reported as the value found. Analytical results less than the RL are reported as non-detect to the adjusted RL. The RL is adjusted for sample dilution/concentration. The unadjusted RL for each target analyte is provided in Section 1.

Electronic and hardcopy data are maintained as described in laboratory SOP BR-QA-014 Laboratory Records.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

Perform a method detection limit (MDL) study at initial method set-up following the procedures specified in laboratory SOP BR-QA-005.

12.2 Demonstration of Capabilities (DOC)

Perform a method demonstration of capability at initial set-up and when time there is a significant change in instrumentation or procedure.

Each analyst that performs the analytical procedure must complete an initial demonstration of capability (IDOC) prior to independent analysis of client samples. Each analyst must demonstrate on-going proficiency (ODOC) annually thereafter. DOC procedures are further described in the laboratory's quality system manual (QAM) and in the laboratory SOP for employee training.

12.3 Interelement Corrections

Interelement correction factors are determined quarterly by the analysis of a single element standard for each element at an environmentally representative concentration. For each of those analyses the presence of a positive or negative value whose absolute value for any other element exceeds the CRQL is documented. A "K" factor is determined by dividing the concentration observed of a given element by the concentration of the interfering element and is entered into the software system. Following this, the ICSA solution is analyzed and the process is repeated for any elements not present in the solution that exhibit a positive or negative value. When the procedure is complete, all "K" values are considered final if the ICSA analysis meets the acceptance criteria for the ICSA analysis.

12.4 Linear Range Analysis

Linear range analysis is determined quarterly by the analysis of a multi-component or single element standard for each element. The highest concentration recovered within 5% of its true value determines the linear range for the instrument.

12.5 Training Requirements

Any employee that performs any portion of the procedure described in this SOP must have documentation in their employee training file that they have read this version of this SOP.

Instrument analysts, prior to independent analysis of client samples, must also have documentation of demonstration of initial proficiency (IDOC) and annual on-going proficiency (ODOC) in their employee training files.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to laboratory SOP BR-LP-001.

15.0 References / Cross-References

- SW-846 Method 6010B, Inductively Coupled Plasma-Atomic Emission Spectrometry, Revision 2, December 1996.
- Laboratory SOP LM-MP-3005 Acid Digestion of Waters for Total Recoverable or Dissolved Metals
- Laboratory SOP LM-MP-3010A Acid Digestion of Waters for Total Metals
- Laboratory SOP LM-MP-3050B Acid Digestion of Soils, Sediments & Sludge for Total Metals
- Laboratory SOP BR-QA-005, Procedures for the Determination of Limits of Detection (LOD), Limits of Quantitation (LOQ) and Reporting Limits (RL).
- Laboratory SOP BR-QA-011 Employee Training
- Laboratory SOP BR-LP-011 Hazardous Waste
- Laboratory SOP BR-QA-014 Laboratory Records
- Laboratory SOP BR-QA-006 Procedures & Documentation Requirements for Manual Integration
- Laboratory Quality Assurance Manual (QAM)

16.0 Method Modifications

Modification Number	Method Reference	Modification
1	NA	The laboratory monitors the internal standard behavior throughout the analysis. Check the response of the internal standard (IS) in every field and QC sample. The raw average should not vary by ± 30% from the raw average result of the ICB. If the IS response is outside this range, dilute 1:2 and reanalyze the sample. If the IS is still outside of range report the original result and narrative note the IS failure.

17.0 Attachments

- Table 1: Target Compound List and Reporting Limit
- Table 1A: Accuracy and Precision Limits

- Table 2: Primary Materials Used
- Table 3: QC Summary & Recommended Corrective Action
- Appendix B: Standard Preparation Tables
- Appendix C: Equations

18.0 Revision History

BR-ME-005, Revision 10:

Table 1: Routine Target Analyte List & Reporting Limit (RL)

Element	CAS No.	Reporting Limit		Wavelength
		Water (ug/L)	Soil (mg/Kg)	Thermo ICAP ICP7
Aluminum	7429-90-5	200	20	308.215
Antimony	7440-36-0	60	6	206.838
Arsenic	7440-38-2	10	1.0	189.042
Barium	7440-39-3	200	20	493.409
Beryllium	7440-41-7	5	0.5	313.042
Cadmium	7440-43-9	5	0.5	226.502
Calcium	7440-70-2	5000	500	317.933
Chromium	7440-47-3	10	1	267.716
Cobalt	7440-48-4	50	5	228.616
Copper	7440-50-8	25	2.5	324.753
Iron	7439-89-6	200	20	271.441
Lead	7439-92-1	10	1.0	220.353
Magnesium	7439-95-4	5000	500	279.078
Manganese	7439-96-5	15	1.5	257.610
Nickel	7440-02-0	40	4	202.030
Potassium	7440-09-7	5000	500	766.491
Selenium	7782-49-2	35	3.5	196.026
Silver	7440-22-4	10	1	328.068
Sodium	7440-23-5	5000	500	330.232
Thallium	7440-28-0	25	2.5	190.864
Vanadium	7440-62-2	50	5	292.402
Zinc	7440-66-6	20	2	206.200
Boron	7440-42-8	100	10	246.678
Molybdenum	7439-98-7	10	1	202.030
Tin	7440-31-5	20	2	189.989
Silicon	7440-21-3	100	10	--
Titanium	7440-32-6	20	2	334.941
Strontium	7440-24-6	20	2	421.552
Phosphorous	7723-14-0	250	25	178.287

Table 2: Primary Materials Used

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

Table 3: QC Summary, Frequency, Acceptance Criteria and Recommended Corrective Action

QC Item	Frequency	Acceptance Criteria	Recommended Corrective Action[1]
ICAL	Daily	NA	NA
ICV	After each initial calibration, prior to sample analysis.	±10% of expected value	Correct problem and verify second source standard. If that fails, repeat initial calibration.
ICB	Beginning of analytical sequence after ICV	No analytes ≥ RL	Correct problem and reanalyze.
CCV	At beginning of analytical sequence, after every 10 samples and at the end of the analytical sequence.	±10% of expected value %RSD between replicate integrations <5%.	Correct problem; reanalyze CCV. If that fails, repeat calibration and reanalyze all samples since last successful calibration.
CCB	Beginning of sample run, after every 10 samples and at end of the sequence (i.e. after each CCV).	No analytes ≥ RL	Correct problem and reanalyze the calibration blank and previous 10 samples.
ICSA ICSAB	At the beginning of the analytical run.	±20% of expected value	Stop analysis, locate and correct problem, reanalyze ICS and all associated QC and samples.
CRI (Low Level Standard)	Daily, after ICSA and ICSAB		Examine project DQO's. If necessary, reanalyze.
MB	One per digestion batch.	No analytes ≥RL	Correct problem, redigest and reanalyze MB and associated samples.
LCS	One per digestion batch of 20 or fewer samples	%R= 80-120	Correct problem, redigest and reanalyze LCS, MB and associated samples for failed analytes if sufficient sample volume is available.
MS	One per digestion batch of 20 or fewer samples	%R= 80-120	Examine project DQO's with Project Manager. Evaluate data to determine if outage is related to analytical error or matrix effect.
DP	One per digestion batch of 20 or fewer samples	RPD ≤ 20	Examine project DQO's with Project Manager. Evaluate data to determine source of difference between results.
Serial Dilution	Each digestion batch	5X dilution within ±10% of original sample result	Perform Post Digestion Spike. Flag data.
Post Digestion Spike	Each digestion batch	%R within 75-125	Flag data or run samples by MSA.

[1] *The recommended corrective action may include some or all of the items listed in this column. The corrective action taken may be dependent on project data quality objectives and/or analyst judgment but must be sufficient to ensure that results will be valid. If corrective action is not taken or is not successful, data must be flagged with appropriate qualifiers.*

Appendix A: Terms and Definitions

Acceptance Criteria: specified limits placed on characteristics of an item, process or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyte: The specific chemicals or components for which a sample is analyzed. (EPA Risk Assessment Guide for Superfund, OSHA Glossary).

Batch: environmental samples that are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria. An analytical batch is composed of prepared environmental samples (extracts, digestates and concentrates), which are analyzed together as a group.

Calibration: a set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material and the corresponding values realized by the standards.

Calibration Curve: the graphical relationship between the known values or a series of calibration standards and their instrument response.

Calibration Standard: A substance or reference used to calibrate an instrument.

Continuing Calibration Verification (CCV): a single or multi-parameter calibration standard used to verify the stability of the method over time. Usually from the same source as the calibration curve.

Corrective Action: the action taken to eliminate the cause of an existing nonconformity, defect or other undesirable occurrence in order to prevent recurrence.

Data Qualifier: a letter designation or symbol appended to an analytical result used to convey information to the data user. (Laboratory)

Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.

Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s) processed simultaneously with and under the same conditions as samples through all steps of the procedure.

Matrix Spike (MS): a field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a second replicate matrix spike

Method Blank (MB): a blank matrix processed simultaneously with and under the same conditions as samples through all steps of the procedure. Also known as the preparation blank (PB).

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs. Quantitative results are not produced in this range.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical, and/or biological integrity of the sample.

Quality Control Sample (QC): a sample used to assess the performance of all or a portion of the measurement system.

Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample.

Stock Standard: a solution made with one or more neat standards usually with a high concentration. Also known as a primary standard. Stock standards may be certified solutions purchased from a vendor.

Appendix B: Standard Preparation Tables

The standard formulations contained in this Appendix are recommended and are subject to change. If the concentration of the stock standard is different than those noted in this table, adjust the standard preparation formulation accordingly. Unless otherwise specified, all standards are prepared in a solutions that consists of 5% Hydrochloric Acid and 2% Nitric Acid and primary source standards are purchased from SPEX and second source standards are purchased from Inorganic Ventures. Unless otherwise specified for a standard solution, assign an expiration date of 6 months from date of preparation unless the parent standard expires sooner in which case use the earliest expiration date. See laboratory SOP BR-QA-002 *Standard Preparation* for further guidance.

Calibration Standard #7

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Aluminum (Al)	500 ppm	200 mL of X-AQU-4	2000 mL	50000 ug/L
Calcium (Ca)	500 ppm			50000 ug/L
Iron (Fe)	500 ppm			50000 ug/L
Magnesium (Mg)	500 ppm			50000 ug/L
Sodium (Na)	500 ppm			50000 ug/L
Potassium (K)	500 ppm			50000 ug/L

Calibration Standard #8

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Arsenic (As)	1000 ppm	1.0 mL	2000 mL	500 ug/L
Antimony (Sb)	1000 ppm	1.0 mL		500 ug/L
Lead (Pb)	1000 ppm	2.0 mL		1000 ug/L
Selenium (Se)	1000 ppm	1.0 mL		500 ug/L
Strontium (Sr)	1000 ppm	2.0 mL		1000 ug/L
Thallium (Tl)	1000 ppm	1.0 mL		500 ug/L
Tin (Sn)	1000 ppm	2.0 mL		1000 ug/L
Titanium (Ti)	1000 ppm	2.0 mL		1000 ug/L

Calibration Standard #4

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Silver (Ag)	1000 ppm	1.0 mL	2000	500 ug/L
Phosphorus (P)	1000 ppm	2.0 mL		1000 ug/L
Silicon (Si)	1000 ppm	10 mL		5000 ug/L
Aluminum (Al)	100 ppm	20 mL of X-AQU-5		1000 ug/L
Antimony	100 ppm			1000 ug/L
Barium	100 ppm			1000 ug/L
Berylium (Be)	50 ppm			500 ug/L
Boron (B)	100 ppm			1000 ug/L
Cadmium (Cd)	50 ppm			500 ug/L
Chromium (Cr)	100 ppm			1000 ug/L
Cobalt (Co)	100 ppm			1000 ug/L
Copper (Cu)	100 ppm			1000 ug/L
Iron (Fe)	100 ppm			1000 ug/L
Lead (Pb)	100 ppm			1000 ug/L
Magnesium (Mg)	100 ppm			1000 ug/L
Manganese (Mn)	100 ppm			1000 ug/L
Molybdenum (Mo)	100 ppm			1000 ug/L

Nickel (Ni)	100 ppm			1000 ug/L
Potassium (K)	100 ppm			1000 ug/L
Sodium (Na)	100 ppm			1000 ug/L
Strontium (Sr)	50 ppm			500 ug/L
Titanium (Ti)	100 ppm			1000 ug/L
Vanadium (V)	100 ppm			1000 ug/L
Zinc (Zn)	100 ppm			1000 ug/L

CRI Intermediate Solution #1

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Antimony (Sb)	1000 ppm	6.0 mL	100 mL	60000 ug/L
Arsenic (As)	1000 ppm	1.0 mL		10000 ug/L
Berylium (Be)	1000 ppm	0.5 mL		5000 ug/L
Cadmium (Cd)	1000 ppm	0.5 mL		5000 ug/L
Chromium (Cr)	1000 ppm	1.0 mL		10000 ug/L
Cobalt (Co)	1000 ppm	5.0 mL		50000 ug/L
Copper (Cu)	1000 ppm	2.5 mL		25000 ug/L
Lead (Pb)	1000 ppm	1.0 mL		10000 ug/L
Mangenese (Mn)	1000 ppm	1.5 mL		15000 ug/L
Nickel (Ni)	1000 ppm	4.0 mL		40000 ug/L
Selenium (Se)	1000 ppm	3.5 mL		35000 ug/L
Silver (Ag)	1000 ppm	1.0 mL		10000 ug/L
Thallium (Tl)	1000 ppm	2.5 mL		25000 ug/L
Vanadium (V)	1000 ppm	5.0 mL		50000 ug/L

CRI Intermediate Solution #2

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Aluminum (Al)	10000 ppm	0.2 mL	100 mL	20000 ug/L
Barium (Ba)	1000 ppm	2.0 mL		200000 ug/L
Calcium (Ca)	10000 ppm	5.0 mL		500000 ug/L
Iron (Fe)	10000 ppm	0.2 mL		20000 ug/L
Potassium (K)	10000 ppm	5.0 mL		500000 ug/L
Magnesium (Mg)	10000 ppm	5.0 mL		500000 ug/L
Sodium (Na)	10000 ppm	5.0 mL		500000 ug/L
Boron (B)	1000 ppm	1.0 mL		10000 ug/L
Molybdenum (Mo)	1000 ppm	0.1 mL		1000 ug/L
Phosphorus (P)	1000 ppm	2.5 mL		25000 ug/L
Silicon (Si)	1000 ppm	1.0 mL		10000 ug/L
Strontium (Sr)	1000 ppm	0.2 mL		2000 ug/L
Tin (Sn)	1000 ppm	0.2 mL		2000 ug/L
Titanium (Ti)	1000 ppm	0.2 mL		2000 ug/L

CRI Intermediate Solution #3

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Zinc (Zn)	1000 ppm	2.0 mL	100 mL	20000 ug/L

CRI Working Standard Solution

Element	Stock Standard	Volume Used	Final Volume	Final Concentration

Antimony (Sb)	60000 ug/L	1.0 mL of CRI #1	100 mL	60 ug/L
Arsenic (As)	10000 ug/L			10 ug/L
Berylium (Be)	5000 ug/L			5 ug/L
Cadmium (Cd)	5000 ug/L			5 ug/L
Chromium (Cr)	10000 ug/L			10 ug/L
Cobalt (Co)	50000 ug/L			50 ug/L
Copper (Cu)	25000 ug/L			25 ug/L
Lead (Pb)	10000 ug/L			10 ug/L
Mangenese (Mn)	15000 ug/L			15 ug/L
Nickel (Ni)	40000 ug/L			40 ug/L
Selenium (Se)	35000 ug/L			35 ug/L
Silver (Ag)	10000 ug/L			10 ug/L
Thallium (Tl)	25000 ug/L			25 ug/L
Vanadium (V)	50000 ug/L			50 ug/L
Aluminum (Al)	20000 ug/L	10 mL of CRI #2		200 ug/L
Barium (Ba)	20000 ug/L			200 ug/L
Calcium (Ca)	500000 ug/L			5000 ug/L
Iron (Fe)	20000 ug/L			200 ug/L
Potassium (K)	500000 ug/L			5000 ug/L
Magnesium (Mg)	500000 ug/L			5000 ug/L
Sodium (Na)	500000 ug/L			5000 ug/L
Boron (B)	10000 ug/L			100 ug/L
Molybdenum (Mo)	1000 ug/L			10 ug/L
Phosphorus (P)	25000 ug/L			250 ug/L
Silicon (Si)	10000 ug/L			100 ug/L
Strontium (Sr)	2000 ug/L			20 ug/L
Tin (Sn)	2000 ug/L			20 ug/L
Titanium (Ti)	2000 ug/L			20 ug/L
Zinc (Zn)	20000 ug/L	1.0 mL of CRI #3		20 ug/L

ICSA Working Standard Solution

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Aluminum (AL)	10000 ppm	100 mL	2000 mL	500000 ug/L
Calcium (Ca)	10000 ppm	100 mL		500000 ug/L
Iron (Fe)	10000 ppm	40 mL		200000 ug/L
Magnesium (Mg)	10000 ppm	100 mL		500000 ug/L

ICSAB Working Standard Solution

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Silver (Ag)	1000 ppm	0.40 mL	2000 mL	200 ug/L
Antimony (Sb)	1000 ppm	1.2 mL		600 ug/L
Zinc (Zn)	1000 ppm	2.0 mL		1000 ug/L
Cadmium (Cd)	1000 ppm	2.0 mL		1000 ug/L
Nickel (Ni)	1000 ppm	2.0 mL		1000 ug/L
Arsenic (As)	1000 ppm	0.20 mL		100 ug/L
Boron (B)	1000 ppm	3.0 mL		1500 ug/L

Tin (Sn)	1000 ppm	3.0 mL		1500 ug/L
Iron (Fe)	10000 ppm	40 mL		200000 ug/L
Calcium (Ca)	10000 ppm	100 mL		500000 ug/L
Magnesium (Mg)	10000 ppm	100 mL		500000 ug/L
Aluminum (Al)	10000 ppm	100 mL		500000 ug/L
Molybdenum (Mo)	1000 ppm	2.0 mL		1000 ug/L
Silicon (Si)	1000 ppm	2.0 mL		1000 ug/L
Selenium (Se)	1000 ppm	0.10 mL		50 ug/L
Thallium (Tl)	1000 ppm	0.20 mL		100 ug/L
Barium (Ba)	1000 ppm	1.0 mL		500 ug/L
Berylium (Be)	1000 ppm	1.0 mL		500 ug/L
Cobalt (Co)	1000 ppm	1.0 mL		500 ug/L
Chromium (Cr)	1000 ppm	1.0 mL		500 ug/L
Copper (Cu)	1000 ppm	1.0 mL		500 ug/L
Manganese (Mn)	1000 ppm	1.0 mL		500 ug/L
Lead (Pb)	1000 ppm	0.10 mL		50 ug/L
Vanadium (V)	1000 ppm	1.0 mL		500 ug/L
Phosphorus (P)	1000 ppm	1.0 mL		500 ug/L
Titanium (Ti)	1000 ppm	1.0 mL		500 ug/L
Strontium (Sr)	1000 ppm	0.50 mL		250 ug/L

Initial Calibration Verification (ICV)

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Aluminum (Al)*	100 ppm	20 mL of AT-2	2000 mL	1000 ppb
Lead (Pb)	100 ppm			1000 ppb
Barium (Ba)	50 ppm			500 ppb
Berylium (Be)	50 ppm			500 ppb
Boron (B)	50 ppm			500 ppb
Cadmium (Cd)	50 ppm			500 ppb
Chromium (Cr)	50 ppm			500 ppb
Cobalt (Co)	50 ppm			500 ppb
Iron (Fe)*	50 ppm			500 ppb
Manganese (Mn)	50 ppm			500 ppb
Nickel (Ni)	50 ppm			500 ppb
Silver (Ag)	50 ppm			500 ppb
Strontium (Sr)	50 ppm			500 ppb
Vanadium (V)	50 ppm			500 ppb
Zinc (Zn)	50 ppm			500 ppb
Aluminum (Al)*	500 ppm	100 mL of AT-3		25000 ppb
Calcium (Ca)	500 ppm			25000 ppb
Iron (Fe)*	500 ppm			25000 ppb
Magnesium (Mg)	500 ppm			25000 ppb
Potasium (K)	500 ppm			25000 ppb
Sodium (Na)	500 ppm			25000 ppb
Arsenic (As)	1000 ppm	0.50 mL		250 ppb
Antimony (Sb)	1000 ppm	0.50 mL		250 ppb

Molybdenum (Mo)	1000 ppm	1.0 mL		500 ppb
Phosphorous (P)	1000 ppm	1.0 mL		500 ppb
Selenium (Se)	1000 ppm	0.50 mL		250 ppb
Silicon (Si)	1000 ppm	0.50 mL		250 ppb
Tin (Sn)	1000 ppm	0.50 mL		250 ppb
Thallium (Tl)	1000 ppm	0.50 mL		250 ppb
Titanium (Ti)	1000 ppm	1.0 mL		500 ppb

**Elements present in multiple intermediate solutions*

CCV Working Standard Solution

Element	Stock Standard	Volume Used	Final Volume	Final Concentration
Aluminum (Al)*	50000 ppb	600 mL of STD 7	1000 mL	30000 ug/L
Calcium (Ca)	50000 ppb			30000 ug/L
Iron (Fe)*	50000 ppb			30000 ug/L
Magnesium (Mg)*	50000 ppb			30000 ug/L
Sodium (Na)*	50000 ppb			30000 ug/L
Potassium (K)*	50000 ppb			30000 ug/L
Arsenic (As)	500 ppb	200 mL of STD 8		100 ug/L
Antimony (Sb)*	500 ppb			100 ug/L
Lead (Pb)*	1000 ppb			200 ug/L
Selenium (Se)	500 ppb			100 ug/L
Strontium (Sr)*	1000 ppb			200 ug/L
Thallium (Tl)	500 ppb			100 ug/L
Tin (Sn)	1000 ppb			200 ug/L
Titanium (Ti)*	1000 ppb			200 ug/L
Aluminum (Al)*	1000 ppb	200 mL of STD 4		200 ug/L
Antimony (Sb)*	1000 ppb			200 ug/L
Barium (Ba)	1000 ppb			200 ug/L
Berylium (Be)	500 ppb			100 ug/L
Boron (B)*	1000 ppb			200 ug/L
Cadmium (Cd)	500 ppb			100 ug/L
Chromium (Cr)	1000 ppb			200 ug/L
Cobalt (Co)	1000 ppb			200 ug/L
Copper (Cu)	1000 ppb			200 ug/L
Iron (Fe)*	1000 ppb			200 ug/L
Lead (Pb)*	1000 ppb			200 ug/L
Magnesium (Mg)*	1000 ppb			200 ug/L
Manganese (Mn)	1000 ppb			200 ug/L
Molybdenum (Mo)	1000 ppb			200 ug/L
Nickel (Ni)	1000 ppb			200 ug/L
Phosphorous (P)	1000 ppb			200 ug/L
Potassium (K)*	1000 ppb			200 ug/L
Silicon(Si)	5000 ppb			1000 ug/L
Silver (Ag)	500 ppb			100 ug/L
Sodium (Na)*	1000 ppb			200 ug/L
Strontium (Sr)*	500 ppb			100 ug/L
Titanium (Ti)*	1000 ppb			200 ug/L
Vanadium (V)	1000 ppb			200 ug/L
Zinc (Zn)	1000 ppb			200 ug/L
Boron (B)*	1000 ppm	0.50 mL		500 ug/L

*Elements present in multiple intermediate solutions.

Appendix C: Equations

Water Sample Concentration

$$C_{(ug/L)} = \frac{\mu g}{L_{dig}} \times \frac{V_{dig}}{V_{samp}}$$

Where:
$\mu g/L_{dig}$ ICP result including dilution factors
V_{dig} Digestate Volume (mL)
V_{samp} Sample Volume (mL)

Soil/Sediment Sample Concentration

$$C_{(mg/Kg)} = \frac{\mu g}{L_{dig}} \times \frac{V_{dig}}{g_{samp}} \times \frac{100}{\%\ solids}$$

Where:
$\mu g/L_{dig}$ = ICP result including all dilution factors
V_{dig} = final digestate volume in Liters
g_{samp} = sample weight in grams

Percent Recovery (%R) LCS and CCVs

$$\%R = \frac{SR}{SA} \times 100\%$$

Where:
SR= Sample Result
SA=Concentration of Spike Added

Percent Recovery (%R) MS

$$\%R = \frac{SSR - SR}{SA} \times 100\%$$

Where:
SSR=Matrix Spike Result
SR=Sample Result
SA=Concentration of Spike Added

Relative Percent Difference (RPD)

$$RPD = \frac{|D_1 - D_2|}{\frac{D_1 + D_2}{2}} \times 100$$

Where:
D_1 = Sample result
D_2 = Duplicate Result

Title: ACID DIGESTION OF SEDIMENTS, SLUDGES AND SOILS (SW-846 3050A)

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1.0 Scope and Application

This SOP describes the laboratory procedures for the acid digestion of soils, sediment, sludge, tissue, and air samples in preparation for analysis by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) or Inductively Coupled Plasma-Mass Spectrometry (ICP-MS).

Separate digestion procedures are provided for each determinative technique and the digestates produced from each procedure are not interchangeable.

This SOP does not include the procedure for the determination of percent solids or the determination of percent lipids in tissue. These procedures are described in laboratory SOPs BR-WC-006 and BR-EX-016, respectively.

1.1 Analytes, Matrix(s), and Reporting Limits

This procedure may be used for the following matrices: soil, sediment, sludge, tissue and air samples collected on filters or wipes. Samples prepared by this procedure may be used to determine the metals listed in Table 1.

Per the reference method, this procedure employs a very strong acid digestion that will dissolve most elements that could become environmentally available but is not recommended for elements bound in silicate structures.

2.0 Summary of Method

A representative 1-2 gram (wet weight) soil, sediment or tissue sample is digested with repeated additions of nitric acid and hydrogen peroxide. Air samples collected on filters or wipes are digesteted as whole volume samples or a portion of the filter or wipe is subsampled as per the instructions from the customer.

For ICP-MS analysis, the initial digestate is heated to reduce the volume and then diluted to a final volume of 100 mL.

For ICP-OES analysis, hydrochloric acid (HCl) is added to the initial digestate and the digestate is refluxed, filtered or allowed to settle for 24 hours then diluted to a final volume of 100 mL.

This procedure is based on the following reference methods:

- SW-846 Method 3050B, Acid Digestion of Sediments, Sludge, and Soils, Revision 2 December 1996.

If the laboratory's procedure is modified from the above reference method, a list of such modifications are provided in Section 16.0

3.0 Definitions

A list of general laboratory terms and definitions are provided in Appendix A.

4.0 Interferences

- Dust, particulates, and materials from the fume hood may cause contamination. Keep the work area clean.

- Precipitation in the digestate may result in a low biased silver concentration.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.2 Primary Materials Used

Table 1 lists those materials used in this procedure that have a serious or significant hazard rating along with the exposure limits and primary hazards associated with that material as identified in the MSDS. The table does not include all materials used in the procedure. A complete list of materials used can be found in section 7.0. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS. Any questions regarding the safe handling of these materials should be directed to the laboratory's Environmental Health and Safety Coordinator.

6.0 Equipment and Supplies

- Block Digester capable of maintaining temperature of 90-95°C. Environmental Express 25 Position Digester or equivalent.

- Digestion Vessel, 100 mL Polyethylene, Environmental Express or equivalent.

- Volumetric Pipettes: Finpipette 0.10-1.00 mL and 1.00-5.00 mL adjustable pipettes.

- Class "A" Volumetric Flasks: 50, 100, 500, and 1000 mL.

- Polyethylene Ribbed Watch Glass, Environmental Express or equivalent.

- Filter Paper (0.45 um): Corning Cellulose Acetate Filter System or equivalent.

- Teflon Chips: Fisher Scientific or equivalent.

- Top Loading Balance: capable of measurements to 0.1 g.

7.0 Reagents and Standards

Unless otherwise indicated, all chemicals must be reagent grade.

7.1 Reagents

- Reagent Water

- Nitric Acid, concentrated, reagent grade: JT Baker or equivalent.

  1:1 Nitric Acid: Fill a 20 Liter Carboy container half full with reagent water and slowly add an equal volume of concentrated HNO_3. Shake to mix reagent. Assign an expiration date of six months from the date prepared and store at room temperature.

- Hydrochloric Acid (HCl), concentrated, reagent grade: JT Baker or equivalent.

- 30% Hydrogen Peroxide (H_2O_2), Standard grade: J.T. Baker or equivalent.

- 30% Hydrogen Peroxide (H_2O_2), High Purity grade: J.T. Baker or equivalent.

  - *Use the high purity grade hydrogen peroxide any time analysis for Tin is requested.*

7.2 Standards

Purchase stock standard solutions from an approved vendor and from these prepare working standard solutions using the formulations provided in Appendix A. Prepare the standards as needed, every 6 months or in accordance with the expiration date of the parent standard, whichever occurs first.

8.0 Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection so these procedures are not included in this SOP. Sampling requirements may be found in the published reference method.

Listed below are minimum sample size, preservation and holding time requirements:

Matrix	Container	Sample Size	Preservation	Holding Time	Reference
Soil, Sediment, Sludge	Polyethyelene or Glass	10 g	4°C	6 months	SW-846

Immediately following sample collection, samples should be cooled to 4°C and maintained near that temperature until time of digestion. For samples with a temperature requirement of 4°C the EPA has established a sample receipt temperature criteria of 0-6°C and a sample storage criteria of 4°C ±2.

Samples shipped by common carrier or sent through US mail must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person authorizing shipment of the sample to the laboratory is responsible for compliance to this regulation.

Holding time is determined from date of sample collection.

9.0 Quality Control

The laboratory prepares the following quality control samples with each preparation batch:

QC Check	Frequency
Method Blank	One per preparation batch of 20 or fewer samples
Laboratory Control Sample	One per preparation batch of 20 or fewer samples
Matrix Spike	One per preparation batch of 20 or fewer samples (if sufficient sample amount is provided)
Sample Duplicate	One sample duplicate per preparation batch of 20 or fewer samples. (if sufficient sample amount is provided)
Matrix Spike Duplicate	Per client request

The criteria used to assess the QC checks are provided in the laboratory SOPs for instrument analysis.

10.0 Procedure

10.1 Calibration and Standardization

Check the support equipment monitoring log to ensure the daily checks of the balance was performed.

Check the pipettes to ensure the calibration check is current. If not, perform the calibration of the mechanical pipettes using the procedure described in laboratory SOP BR-QA-008.

The digestion vessels purchased from the recommended manufacturer listed in section 6.0 of this SOP supplies a certificate of accuracy with each lot and this certificate serves as documentation of verification for bias. Before the use of each lot of digestion vessels, check the precision of the digestion vessels using the following procedure:

- Pull 10 digestion vessels from each lot provided by the manufacturer. Place the vessel on the balance and tare the balance. Fill the vessel to the 100 mL mark with reagent water. Record the weight measurement in the spreadsheet established for this purpose. Repeat for each digestion vessel. Calculate the RSD of the replicate weight measurements assuming that 1 mL is equal to 1 g. The RSD should be ≤ to 1% of the nominal volume.

Check the calibration and condition of the thermometers used to monitor the temperature of the digestion blocks. If the calibration of any thermometer is not current or any separation of liquid is observed, immediately notify the QA department.

10.2 ICP-OES

10.2.1 Sample Preparation

Mix the sample thoroughly following the homogenization procedures specified in laboratory SOP LP-QA-020.

For soils, sediment, sludge and tissue, transfer a 1-2 g portion of sample to the digestion vessel and record the amount used to the nearest 0.01 g. Add 1.0 mL of the ICP-OES matrix spike solution and 1.0 mL of the ICP-OES supplemental solution to each MS and to the MSD if MSD was requested.

For filters or wipe samples, use the entire sampling media or a portion as instructed for use by the customer and record the amount used to the nearest 0.01 g.

To prepare the method blank (MB) and LCS, transfer 1-2 g of Teflon chips to a digestion vessel. Add 1.0 mL of the ICP-OES matrix spike solution and 5.0 mL of the ICP-OES supplemental solution to the LCS.

10.2.2 Digestion

Add 10 mL of 1:1 nitric acid solution to each digestion vessel, mix the slurry, and cover the vessel with a watch glass. Heat the sample to 90-95°C and reflux for 10 minutes without boiling. Allow the sample to cool, add 5 mL of concentrated nitric acid, replace the watch glass, and reflux for 30 minutes. If brown fumes occur, repeat this last step until no brown fumes are observed. Heat the solution at 90-95°C without boiling for 2 hours. Monitor the digestion so that the solution does not evaporate to dryness.

After the digestate has cooled, add 2 mL of reagent water and 3 mL of 30% hydrogen peroxide. Cover the vessel with a watch glass and heat the vessel to start the peroxide reaction. When the effervescence subsides, remove the vessel to cool. 1 mL portions of the hydrogen peroxide solution may be added during this step until such time as the effervescence is minimal or until general sample appearance is unchanged but do not add more than a total of 10 mL of the peroxide solution to the digestate.

Note: If samples require analysis for Tin, use high purity hydrogen peroxide.

Cover the sample with a watch glass and heat the acid-peroxide digestate until the apparent volume is reduced to ~5 mL. Do not allow the solution to evaporate to dryness. Remove the digestate to cool and add 10 mL of concentrated HCl. Replace watch glass, and heat the sample to 90-95°C and reflux for 15 minutes. Remove from the vessel from the digestion block, cool the digestate and then dilute to 100 mL with reagent water.

Allow the digestate to sit to settle out suspended solids. The digestates may also be centrifuged as necessary.

10.3 ICP-MS Sample Preparation

Mix the sample thoroughly following the homogenization procedures specified in laboratory SOP LP-QA-020.

For soils, sediment, sludge and tissue, transfer a 1-2 g portion of sample to the digestion vessel and record the amount used to the nearest 0.01 g. Add 1 mL of the ICP-MS matrix spike solution to each matrix spike (MS) and MSD if MSD was requested.

For filters or wipe samples, use the entire sampling media or a portion as instructed for use by the customer and record the amount used to the nearest 0.01 g.

To prepare the method blank (MB) and LCS, transfer 1-2 g of Teflon chips to a digestion vessel. Add 1.0 mL of the ICP-MS LCS spike solution to the LCS.

Add 10 mL of 1:1 nitric acid solution to each digestion vessel, mix the slurry, and cover the vessel with a watch glass. Heat the sample to 90-95°C and reflux for 10 minutes without boiling. Allow the sample to cool, add 5 mL of concentrated nitric acid, replace the watch glass, and reflux for 30 minutes. If brown fumes occur, repeat this last step until no brown fumes are observed. Heat the solution at 90-95°C without boiling for 2 hours. Monitor the digestion so that the solution does not evaporate to dryness.

After the digestate has cooled, add 2 mL of reagent water and 3 mL of 30% hydrogen peroxide. Cover the vessel with a watch glass and heat the vessel to start the peroxide reaction. When the effervescence subsides, remove the vessel to cool. 1 mL portions of the hydrogen peroxide solution may be added during this step until such time as the effervescence is minimal or until general sample appearance is unchanged but do not add more than a total of 10 mL of the peroxide solution to the digestate.

Cover the sample with a watch glass and heat the acid-peroxide digestate until the apparent volume is reduced to ~5 mL. Do not allow the solution to evaporate to dryness. Cool and dilute to 100 mL with reagent water.

Allow the digestate to sit to settle out suspended solids. The digestates may also be centrifuged as necessary.

11.0 Calculations / Data Reduction

11.1 Calculations

Not applicable

11.2 Data Reduction

11.2.1 Primary Review

Review project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements to ensure those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Enter the batch information into LIMS and complete the batch editor and worksheet for each extraction and cleanup batch performed. Initiate NCMs for any anomalies observed during the preparation process. Set the status of each batch to 1st level review.

11.2.2 Secondary Data Review

Review project documents such as the Project Plan (PP), Project Memo or any other document/process used to communicate project requirements and verify those project requirements were met. If project requirements were not met, immediately notify the project manager (PM) to determine an appropriate course of action.

Check the batch editor and worksheet to verify the batch is complete and any outages are documented with an NCM along with the results of any corrective actions taken. Set the status of each batch to second level review.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

The requirements for MDL studies are specified in the SOP for the determinative method.

12.2 Demonstration of Capabilities (DOC)

Each analyst that performs the analytical procedure must complete an initial demonstration of capability (IDOC) prior to independent analysis of client samples. Each analyst must demonstrate on-going proficiency (ODOC) annually thereafter. DOC procedures are further described in the laboratory's quality system manual (QAM) and in the laboratory SOP for employee training.

12.3 Training Requirements

Any employee that performs any portion of the procedure described in this SOP must have documentation in their employee training file that they have read this version of this SOP.

Instrument analysts, prior to independent analysis of client samples, must also have documentation of demonstration of initial proficiency (IDOC) and annual on-going proficiency (ODOC) in their employee training files.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to BR-EH-001.

The following waste streams are produced when this method is carried out.

- Acidic Waste - 55 gallon satellite container.
- Contaminated Disposable Material - Rinsed and disposed of in general waste.

Transfer the solid waste to the plastic bucket labeled solid waste located in your work area. The satellite containers are labeled "Hazardous Waste" along with the type of waste category generated. Authorized personnel routinely transfer the contents of the satellite containers to the

hazardous waste storage room for future disposal in accordance with Federal, State and Local regulations.

15.0 References / Cross-References

SW-846 Method 3050B, Acid Digestion of Sediments, Sludge, and Soils, Revision 2 December 1996.

16.0 Method Modifications

Not applicable.

17.0 Attachments

- Table 1: Primary Materials Used
- Table 2: QC Summary & Recommended Corrective Action
- Appendix A: Terms and Definitions
- Appendix B: Standard Preparation Formulations

18.0 Revision History

BR-ME-011, Revision 10:

- Title Page: Updated approval signatures.
- Updated format of SOP
- Inserted procedure for precision evaluation of digestion vessels.
- Removed program specific QC check and criteria.

Table 1: Target Element List

Element	CAS #	ICP-OES	ICP-MS
Aluminum	7429-90-5	X	X
Antimony	7440-36-0	X	X
Arsenic	7440-38-2	X	X
Barium	7440-39-3	X	X
Beryllium	7440-41-7	X	X
Boron	7440-42-8	X	X
Cadmium	7440-43-9	X	X
Calcium	7440-70-2	X	X
Chromium	7440-47-3	X	X
Cobalt	7440-48-4	X	X
Copper	7440-50-8	X	X
Iron	7439-89-6	X	X
Lead	7439-92-1	X	X
Magnesium	7439-95-4	X	X
Manganese	7439-96-5	X	X
Molybdenum	7439-98-7	X	X
Nickel	7440-02-0	X	X
Phosphorous	7723-14-0	X	
Potassium	7440-09-7	X	X
Selenium	7782-49-2	X	X
Silicon	7740-21-3	X	
Silver	7440-22-4	X	X
Sodium	7440-23-5	X	X
Strontium	7740-24-6	X	
Thallium	7440-28-0	X	X
Tin	7740-31-5	X	
Titanium	7740-32-6	X	
Tungsten	7440-33-7		X
Vanadium	7440-62-2	X	X
Zinc	7440-66-6	X	X
Uranium	7440-61-1		X
Thorium	7440-29-1		X

Table 2: Primary Materials Used

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure

Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
30% Hydrogen Peroxide	Oxidizer	1 ppm-TWA	May cause burns if it comes into contact with skin.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

Appendix A: Terms & Definitions

Batch: environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria.

Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.

Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s) processed simultaneously with and under the same conditions as samples through all steps of the procedure.

Matrix Duplicate (DP): duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate.

Matrix Spike (MS): a field sample to which a known amount of target analyte(s) is added.

Method Blank (MB): a blank matrix processed simultaneously with and under the same conditions as samples through all steps of the procedure. Also known as the preparation blank (PB).

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a <u>range</u> where qualitative detection occurs. Quantitative results are not produced in this range.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical, and/or biological integrity of the sample.

Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample. The RL must be minimally at or above the MDL.

Stock Standard: a solution made with one or more neat standards usually with a high concentration. Also known as a primary standard. Stock standards may be certified solutions purchased from a vendor.

Appendix B: Standard Preparation Tables

The standard formulations contained in this Appendix are recommended and are subject to change. If the concentration of the stock standard is different than those noted in this table, adjust the standard preparation formulation accordingly. Unless otherwise specified, prepare the standard solutions in the reagents specified using Class A volumetric glassware, using appropriate pipettes. When standard preparation requires the addition of concentrated acids, always add acids to water. Unless otherwise specified for a standard solution, assign an expiration date of 6 months from date of preparation unless the parent standard expires sooner in which case use the earliest expiration date. See laboratory SOP BR-QA-002 *Standard Preparation* for further guidance.

ICP-OES Matrix Spike

Parent Standard	Vendor	Component	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Aluminum	Inorganic Ventures	Aluminum	10000	10	500	200
Antimony	Inorganic Ventures	Antimony	1000	25		50
Arsenic	Inorganic Ventures	Arsenic	1000	2		4
Barium	Inorganic Ventures	Barium	1000	100		200
Beryllium	Inorganic Ventures	Beryllium	1000	2.5		5
Boron	Inorganic Ventures	Boron	1000	25		50
Cadmium	Inorganic Ventures	Cadmium	1000	2.5		5
Chromium	Inorganic Ventures	Chromium	1000	10		20
Cobalt	Inorganic Ventures	Cobalt	1000	25		50
Copper	Inorganic Ventures	Copper	1000	12.5		25
Iron	Inorganic Ventures	Iron	10000	5		100
Lead	Inorganic Ventures	Lead	1000	1		2
Manganese	Inorganic Ventures	Manganese	1000	25		50
Molybdenum	Inorganic Ventures	Molybdenum	1000	25		50
Nickel	Inorganic Ventures	Nickel	1000	25		50
Phosphorous	Inorganic Ventures	Phosphorous	1000	25		50
Selenium	Inorganic Ventures	Selenium	1000	2.5		5
Silicon	Inorganic Ventures	Silicon	1000	25		50
Strontium	Inorganic Ventures	Strontium	1000	25		50
Thallium	Inorganic Ventures	Thallium	1000	2.5		5
Tin	Inorganic Ventures	Tin	1000	25		50
Titanium	Inorganic Ventures	Titanium	1000	25		50
Vanadium	Inorganic Ventures	Vanadium	1000	25		50
Zinc	Inorganic Ventures	Zinc	1000	25		50

Bring to final volume with 2% HNO_3/ 5% HCl solution.

ICP-OES Supplemental Spike (Matrix Spike and LCS) (Silver)

Parent Standard	Vendor	Component	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Silver	Inorganic Ventures	Silver	1000	1	200	5

Bring to final volume with reagent water.

ICP-OES LCS Spike

Parent Standard	Vendor	Component	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Antimony	Inorganic Ventures	Antimony	1000	8	2000	4
Arsenic	Inorganic Ventures	*Arsenic	1000	4		2

Tin	Inorganic Ventures	Tin	1000	4		2
Molybdenum	Inorganic Ventures	Molybdenum	1000	4		2
Selenium	Inorganic Ventures	*Selenium	1000	2		1
Thallium	Inorganic Ventures	*Thallium	1000	2		1
Strontium	Inorganic Ventures	*Strontium	1000	4		2
Silicon	Inorganic Ventures	Silicon	1000	4		2
Phosphorus	Inorganic Ventures	Phosphorus	1000	4		2
Titanium	Inorganic Ventures	Titanium	1000	4		2
AT-2 Mix	Inorganic Ventures	*Aluminum	100	40		2
		*Lead	100			2
		Barium	50			1
		Beryllium	50			1
		Boron	50			1
		*Cadmium	50			1
		Chromium	50			1
		Cobalt	50			1
		*Iron	50			1
		Manganese	50			1
		Nickel	50			1
		Silver	50			1
		*Strontium	50			1
		Vanadium	50			1
		Zinc	50			1
AT-3 Mix	Inorganic Ventures	*Aluminum	500	400		100
		Calcium	500			100
		*Iron	500			100
		Magnesium	500			100
		Potassium	500			100
		Sodium	500			100
LCSWF Mix	Inorganic Ventures	*Arsenic	10	20		0.1
		*Thallium	10			0.1
		*Cadmium	5			0.05
		*Selenium	5			0.05
		*Lead	3			0.03
HNO_3	JT Baker	HNO_3	Concentrated	20		NA
HCl	JT Baker	HCl	Concentrated	50		NA
Reagent Water		Reagent Water	NA	1430		NA

*Elements present in multiple intermediate solutions.

ICP-MS Matrix Spike

Parent Standard	Vendor	Component	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Aluminum	Inorganic Ventures	Aluminum	10000	0.4	100	40
Antimony	Inorganic Ventures	Antimony	1000	0.4		4
Arsenic	Inorganic Ventures	Arsenic	1000	0.2		2
Barium	Inorganic Ventures	Barium	1000	10		100
Beryllium	Inorganic Ventures	Beryllium	1000	0.2		2
Boron	Inorganic Ventures	Boron	1000	2		20
Cadmium	Inorganic Ventures	Cadmium	1000	0.2		2
Calcium	Inorganic Ventures	Calcium	10000	10		1000
Chromium	Inorganic Ventures	Chromium	1000	0.4		4
Cobalt	Inorganic Ventures	Cobalt	1000	1		10
Copper	Inorganic Ventures	Copper	1000	0.4		4
Iron	Inorganic Ventures	Iron	10000	2		200
Lead	Inorganic Ventures	Lead	1000	0.2		2
Magnesium	Inorganic Ventures	Magnesium	10000	10		1000
Manganese	Inorganic Ventures	Manganese	1000	0.4		4

Molybdenum	Inorganic Ventures	Molybdenum	1000	2		20
Nickel	Inorganic Ventures	Nickel	1000	0.4		4
Potassium	Inorganic Ventures	Potassium	10000	10		1000
Selenium	Inorganic Ventures	Selenium	1000	0.2		2
Silver	Inorganic Ventures	Silver	1000	0.2		2
Sodium	Inorganic Ventures	Sodium	10000	10		1000
Thallium	Inorganic Ventures	Thallium	1000	0.2		2
Tungsten	Inorganic Ventures	Tungsten	1000	0.2		2
Vanadium	Inorganic Ventures	Vanadium	1000	0.4		4
Zinc	Inorganic Ventures	Zinc	1000	0.4		4
Nitric Acid	JT Baker	Nitric Acid	Concentrated	2		NA
Reagent Water		Reagent Water	NA	20.8		NA

ICP-MS LCS Spike

Parent Standard	Vendor	Component	Parent Standard Concentration (ug/L)	Volume Added (mL)	Final Volume (mL)	Final Concentration (ug/L)
Aluminum	Inorganic Ventures	Aluminum	10000	0.5	100	50
Antimony	Inorganic Ventures	Antimony	1000	0.5		5
Arsenic	Inorganic Ventures	Arsenic	1000	0.25		2.5
Barium	Inorganic Ventures	Barium	1000	12.5		125
Beryllium	Inorganic Ventures	Beryllium	1000	0.25		2.5
Boron	Inorganic Ventures	Boron	1000	2.5		25
Cadmium	Inorganic Ventures	Cadmium	1000	0.25		2.5
Calcium	Inorganic Ventures	Calcium	10000	12.5		1250
Chromium	Inorganic Ventures	Chromium	1000	0.5		5
Cobalt	Inorganic Ventures	Cobalt	1000	1.25		125
Copper	Inorganic Ventures	Copper	1000	0.5		5
Iron	Inorganic Ventures	Iron	10000	2.5		250
Lead	Inorganic Ventures	Lead	1000	0.25		2.5
Magnesium	Inorganic Ventures	Magnesium	10000	12.5		1250
Manganese	Inorganic Ventures	Manganese	1000	0.5		5
Molybdenum	Inorganic Ventures	Molybdenum	5000	2.5		25
Nickel	Inorganic Ventures	Nickel	5000	0.5		5
Potassium	Inorganic Ventures	Potassium	10000	12.5		1250
Selenium	Inorganic Ventures	Selenium	1000	0.25		2.5
Silver	Inorganic Ventures	Silver	1000	0.25		2.5
Sodium	Inorganic Ventures	Sodium	10000	12.5		1250
Thallium	Inorganic Ventures	Thallium	1000	0.25		2.5
Tungsten	Inorganic Ventures	Tungsten	1000	0.25		2.5
Vanadium	Inorganic Ventures	Vanadium	1000	0.5		5
Zinc	Inorganic Ventures	Zinc	1000	0.5		5
Nitric Acid	JT Baker	Nitric Acid	Concentrated	2		NA
Reagent Water		Reagent Water	NA	21		NA

APPENDIX E

VAPOR INTRUSION STANDARD OPERATING PROCEDURES

SUMMA CANISTER INSTRUCTIONS

Columbia Analytical Services INC.
An Employee - Owned Company

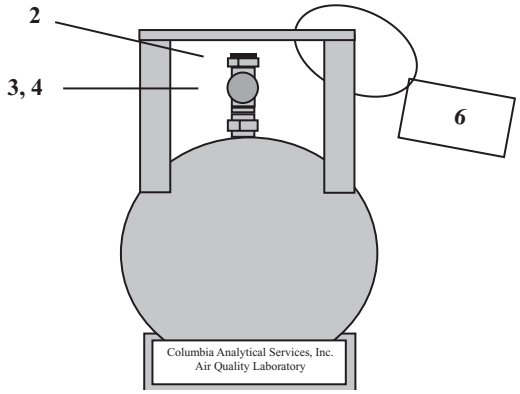
Sampling with a Summa Canister - How to take a Grab Sample

Equipment:

Summa or Silco canister – cleaned, evacuated, valve checked for leakage, and certified by CAS Air Quality Laboratory prior to shipment.

Procedure:

1. Ensure that the valve is fully closed (the green knob should be turned completely clockwise).
2. Using a 9/16" wrench, remove the brass cap above the valve on the top of the Summa canister.
3. To fully open the canister valve, turn the green knob counterclockwise until there is no resistance. This is approximately 1¼ turns. You will hear a hissing noise as the vacuum dissipates and air flows in.
4. Once the hissing noise stops, the vacuum has fully dissipated, and your sample has been collected. This takes approximately 5-10 seconds. Close the valve by turning the green knob clockwise.
5. Replace the brass cap. Tighten it with a 9/16" wrench.
6. Label the sample with the tag provided, then attach the tag to the canister with the plastic tie. Complete a chain of custody form.
7. Place the chain of custody form, along with the canister, back into the original box in which it was shipped to you.



Important Notes:

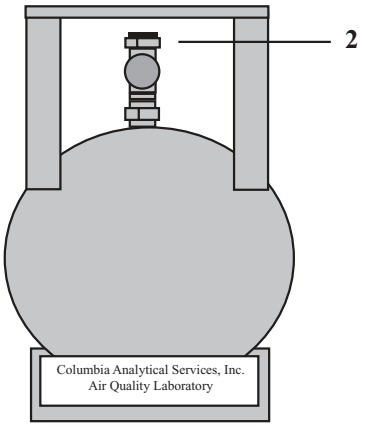
- *Care must be used with the canister valves. DO NOT OVER-TIGHTEN THE VALVES.*
- *Do NOT connect to a source with positive pressure greater than 40 psi.*
- *The valve fitting is a ¼" male Swagelok fitting.*
- *Do not remove the bar code or serial number labels from the canisters.*
- *Do not make any markings directly on the canister or affix any labels.*
- *Please call the laboratory with any questions regarding proper shipping of canisters.*

Columbia Analytical Services
Air Quality Laboratory
2665 Park Center Drive, Suite D ▪ Simi Valley, California 93065
(805) 526-7161 ▪ Fax (805) 526-7270
www.CASAirlab.com

Sampling with a Summa Canister and Flow Controller-
How to take a Time Integrated Sample

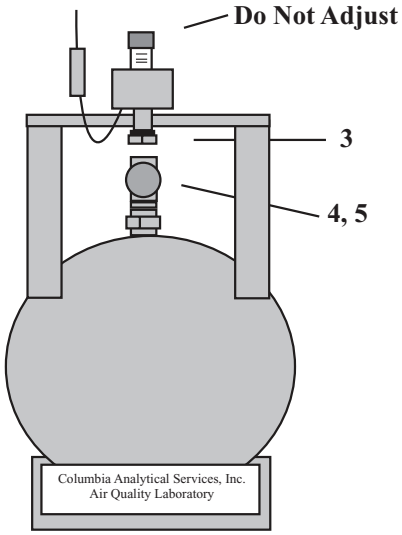
Equipment:

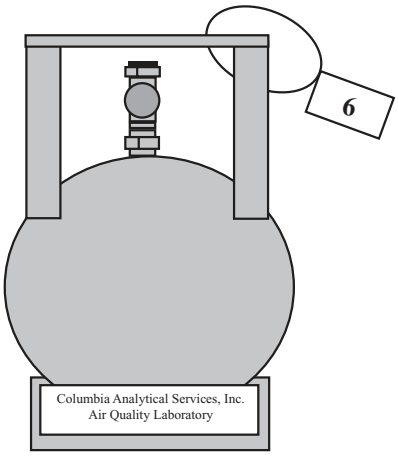
Summa or Silco canister – cleaned, evacuated, valve checked for leakage, and certified by CAS Air Quality Laboratory prior to shipment.
Flow controller – pre-calibrated by the laboratory for your project specific requirements. *Do not adjust any of the settings or knobs on the flow controller.*



Procedure:

1. Ensure that the valve is fully closed (the green knob should be turned completely clockwise).
2. Using a 9/16” wrench, remove the brass cap from the valve on the top of the Summa canister.
3. Attach the flow controller to the valve on the top of the canister. Tighten down with your fingers first, then tighten gently with 9/16” wrench.
4. To open the canister valve, turn the green knob counterclockwise until there is no resistance. This is approximately 1¼ turns. Then turn back clockwise slightly until resistance is detected. Since the flow controller restricts the airflow, you will not hear a hissing noise as the vacuum dissipates and draws air in.
5. At the end of the sampling period, close the valve by turning the green knob clockwise. Do not over-tighten.
6. Label the sample with the tag provided, then attach the tag to the canister with the plastic tie.
7. Remove the flow controller. Wrap securely in bubble wrap.
8. Replace the brass cap on the canister valve. Tighten it with a 9/16” wrench.
9. Complete a chain of custody form. Note the flow controller bar code with the corresponding canister.
10. Place the chain of custody form, the bubble-wrapped flow controller, and the canister back into the original box in which they were shipped to you.





Important Notes:

- *Care must be used with the canister valves. DO NOT OVER-TIGHTEN THE VALVES.*
- *Flow controllers must be securely wrapped in bubble wrap for shipping.*
- *The valve fitting is a ¼” male Swagelok fitting.*
- *Do not remove the bar code or serial number labels from the canisters.*
- *Do not make any markings directly on the canister or affix any labels.*
- *Please call the laboratory with any questions regarding proper shipping of canisters.*

Draft

Standard Operating Procedure (SOP) for Installation of Sub-Slab Vapor Probes and Sampling Using EPA Method TO-15 to Support Vapor Intrusion Investigations

Dominic DiGiulio, Ph.D.
U.S. Environmental Protection Agency
Office of Research and Development
National Risk Management Research Laboratory
Ground-Water and Ecosystem Restoration Division
Ada, Oklahoma

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Background

Vapor intrusion is defined as vapor phase migration of volatile organic and/or inorganic compounds into occupied buildings from underlying contaminated ground water and/or soil. Until recently, this transport pathway was not routinely considered in RCRA, CERCLA, or UST investigations. Therefore the number of buildings or homes where vapor intrusion has occurred or is occurring is undefined. However, considering the vast number of current and former industrial, commercial, and waste processing facilities in the United States capable of causing volatile organic or inorganic ground-water or soil contamination, contaminant exposure via vapor intrusion could pose a significant risk to the public. Also, consideration of this transport pathway may necessitate review of remedial decisions at RCRA and CERCLA sites as well as implementation of risk-reduction technologies at Brownsfield sites where future development and subsequent potential exposure may occur. EPA's Office of Solid Waste and Emergency Response (OSWER) recently (2002) developed guidance to facilitate assessment of vapor intrusion at sites regulated by RCRA and CERCLA where halogenated organic compounds constitute the bulk of risk to human health. EPA's Office of Underground Storage Tanks (OUST) is considering modifying this guidance to include underground storage tank sites where petroleum compounds primarily determine risk and biodegradation in subsurface media may be a dominant fate process.

The OSWER guidance recommends indoor air and sub-slab gas sampling in potentially affected buildings at sites containing elevated levels of soil-gas and ground-water contamination. To support the guidance and improve site-characterization and data interpretation methods to assess vapor intrusion, EPA's Office or Research and Development is developing a protocol for sub-slab gas sampling. When used in conjunction with indoor air, outdoor air, and soil gas and/or ground-water sampling, sub-slab gas sampling can be used to differentiate indoor and outdoor sources of volatile organic and/or inorganic compounds from compounds emanating from contaminated subsurface media. This information can then be used to assess the need for sub-slab depressurization or other risk-reduction technologies to reduce present or potential future indoor air contamination due to vapor intrusion.

Sub-Slab Vapor Probe Construction and Installation

1. Prior to drilling holes in a foundation or slab, contact local utility companies to identify and mark utilities coming into the building from the outside (e.g., gas, water, sewer, refrigerant, and electrical lines). Consult with a local electrician and plumber to identify the location of utilities inside the building.

2. Prior to fabrication of sub-slab vapor probes, drill a pilot hole to assess the thickness of a slab. As illustrated in **Figure 1**, use a rotary hammer drill to create a "shallow" (e.g., 2.5 cm or 1 in) "outer" hole (e.g., 2.2 cm or 7/8 in diameter) that partially penetrates the slab. Use a small portable vacuum cleaner to remove cuttings from the hole if penetration has not occurred. Removal of cuttings in this manner in a competent slab will not compromise sampling because of lack of pneumatic communication between sub-slab material and the source of vacuum.

3. Then use the rotary hammer drill to create a smaller diameter "inner" hole (e.g., 0.8 cm or 5/16 in) through the remainder of the slab and some depth (e.g., 7 to 8 cm or 3 in) into sub-slab material. **Figure 2** illustrates the appearance of "inner" and "outer" holes. Drilling into sub-slab material will create an open cavity which will prevent obstruction of

probes during sampling by small pieces of gravel.

4. The basic design of a sub-slab vapor probe is illustrated in **Figure 3**. Once the thickness of the slab is known, tubing should be cut to ensure that probes "float" in the slab to avoid obstruction of the probe with sub-slab material. Construct sub-slab vapor probes from small diameter (e.g., 0.64 cm or 1/4 in OD x 0.46 cm or 0.18 in ID) chromatography grade 316 stainless steel tubing and stainless-steel compression to thread fittings (e.g., 0.64 cm or 1/4 in OD x 0.32 cm or 1/8 in NPT Swagelok female thread connectors) as illustrated in **Figure 4**. Use of stainless-steel materials to ensure that construction materials are not a source of VOCs.

5. Set sub-slab vapor probes in holes. As illustrated in **Figure 5**, the top of the probes should be completed flush with the slab and have recessed stainless steel or brass plugs so as not interfere with day-to-day use of buildings. Mix a quick-drying portland cement which expands upon drying (to ensure a tight seal) with water to form a slurry and inject or push into the annular space between the probe and outside of the "outer" hole. Allow cement to cure for at least 24 hours prior to sampling.

6. Install at least 3 sub-slab vapor probes in each residence. As illustrated in **Figure 6**, create a schematic identifying the location of each sub-slab probe.

Sub-Slab Sampling

1. Connect dedicated a stainless-steel fitting and tubing (e.g., 1/8 in NPT to 1/4 in tube Swagelok fitting and 30 cm or 1 ft of 1/4 in I.D. Teflon tubing to a sub-slab vapor probe as illustrated in **Figure 7**. Use of dedicated fitting and tubing will avoid cross-contamination issues.

2. Connect the Teflon tubing to 1/4" ID Masterflex (e.g., 1.4 in ID high performance Tygon LFL) tubing and a peristaltic pump and 1-L Tedlar bag as illustrated in **Figure 8**. Use of a peristaltic pump will ensure that sampled air does not circulate through a pump causing potential cross contamination and leakage.

3. Purge vapor probe by filling two dedicated 1-L Tedlar bags. The internal volume of sub-slab probes is insignificant (< 5 cm^3). A purge volume of 2 L was chosen based on the assumption of a 0.64 cm (1/4") air space beneath a slab and an affected sample diameter of 0.61 m (2 ft).

4. Use a portable landfill gas meter to analyze for O_2, CO_2 and CH_4 in Tedlar bags as illustrated in **Figure 9**.

5. Collect sub-slab vapor samples in evacuated 10% or 100% certified 1-L Summa polished canisters and dedicated particulate filters as illustrated in **Figure 10**. Check vacuum in canisters prior to sampling. Sampling will cease when canister pressure reaches atmospheric pressure. Submit canisters to a commercial laboratory for analysis by EPA Method TO-15.

6. Collect at least one duplicate sub-slab sample per building using dedicated stainless-steel tubing as illustrated in **Figure 11.**

Figure 1. Drilling through a slab

Figure 2. “inner and “outer

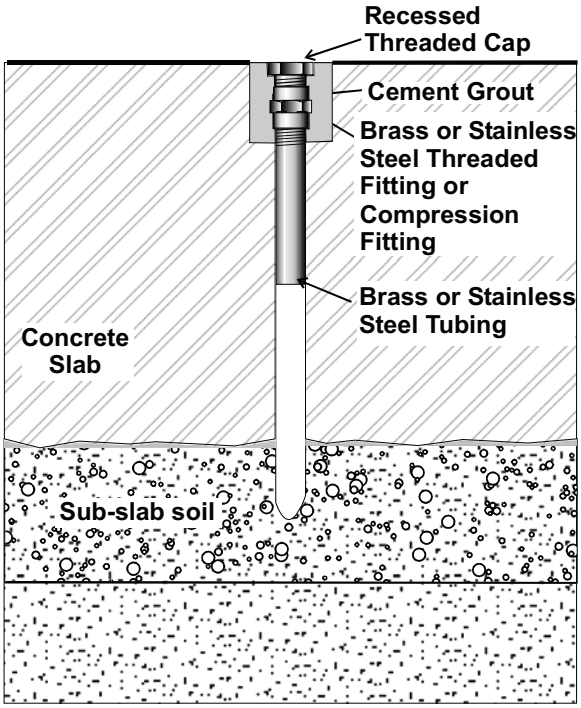

Figure 3. General schematic of sub-slab vapor probe

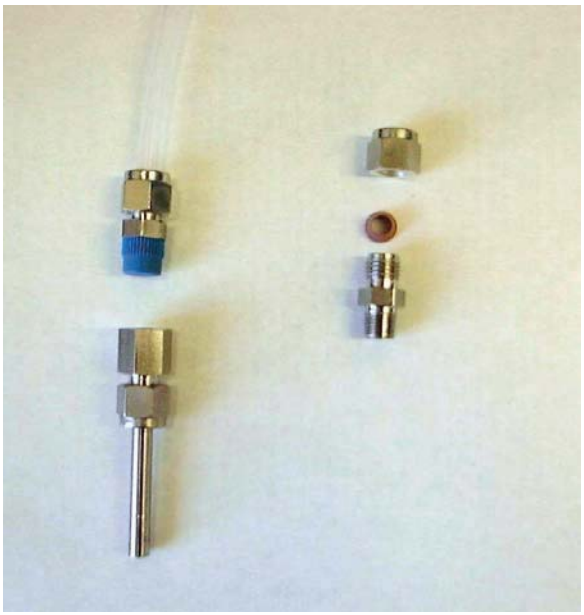

Figure 4. Stainless steel sub-slab vapor probe components

Figure 5. Competed vapor probe installation

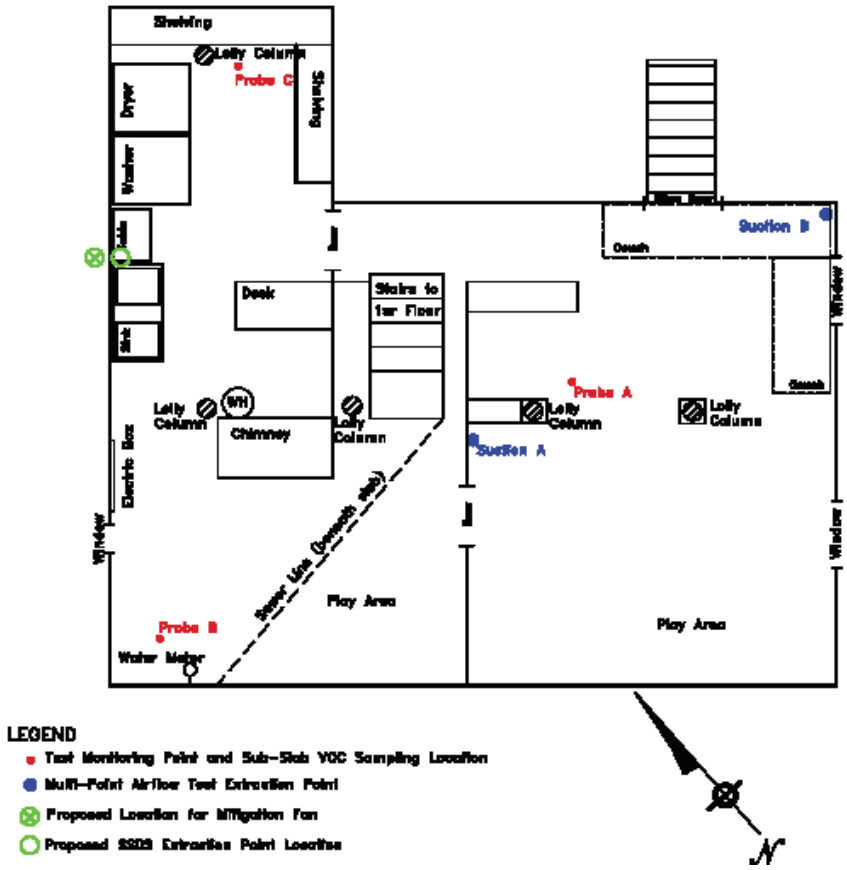

Figure 6. Schematic illustration location of vapor probes in a basement

Figure 7. Compression fitting to probe

Figure 8. Purge prior to sampling

Figure 9. Analysis of O2, CO2, and CH4

Figure 10. Sampling in 1-L evacuated canister for TO-15 analysis

Figure 11. Collection of duplicate sample

APPENDIX F

LABORATORY CERTIFICATION

State of New Jersey
Department of Environmental Protection

Certifies That

TestAmerica Laboratories Inc. - Burlington

Laboratory Certification ID # VT972

having duly met the requirements of the

Regulations Governing The Certification Of
Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the standards approved by the

The NELAC Institute

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List
which must accompany this certificate to be valid

Expiration Date June 30, 2010

NJDEP is a NELAP Recognized Accrediting Authority

Joseph F. Aiello, Chief
Office of Quality Assurance

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public.
Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP01 -- Atmos. Inorg. Parameters, Non-Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP01.00005	AE	Thermal Conductivity	[EPA 3C]	Carbon Dioxide
Certified	Yes	NJ	CAP01.00068	AE	Thermal Conductivity	[EPA 3C]	Methane
Certified	Yes	NJ	CAP01.00070	AE	Thermal Conductivity	[EPA 3C]	Nitrogen
Certified	Yes	NJ	CAP01.00100	AE	Thermal Conductivity	[EPA 3C]	Oxygen

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00015	AE	FID	[EPA 25C]	Non-Methane Organic Compounds
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Applied	No	NJ	CAP03.00185	AE	GC/MS, Canisters	[EPA TO-15]	Acetonitrile
Applied	No	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Applied	No	NJ	CAP03.00230	AE	GC/MS, Canisters	[EPA TO-15]	Benzyl chloride
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Certified	Yes	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.00335	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.00465	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Certified	Yes	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Certified	Yes	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Certified	Yes	NJ	CAP03.00511	AE	GC/MS, Canisters	[EPA TO-15]	Isopropanol
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone
Applied	No	NJ	CAP03.00545	AE	GC/MS, Canisters	[EPA TO-15]	Methyl methacrylate
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Applied	No	NJ	CAP03.00567	AE	GC/MS, Canisters	[EPA TO-15]	Naphthalene
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethane (1,1,2,2-)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene
Applied	No	NJ	CAP03.00662	AE	GC/MS, Canisters	[EPA TO-15]	Tetrahydrofuran
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)
Certified	Yes	NJ	CAP03.02450	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Benzene
Certified	Yes	NJ	CAP03.02460	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Chlorobenzene
Certified	Yes	NJ	CAP03.02470	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Chloroform
Certified	Yes	NJ	CAP03.02480	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.02482	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Ethylbenzene
Certified	Yes	NJ	CAP03.02483	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Isopropylbenzene
Certified	Yes	NJ	CAP03.02485	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Methane
Certified	Yes	NJ	CAP03.02486	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.02488	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.02489	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Toluene
Certified	Yes	NJ	CAP03.02490	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Tetrachloroethane (1,1,2,2-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.02500	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.02510	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Vinylidene chloride
Certified	Yes	NJ	CAP03.02515	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Xylenes (total)
Certified	Yes	NJ	CAP03.06150	AE	GC/MS	[EPA TO-13A]	Acenaphthene
Certified	Yes	NJ	CAP03.06160	AE	GC/MS	[EPA TO-13A]	Acenaphthylene
Certified	Yes	NJ	CAP03.06170	AE	GC/MS	[EPA TO-13A]	Anthracene
Certified	Yes	NJ	CAP03.06180	AE	GC/MS	[EPA TO-13A]	Benzo(a)anthracene
Certified	Yes	NJ	CAP03.06190	AE	GC/MS	[EPA TO-13A]	Benzo(a)pyrene
Certified	Yes	NJ	CAP03.06200	AE	GC/MS	[EPA TO-13A]	Benzo(b)fluoranthene
Certified	Yes	NJ	CAP03.06210	AE	GC/MS	[EPA TO-13A]	Benzo(k)fluoranthene
Certified	Yes	NJ	CAP03.06230	AE	GC/MS	[EPA TO-13A]	Benzo(ghi)perylene
Certified	Yes	NJ	CAP03.06240	AE	GC/MS	[EPA TO-13A]	Chrysene
Certified	Yes	NJ	CAP03.06260	AE	GC/MS	[EPA TO-13A]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	CAP03.06270	AE	GC/MS	[EPA TO-13A]	Fluoranthene
Certified	Yes	NJ	CAP03.06280	AE	GC/MS	[EPA TO-13A]	Fluorene
Certified	Yes	NJ	CAP03.06290	AE	GC/MS	[EPA TO-13A]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	CAP03.06300	AE	GC/MS	[EPA TO-13A]	Naphthalene
Certified	Yes	NJ	CAP03.06320	AE	GC/MS	[EPA TO-13A]	Phenanthrene
Certified	Yes	NJ	CAP03.06330	AE	GC/MS	[EPA TO-13A]	Pyrene
Certified	Yes	NJ	CAP03.06430	AE	GC/MS, Canisters	[EPA TO-14A]	Benzene
Certified	Yes	NJ	CAP03.06450	AE	GC/MS, Canisters	[EPA TO-14A]	Bromomethane
Certified	Yes	NJ	CAP03.06460	AE	GC/MS, Canisters	[EPA TO-14A]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.06470	AE	GC/MS, Canisters	[EPA TO-14A]	Chlorobenzene
Certified	Yes	NJ	CAP03.06480	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroethane
Certified	Yes	NJ	CAP03.06490	AE	GC/MS, Canisters	[EPA TO-14A]	Chloroform
Certified	Yes	NJ	CAP03.06500	AE	GC/MS, Canisters	[EPA TO-14A]	Chloromethane
Certified	Yes	NJ	CAP03.06510	AE	GC/MS, Canisters	[EPA TO-14A]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.06520	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.06530	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.06540	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorobenzene (1,4-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.06550	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.06560	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.06570	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.06580	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.06590	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.06610	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.06620	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.06630	AE	GC/MS, Canisters	[EPA TO-14A]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.06640	AE	GC/MS, Canisters	[EPA TO-14A]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.06650	AE	GC/MS, Canisters	[EPA TO-14A]	Ethylbenzene
Certified	Yes	NJ	CAP03.06660	AE	GC/MS, Canisters	[EPA TO-14A]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.06670	AE	GC/MS, Canisters	[EPA TO-14A]	Styrene
Certified	Yes	NJ	CAP03.06680	AE	GC/MS, Canisters	[EPA TO-14A]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.06690	AE	GC/MS, Canisters	[EPA TO-14A]	Tetrachloroethene
Certified	Yes	NJ	CAP03.06700	AE	GC/MS, Canisters	[EPA TO-14A]	Toluene
Certified	Yes	NJ	CAP03.06710	AE	GC/MS, Canisters	[EPA TO-14A]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06720	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.06730	AE	GC/MS, Canisters	[EPA TO-14A]	Trichloroethene
Certified	Yes	NJ	CAP03.06740	AE	GC/MS, Canisters	[EPA TO-14A]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.06760	AE	GC/MS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06770	AE	GC/MS, Canisters	[EPA TO-14A]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.06780	AE	GC/MS, Canisters	[EPA TO-14A]	Vinyl chloride
Certified	Yes	NJ	CAP03.06790	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (o-)
Certified	Yes	NJ	CAP03.06800	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (m-)
Certified	Yes	NJ	CAP03.06810	AE	GC/MS, Canisters	[EPA TO-14A]	Xylene (p-)
Certified	Yes	NJ	CAP03.06850	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Acetone
Certified	Yes	NJ	CAP03.06852	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Allyl chloride
Certified	Yes	NJ	CAP03.06854	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Benzene
Certified	Yes	NJ	CAP03.06856	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromodichloromethane
Certified	Yes	NJ	CAP03.06858	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromoform
Certified	Yes	NJ	CAP03.06860	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromomethane
Certified	Yes	NJ	CAP03.06862	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Butadiene (1,3-)

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ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.06864	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Carbon disulfide
Certified	Yes	NJ	CAP03.06866	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.06868	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chlorobenzene
Certified	Yes	NJ	CAP03.06870	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloroethane
Certified	Yes	NJ	CAP03.06872	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloroform
Certified	Yes	NJ	CAP03.06874	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloromethane
Certified	Yes	NJ	CAP03.06876	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.06878	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Cyclohexane
Certified	Yes	NJ	CAP03.06880	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dibromochloromethane
Certified	Yes	NJ	CAP03.06882	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.06884	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.06886	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.06888	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.06890	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.06892	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.06894	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.06896	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.06898	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.06900	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	CAP03.06902	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.06904	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.06906	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.06908	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.06910	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.06914	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Ethylbenzene
Certified	Yes	NJ	CAP03.06916	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.06918	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Heptane (n-)
Certified	Yes	NJ	CAP03.06920	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.06922	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Hexane (n-)
Certified	Yes	NJ	CAP03.06924	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Isopropanol
Certified	Yes	NJ	CAP03.06926	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.06928	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl ethyl ketone

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National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.06930	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl isobutyl ketone
Certified	Yes	NJ	CAP03.06932	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl methacrylate
Certified	Yes	NJ	CAP03.06934	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.06936	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Styrene
Certified	Yes	NJ	CAP03.06938	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.06940	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.06942	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrachloroethene
Certified	Yes	NJ	CAP03.06944	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrahydrofuran
Certified	Yes	NJ	CAP03.06946	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Toluene
Certified	Yes	NJ	CAP03.06948	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06950	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.06952	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.06954	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethene
Certified	Yes	NJ	CAP03.06956	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.06958	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.06960	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.06962	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.06964	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.06966	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Vinyl bromide
Certified	Yes	NJ	CAP03.06968	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Vinyl chloride
Certified	Yes	NJ	CAP03.06970	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Xylene (m- + p-)
Certified	Yes	NJ	CAP03.06972	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Xylene (o-)

Category: SDW02 -- Inorganic Parameters Including Na + Ca

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Dropped	No	NJ	SDW02.31120	DW	Ion Chromatography	[EPA 314.0]	Perchlorate
Certified	Yes	NJ	SDW02.31125	DW	LC/MS or LC/MS/MS	[EPA 331.0]	Perchlorate

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SDW03 -- Analyze-Immediately Inorganic Parameter

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW03.08000	DW	Electrometric	[SM 4500-H B]	pH

Category: SDW04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW04.07000	DW	ICP/MS	[EPA 200.8]	Antimony
Certified	Yes	NJ	SDW04.12000	DW	ICP/MS	[EPA 200.8]	Arsenic
Applied	No	NJ	SDW04.17000	DW	ICP/MS	[EPA 200.8]	Barium
Applied	No	NJ	SDW04.21000	DW	ICP/MS	[EPA 200.8]	Beryllium
Applied	No	NJ	SDW04.25000	DW	ICP/MS	[EPA 200.8]	Cadmium
Applied	No	NJ	SDW04.29000	DW	ICP/MS	[EPA 200.8]	Chromium
Applied	No	NJ	SDW04.34000	DW	ICP/MS	[EPA 200.8]	Copper
Certified	Yes	NJ	SDW04.40000	DW	ICP/MS	[EPA 200.8]	Lead
Applied	No	NJ	SDW04.45000	DW	ICP/MS	[EPA 200.8]	Manganese
Certified	Yes	NJ	SDW04.46000	DW	Manual Cold Vapor	[EPA 245.1]	Mercury
Applied	No	NJ	SDW04.48000	DW	ICP/MS	[EPA 200.8]	Mercury
Applied	No	NJ	SDW04.53000	DW	ICP/MS	[EPA 200.8]	Nickel
Certified	Yes	NJ	SDW04.57000	DW	ICP/MS	[EPA 200.8]	Selenium
Applied	No	NJ	SDW04.63000	DW	ICP/MS	[EPA 200.8]	Silver
Certified	Yes	NJ	SDW04.65000	DW	ICP/MS	[EPA 200.8]	Thallium

Category: SDW05 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW05.12010	DW	Solvent Extract, GC	[EPA 504.1]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SDW05.12020	DW	Solvent Extract, GC	[EPA 504.1]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SDW05.12030	DW	Solvent Extract, GC	[EPA 504.1]	Trichloropropane (1,2,3-)

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SDW06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.01010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromoform
Certified	Yes	NJ	SDW06.01020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroform
Certified	Yes	NJ	SDW06.01030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromochloromethane
Certified	Yes	NJ	SDW06.01040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromodichloromethane
Certified	Yes	NJ	SDW06.02010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Benzene
Certified	Yes	NJ	SDW06.02020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Carbon tetrachloride
Certified	Yes	NJ	SDW06.02030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorobenzene
Certified	Yes	NJ	SDW06.02040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SDW06.02050	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SDW06.02060	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SDW06.02070	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethane (1,1-)
Certified	Yes	NJ	SDW06.02080	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethane (1,2-)
Certified	Yes	NJ	SDW06.02090	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	SDW06.02100	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	SDW06.02110	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	SDW06.02120	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (1,2-)
Certified	Yes	NJ	SDW06.02130	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Ethylbenzene
Certified	Yes	NJ	SDW06.02140	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl tert-butyl ether
Certified	Yes	NJ	SDW06.02150	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Naphthalene
Certified	Yes	NJ	SDW06.02160	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Styrene
Certified	Yes	NJ	SDW06.02170	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	SDW06.02180	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethene
Certified	Yes	NJ	SDW06.02190	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	SDW06.02200	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethene
Certified	Yes	NJ	SDW06.02210	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Toluene
Certified	Yes	NJ	SDW06.02220	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SDW06.02230	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (1,1-)
Certified	Yes	NJ	SDW06.02240	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	SDW06.02250	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Vinyl chloride
Certified	Yes	NJ	SDW06.02260	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Xylenes (total)
Certified	Yes	NJ	SDW06.03010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromobenzene
Certified	Yes	NJ	SDW06.03020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromochloromethane

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SDW06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.03030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromomethane
Certified	Yes	NJ	SDW06.03040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Butyl benzene (n-)
Certified	Yes	NJ	SDW06.03050	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Sec-butylbenzene
Certified	Yes	NJ	SDW06.03060	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tert-butylbenzene
Certified	Yes	NJ	SDW06.03070	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroethane
Certified	Yes	NJ	SDW06.03080	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloromethane
Certified	Yes	NJ	SDW06.03090	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorotoluene (2-)
Certified	Yes	NJ	SDW06.03100	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorotoluene (4-)
Certified	Yes	NJ	SDW06.03110	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SDW06.03120	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SDW06.03130	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromomethane
Certified	Yes	NJ	SDW06.03140	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorodifluoromethane
Certified	Yes	NJ	SDW06.03150	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (1,3-)
Certified	Yes	NJ	SDW06.03160	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (2,2-)
Certified	Yes	NJ	SDW06.03170	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (1,1-)
Certified	Yes	NJ	SDW06.03180	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	SDW06.03190	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	SDW06.03200	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SDW06.03210	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Isopropylbenzene
Certified	Yes	NJ	SDW06.03220	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Isopropyltoluene (4-)
Certified	Yes	NJ	SDW06.03230	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Propylbenzene (n-)
Certified	Yes	NJ	SDW06.03240	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethane (1,1,1,2-)
Certified	Yes	NJ	SDW06.03250	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorobenzene (1,2,3-)
Certified	Yes	NJ	SDW06.03251	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorobenzene (1,3,5-)
Certified	Yes	NJ	SDW06.03260	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorofluoromethane
Certified	Yes	NJ	SDW06.03270	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloropropane (1,2,3-)
Certified	Yes	NJ	SDW06.03280	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	SDW06.03300	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	SDW06.03310	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Nitrobenzene
Certified	Yes	NJ	SDW06.03410	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Acetone
Certified	Yes	NJ	SDW06.03420	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Acrylonitrile
Certified	Yes	NJ	SDW06.03430	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Allyl chloride

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SDW06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.03440	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Butanone (2-)
Certified	Yes	NJ	SDW06.03450	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Carbon disulfide
Certified	Yes	NJ	SDW06.03460	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroacetonitrile
Certified	Yes	NJ	SDW06.03470	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorobutane (1-)
Certified	Yes	NJ	SDW06.03480	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloro-2-butene (trans-1,4-)
Certified	Yes	NJ	SDW06.03490	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropanone (1,1-)
Certified	Yes	NJ	SDW06.03500	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Diethyl ether (Ethyl ether)
Certified	Yes	NJ	SDW06.03510	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Ethyl methacrylate
Certified	Yes	NJ	SDW06.03520	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexachloroethane
Certified	Yes	NJ	SDW06.03530	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexanone (2-)
Certified	Yes	NJ	SDW06.03540	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methacrylonitrile
Certified	Yes	NJ	SDW06.03550	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl acrylate
Certified	Yes	NJ	SDW06.03560	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl iodide
Certified	Yes	NJ	SDW06.03570	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl methacrylate
Certified	Yes	NJ	SDW06.03580	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Pentanone (4-methyl-2-)
Certified	Yes	NJ	SDW06.03590	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Nitropropane (2-)
Certified	Yes	NJ	SDW06.03600	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Pentachloroethane
Certified	Yes	NJ	SDW06.03610	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Propionitrile
Certified	Yes	NJ	SDW06.03615	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tert-butyl alcohol
Certified	Yes	NJ	SDW06.03620	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrahydrofuran

Category: CLP01 -- Multi-Media, Multi-Conc. Inorganics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP01.06102	NPW	ICP/MS	[EPA ILM05.4]	Antimony
Certified	Yes	NJ	CLP01.08102	NPW	ICP/MS	[EPA ILM05.4]	Arsenic
Certified	Yes	NJ	CLP01.11102	NPW	ICP/MS	[EPA ILM05.4]	Barium
Certified	Yes	NJ	CLP01.14102	NPW	ICP/MS	[EPA ILM05.4]	Beryllium
Certified	Yes	NJ	CLP01.19102	NPW	ICP/MS	[EPA ILM05.4]	Cadmium
Certified	Yes	NJ	CLP01.24102	NPW	ICP/MS	[EPA ILM05.4]	Chromium

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP01 -- Multi-Media, Multi-Conc. Inorganics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP01.27102	NPW	ICP/MS	[EPA ILM05.4]	Cobalt
Certified	Yes	NJ	CLP01.30102	NPW	ICP/MS	[EPA ILM05.4]	Copper
Certified	Yes	NJ	CLP01.36102	NPW	ICP/MS	[EPA ILM05.4]	Lead
Certified	Yes	NJ	CLP01.41102	NPW	ICP/MS	[EPA ILM05.4]	Manganese
Certified	Yes	NJ	CLP01.47102	NPW	ICP/MS	[EPA ILM05.4]	Nickel
Certified	Yes	NJ	CLP01.51102	NPW	ICP/MS	[EPA ILM05.4]	Selenium
Certified	Yes	NJ	CLP01.54102	NPW	ICP/MS	[EPA ILM05.4]	Silver
Certified	Yes	NJ	CLP01.59102	NPW	ICP/MS	[EPA ILM05.4]	Thallium
Certified	Yes	NJ	CLP01.63102	NPW	ICP/MS	[EPA ILM05.4]	Vanadium
Certified	Yes	NJ	CLP01.66102	NPW	ICP/MS	[EPA ILM05.4]	Zinc

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.01000	NPW	Acid Digestion/Surface and Groundwater, ICP, FLAA	[SW-846 3005A, Rev. 1, 7/92]	Metals, Total Rec and Dissolved
Certified	Yes	NJ	SHW04.01500	NPW	Acid Digestion/Aqueous Samples, ICP, FLAA	[SW-846 3010A, Rev. 1, 7/92]	Metals, Total
Certified	Yes	NJ	SHW04.33000	NPW	AA, Manual Cold Vapor	[SW-846 7470A, Rev. 1, 9/94]	Mercury - liquid waste

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.01000	NPW	Separatory Funnel Extraction	[SW-846 3510C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.02000	NPW	Continuous Liquid-Liquid Extraction	[SW-846 3520C, Rev. 3, 12/96]	Semivolatile organics
Applied	No	NJ	SHW05.02100	NPW	Solid Phase Extraction (SPE)	[SW-846 3535A]	Semivolatile organics
Certified	Yes	NJ	SHW05.07000	NPW	Purge & Trap Aqueous	[SW-846 5030B, Rev. 2, 12/96]	Volatile organics

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.23100	NPW	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Ethane
Certified	Yes	NJ	SHW06.23105	NPW	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Ethene
Certified	Yes	NJ	SHW06.23110	NPW	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Methane

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.17000	NPW	Wheatstone Bridge	[SW-846 9050A, Rev. 1, 12/96]	Specific conductance
Certified	Yes	NJ	SHW09.19000	NPW	Infrared Spectrometry or FID	[SW-846 9060, Rev. 0, 9/86]	Total organic carbon (TOC)

Category: WPP02 -- Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP02.02500	NPW	Distillation, Nesslerization	[SM 4500-NH3 B+C (18th ed.)]	Ammonia
Certified	Yes	NJ	WPP02.06000	NPW	ICP	[EPA 200.7]	Boron
Certified	Yes	NJ	WPP02.08000	NPW	Digestion, ICP	[EPA 200.7]	Calcium
Certified	Yes	NJ	WPP02.08050	NPW	ICP/MS	[EPA 200.8]	Calcium
Certified	Yes	NJ	WPP02.10500	NPW	Spectrophotometric Manual/Auto	[EPA 410.4]	Chemical oxygen demand
Certified	Yes	NJ	WPP02.19000	NPW	Titrimetric, EDTA	[SM 2340 B or C]	Hardness - total as CaCO3
Certified	Yes	NJ	WPP02.20100	NPW	Ca + Mg Carbonates, ICP	[EPA 200.7]	Hardness - total as CaCO3
Certified	Yes	NJ	WPP02.21000	NPW	Digestion, Distillation, Nesslerization	[SM 4500-N Org B or C]	Kjeldahl nitrogen - total
Certified	Yes	NJ	WPP02.24000	NPW	Digestion, ICP	[EPA 200.7]	Magnesium
Certified	Yes	NJ	WPP02.24050	NPW	ICP/MS	[EPA 200.8]	Magnesium
Certified	Yes	NJ	WPP02.30000	NPW	Combustion or Oxidation	[SM 5310 B, C or D]	Total organic carbon (TOC)
Certified	Yes	NJ	WPP02.34000	NPW	Persulfate Digestion + Manual	[EPA 365.3]	Phosphorus (total)
Certified	Yes	NJ	WPP02.36500	NPW	Digestion, ICP	[EPA 200.7]	Potassium
Certified	Yes	NJ	WPP02.36550	NPW	ICP/MS	[EPA 200.8]	Potassium
Certified	Yes	NJ	WPP02.38000	NPW	Gravimetric, 103-105 Degrees C	[SM 2540 B]	Residue - total
Certified	Yes	NJ	WPP02.38500	NPW	Gravimetric, 180 Degrees C	[SM 2540 C]	Residue - filterable (TDS)

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SOUTH BURLINGTON, VT 05403

Category: WPP02 – Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP02.39000	NPW	Gravimetric, 103-105 Degrees C, Post Washing	[SM 2540 D]	Residue - nonfilterable (TSS)
Certified	Yes	NJ	WPP02.40000	NPW	Gravimetric, 550 Degrees C	[EPA 160.4]	Residue - volatile
Certified	Yes	NJ	WPP02.44000	NPW	Digestion, ICP	[EPA 200.7]	Sodium
Certified	Yes	NJ	WPP02.44050	NPW	ICP/MS	[EPA 200.8]	Sodium

Category: WPP03 – Analyze-Immediately Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP03.09000	NPW	Electrometric	[SM 4500-H B]	pH

Category: WPP04 – Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP04.02000	NPW	Digestion, ICP	[EPA 200.7]	Aluminum
Certified	Yes	NJ	WPP04.02100	NPW	ICP/MS	[EPA 200.8]	Aluminum
Certified	Yes	NJ	WPP04.04500	NPW	Digestion, ICP	[EPA 200.7]	Antimony
Certified	Yes	NJ	WPP04.04600	NPW	ICP/MS	[EPA 200.8]	Antimony
Certified	Yes	NJ	WPP04.05600	NPW	Digestion, ICP	[EPA 200.7]	Arsenic
Certified	Yes	NJ	WPP04.05700	NPW	ICP/MS	[EPA 200.8]	Arsenic
Certified	Yes	NJ	WPP04.08000	NPW	Digestion, ICP	[EPA 200.7]	Barium
Certified	Yes	NJ	WPP04.08200	NPW	ICP/MS	[EPA 200.8]	Barium
Certified	Yes	NJ	WPP04.11000	NPW	Digestion, ICP	[EPA 200.7]	Beryllium
Certified	Yes	NJ	WPP04.11100	NPW	ICP/MS	[EPA 200.8]	Beryllium
Certified	Yes	NJ	WPP04.13500	NPW	Digestion, ICP	[EPA 200.7]	Cadmium
Certified	Yes	NJ	WPP04.13600	NPW	ICP/MS	[EPA 200.8]	Cadmium
Certified	Yes	NJ	WPP04.18000	NPW	Digestion, ICP	[EPA 200.7]	Chromium
Certified	Yes	NJ	WPP04.18100	NPW	ICP/MS	[EPA 200.8]	Chromium
Certified	Yes	NJ	WPP04.19500	NPW	Digestion, ICP	[EPA 200.7]	Cobalt
Certified	Yes	NJ	WPP04.19600	NPW	ICP/MS	[EPA 200.8]	Cobalt

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: WPP04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP04.21500	NPW	Digestion, ICP	[EPA 200.7]	Copper
Certified	Yes	NJ	WPP04.21600	NPW	ICP/MS	[EPA 200.8]	Copper
Certified	Yes	NJ	WPP04.26500	NPW	Digestion, ICP	[EPA 200.7]	Iron
Certified	Yes	NJ	WPP04.26550	NPW	ICP/MS	[EPA 200.8]	Iron
Certified	Yes	NJ	WPP04.28000	NPW	Digestion, ICP	[EPA 200.7]	Lead
Certified	Yes	NJ	WPP04.28100	NPW	ICP/MS	[EPA 200.8]	Lead
Certified	Yes	NJ	WPP04.31000	NPW	Digestion, ICP	[EPA 200.7]	Manganese
Certified	Yes	NJ	WPP04.31100	NPW	ICP/MS	[EPA 200.8]	Manganese
Certified	Yes	NJ	WPP04.33000	NPW	Manual Cold Vapor	[EPA 245.1]	Mercury
Certified	Yes	NJ	WPP04.35000	NPW	Digestion, ICP	[EPA 200.7]	Molybdenum
Applied	No	NJ	WPP04.35200	NPW	ICP/MS	[EPA 200.8]	Molybdenum
Certified	Yes	NJ	WPP04.37500	NPW	Digestion, ICP	[EPA 200.7]	Nickel
Certified	Yes	NJ	WPP04.37600	NPW	ICP/MS	[EPA 200.8]	Nickel
Certified	Yes	NJ	WPP04.45500	NPW	Digestion, ICP	[EPA 200.7]	Selenium
Certified	Yes	NJ	WPP04.45600	NPW	ICP/MS	[EPA 200.8]	Selenium
Certified	Yes	NJ	WPP04.48000	NPW	Digestion, ICP	[EPA 200.7]	Silver
Certified	Yes	NJ	WPP04.48200	NPW	ICP/MS	[EPA 200.8]	Silver
Certified	Yes	NJ	WPP04.50000	NPW	Digestion, ICP	[EPA 200.7]	Thallium
Certified	Yes	NJ	WPP04.50100	NPW	ICP/MS	[EPA 200.8]	Thallium
Certified	Yes	NJ	WPP04.51100	NPW	Digestion, ICP	[EPA 200.7]	Tin
Certified	Yes	NJ	WPP04.52050	NPW	Digestion, ICP	[EPA 200.7]	Titanium
Certified	Yes	NJ	WPP04.54000	NPW	Digestion, ICP	[EPA 200.7]	Vanadium
Certified	Yes	NJ	WPP04.54100	NPW	ICP/MS	[EPA 200.8]	Vanadium
Certified	Yes	NJ	WPP04.56500	NPW	Digestion, ICP	[EPA 200.7]	Zinc
Certified	Yes	NJ	WPP04.56600	NPW	ICP/MS	[EPA 200.8]	Zinc

Category: CLP01 -- Multi-Media, Multi-Conc. Inorganics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP01.03003	NPW, SCM	ICP	[EPA ILM05.4]	Aluminum

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP01 -- Multi-Media, Multi-Conc. Inorganics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP01.06003	NPW, SCM	ICP	[EPA ILM05.4]	Antimony
Certified	Yes	NJ	CLP01.08003	NPW, SCM	ICP	[EPA ILM05.4]	Arsenic
Certified	Yes	NJ	CLP01.11003	NPW, SCM	ICP	[EPA ILM05.4]	Barium
Certified	Yes	NJ	CLP01.14003	NPW, SCM	ICP	[EPA ILM05.4]	Beryllium
Certified	Yes	NJ	CLP01.19003	NPW, SCM	ICP	[EPA ILM05.4]	Cadmium
Certified	Yes	NJ	CLP01.21003	NPW, SCM	ICP	[EPA ILM05.4]	Calcium
Certified	Yes	NJ	CLP01.24003	NPW, SCM	ICP	[EPA ILM05.4]	Chromium
Certified	Yes	NJ	CLP01.27003	NPW, SCM	ICP	[EPA ILM05.4]	Cobalt
Certified	Yes	NJ	CLP01.30003	NPW, SCM	ICP	[EPA ILM05.4]	Copper
Certified	Yes	NJ	CLP01.33003	NPW, SCM	ICP	[EPA ILM05.4]	Iron
Certified	Yes	NJ	CLP01.36003	NPW, SCM	ICP	[EPA ILM05.4]	Lead
Certified	Yes	NJ	CLP01.38003	NPW, SCM	ICP	[EPA ILM05.4]	Magnesium
Certified	Yes	NJ	CLP01.41003	NPW, SCM	ICP	[EPA ILM05.4]	Manganese
Certified	Yes	NJ	CLP01.42102	NPW, SCM	CVAA, Manual	[EPA ILM05.4]	Mercury
Certified	Yes	NJ	CLP01.47003	NPW, SCM	ICP	[EPA ILM05.4]	Nickel
Certified	Yes	NJ	CLP01.49003	NPW, SCM	ICP	[EPA ILM05.4]	Potassium
Certified	Yes	NJ	CLP01.51003	NPW, SCM	ICP	[EPA ILM05.4]	Selenium
Certified	Yes	NJ	CLP01.54003	NPW, SCM	ICP	[EPA ILM05.4]	Silver
Certified	Yes	NJ	CLP01.56003	NPW, SCM	ICP	[EPA ILM05.4]	Sodium
Certified	Yes	NJ	CLP01.59003	NPW, SCM	ICP	[EPA ILM05.4]	Thallium
Certified	Yes	NJ	CLP01.63003	NPW, SCM	ICP	[EPA ILM05.4]	Vanadium
Certified	Yes	NJ	CLP01.66003	NPW, SCM	ICP	[EPA ILM05.4]	Zinc
Certified	Yes	NJ	CLP01.69102	NPW, SCM	Midi Distillation, Spectrophotometric	[EPA ILM05.4]	Cyanide, Total in Water and Soil / Sediments

Category: CLP02 -- Multi-Media, Multi-Conc. Organics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP02.01013	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Aldrin
Certified	Yes	NJ	CLP02.01023	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Alpha BHC
Certified	Yes	NJ	CLP02.01033	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Beta BHC

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP02 -- Multi-Media, Multi-Conc. Organics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP02.01043	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Delta BHC
Certified	Yes	NJ	CLP02.01053	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Lindane (gamma BHC)
Certified	Yes	NJ	CLP02.01063	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Chlordane (alpha)
Certified	Yes	NJ	CLP02.01073	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Chlordane (gamma)
Certified	Yes	NJ	CLP02.01083	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	DDD (4,4'-)
Certified	Yes	NJ	CLP02.01093	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	DDE (4,4'-)
Certified	Yes	NJ	CLP02.01103	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	DDT (4,4'-)
Certified	Yes	NJ	CLP02.01113	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Dieldrin
Certified	Yes	NJ	CLP02.01123	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endosulfan I
Certified	Yes	NJ	CLP02.01133	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endosulfan II
Certified	Yes	NJ	CLP02.01143	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endosulfan sulfate
Certified	Yes	NJ	CLP02.01153	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endrin
Certified	Yes	NJ	CLP02.01163	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endrin aldehyde
Certified	Yes	NJ	CLP02.01173	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Endrin ketone
Certified	Yes	NJ	CLP02.01183	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Heptachlor
Certified	Yes	NJ	CLP02.01193	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Heptachlor epoxide
Certified	Yes	NJ	CLP02.01203	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Methoxychlor
Certified	Yes	NJ	CLP02.01213	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	Toxaphene
Certified	Yes	NJ	CLP02.01233	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1016
Certified	Yes	NJ	CLP02.01243	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1221
Certified	Yes	NJ	CLP02.01253	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1232
Certified	Yes	NJ	CLP02.01263	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1242
Certified	Yes	NJ	CLP02.01273	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1248
Certified	Yes	NJ	CLP02.01283	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1254
Certified	Yes	NJ	CLP02.01293	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB 1260
Certified	Yes	NJ	CLP02.01303	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB-1262
Certified	Yes	NJ	CLP02.01313	NPW, SCM	Extraction/GC (ECD)	[EPA SOM01.2 (4/2007)]	PCB-1268
Certified	Yes	NJ	CLP02.03023	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Benzene
Certified	Yes	NJ	CLP02.03027	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Bromochloromethane
Certified	Yes	NJ	CLP02.03033	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Chlorobenzene
Certified	Yes	NJ	CLP02.03043	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CLP02.03053	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorobenzene (1,3-)

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP02 -- Multi-Media, Multi-Conc. Organics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP02.03063	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CLP02.03067	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dioxane (1,4-)
Certified	Yes	NJ	CLP02.03073	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Ethylbenzene
Certified	Yes	NJ	CLP02.03083	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Isopropylbenzene
Certified	Yes	NJ	CLP02.03089	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichlorobenzene (1,2,3-)
Certified	Yes	NJ	CLP02.03093	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CLP02.03103	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Styrene
Certified	Yes	NJ	CLP02.03113	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Toluene
Certified	Yes	NJ	CLP02.03117	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Xylene (m- + p-)
Certified	Yes	NJ	CLP02.03119	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Xylene (o-)
Certified	Yes	NJ	CLP02.03143	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Bromodichloromethane
Certified	Yes	NJ	CLP02.03153	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Bromoform
Certified	Yes	NJ	CLP02.03163	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Bromomethane
Certified	Yes	NJ	CLP02.03173	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Carbon tetrachloride
Certified	Yes	NJ	CLP02.03183	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Chloroethane
Certified	Yes	NJ	CLP02.03193	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Chloroform
Certified	Yes	NJ	CLP02.03203	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Chloromethane
Certified	Yes	NJ	CLP02.03213	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CLP02.03223	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CLP02.03233	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dibromochloromethane
Certified	Yes	NJ	CLP02.03243	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	CLP02.03253	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorodifluoromethane
Certified	Yes	NJ	CLP02.03263	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloroethane (1,1-)
Certified	Yes	NJ	CLP02.03273	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloroethane (1,2-)
Certified	Yes	NJ	CLP02.03283	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloroethene (1,1-)
Certified	Yes	NJ	CLP02.03293	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	CLP02.03303	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CLP02.03313	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloropropane (1,2-)
Certified	Yes	NJ	CLP02.03323	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CLP02.03333	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CLP02.03343	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CLP02.03353	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Tetrachloroethene

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP02 -- Multi-Media, Multi-Conc. Organics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP02.03363	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CLP02.03373	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CLP02.03383	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichloroethene
Certified	Yes	NJ	CLP02.03393	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichlorofluoromethane
Certified	Yes	NJ	CLP02.03403	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CLP02.03413	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Vinyl chloride
Certified	Yes	NJ	CLP02.03433	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Acetone
Certified	Yes	NJ	CLP02.03443	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Carbon disulfide
Certified	Yes	NJ	CLP02.03453	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Cyclohexane
Certified	Yes	NJ	CLP02.03463	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Butanone (2-)
Certified	Yes	NJ	CLP02.03473	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Hexanone (2-)
Certified	Yes	NJ	CLP02.03483	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Methyl acetate
Certified	Yes	NJ	CLP02.03493	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Methylcyclohexane
Certified	Yes	NJ	CLP02.03503	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Pentanone (4-methyl-2-)
Certified	Yes	NJ	CLP02.03513	NPW, SCM	GC/MS/SIM, P & T, Capillary	[EPA SOM01.2 (4/2007)]	Tert-butyl methyl ether
Certified	Yes	NJ	CLP02.04023	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Atrazine
Certified	Yes	NJ	CLP02.04033	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	N-Nitrosodiphenylamine
Certified	Yes	NJ	CLP02.04043	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	N-Nitroso-di-n-propylamine
Certified	Yes	NJ	CLP02.04053	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Carbazole
Certified	Yes	NJ	CLP02.04063	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorobenzidine (3,3'-)
Certified	Yes	NJ	CLP02.04073	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Chloroaniline (4-)
Certified	Yes	NJ	CLP02.04083	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitroaniline (2-)
Certified	Yes	NJ	CLP02.04093	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitroaniline (3-)
Certified	Yes	NJ	CLP02.04103	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitroaniline (4-)
Certified	Yes	NJ	CLP02.04123	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Chloronaphthalene (2-)
Certified	Yes	NJ	CLP02.04133	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Hexachlorobenzene
Certified	Yes	NJ	CLP02.04143	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CLP02.04153	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Hexachlorocyclopentadiene
Certified	Yes	NJ	CLP02.04163	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Hexachloroethane
Certified	Yes	NJ	CLP02.04183	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Bis (2-chloroethoxy) methane
Certified	Yes	NJ	CLP02.04193	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Bis (2-chloroisopropyl) ether
Certified	Yes	NJ	CLP02.04203	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Bis (2-chloroethyl) ether

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Certified	Yes	NJ	CLP02.04213	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Chlorophenyl-phenyl ether (4-)
Certified	Yes	NJ	CLP02.04223	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Bromophenyl-phenyl ether (4-)
Certified	Yes	NJ	CLP02.04233	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitroaromatics and isophorone
Certified	Yes	NJ	CLP02.04243	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dinitrotoluene (2,4-)
Certified	Yes	NJ	CLP02.04253	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dinitrotoluene (2,6-)
Certified	Yes	NJ	CLP02.04263	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Isophorone
Certified	Yes	NJ	CLP02.04273	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitrobenzene
Certified	Yes	NJ	CLP02.04293	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Butyl benzyl phthalate
Certified	Yes	NJ	CLP02.04303	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Bis (2-ethylhexyl) phthalate
Certified	Yes	NJ	CLP02.04313	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Diethyl phthalate
Certified	Yes	NJ	CLP02.04323	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dimethyl phthalate
Certified	Yes	NJ	CLP02.04333	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Di-n-butyl phthalate
Certified	Yes	NJ	CLP02.04343	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Di-n-octyl phthalate
Certified	Yes	NJ	CLP02.04363	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Acenaphthene
Certified	Yes	NJ	CLP02.04373	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Anthracene
Certified	Yes	NJ	CLP02.04383	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Acenaphthylene
Certified	Yes	NJ	CLP02.04393	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzo(a)anthracene
Certified	Yes	NJ	CLP02.04403	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzo(a)pyrene
Certified	Yes	NJ	CLP02.04413	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzo(b)fluoranthene
Certified	Yes	NJ	CLP02.04423	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzo(ghi)perylene
Certified	Yes	NJ	CLP02.04433	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzo(k)fluoranthene
Certified	Yes	NJ	CLP02.04443	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Chrysene
Certified	Yes	NJ	CLP02.04453	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	CLP02.04463	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Fluoranthene
Certified	Yes	NJ	CLP02.04473	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Fluorene
Certified	Yes	NJ	CLP02.04483	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	CLP02.04493	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Methylnaphthalene (2-)
Certified	Yes	NJ	CLP02.04503	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Naphthalene
Certified	Yes	NJ	CLP02.04513	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Phenanthrene
Certified	Yes	NJ	CLP02.04523	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Pyrene
Certified	Yes	NJ	CLP02.04543	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Methyl phenol (4-chloro-3-)
Certified	Yes	NJ	CLP02.04553	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Chlorophenol (2-)

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New Jersey Department of Environmental Protection

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ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: CLP02 -- Multi-Media, Multi-Conc. Organics

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CLP02.04563	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dichlorophenol (2,4-)
Certified	Yes	NJ	CLP02.04573	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dimethylphenol (2,4-)
Certified	Yes	NJ	CLP02.04583	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dinitrophenol (2,4-)
Certified	Yes	NJ	CLP02.04593	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dinitrophenol (2-methyl-4,6-)
Certified	Yes	NJ	CLP02.04603	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Methylphenol (2-)
Certified	Yes	NJ	CLP02.04613	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Methylphenol (4-)
Certified	Yes	NJ	CLP02.04623	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitrophenol (2-)
Certified	Yes	NJ	CLP02.04633	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Nitrophenol (4-)
Certified	Yes	NJ	CLP02.04643	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Pentachlorophenol
Certified	Yes	NJ	CLP02.04653	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Phenol
Certified	Yes	NJ	CLP02.04663	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Trichlorophenol (2,4,5-)
Certified	Yes	NJ	CLP02.04673	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Trichlorophenol (2,4,6-)
Certified	Yes	NJ	CLP02.04693	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Acetophenone
Certified	Yes	NJ	CLP02.04703	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Benzaldehyde
Certified	Yes	NJ	CLP02.04713	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Biphenyl (1,1'-)
Certified	Yes	NJ	CLP02.04723	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Caprolactam
Certified	Yes	NJ	CLP02.04733	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Dibenzofuran
Certified	Yes	NJ	CLP02.04743	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Tetrachlorobenzene (1,2,4,5-)
Certified	Yes	NJ	CLP02.04753	NPW, SCM	Extraction, GC/MS/SIM, Capillary	[EPA SOM01.2 (4/2007)]	Tetrachlorophenol (2,3,4,6-)

Category: SHW02 -- Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW02.06900	NPW, SCM	TCLP, Toxicity Procedure, ZHE	[SW-846 1311]	Volatile organics
Certified	Yes	NJ	SHW02.06950	NPW, SCM	TCLP, Toxicity Procedure, Shaker	[SW-846 1311]	Semivolatile organics
Certified	Yes	NJ	SHW02.07000	NPW, SCM	TCLP, Toxicity Procedure, Shaker	[SW-846 1311]	Metals
Certified	Yes	NJ	SHW02.08000	NPW, SCM	Synthetic PPT Leachate Procedure	[SW-846 1312, Rev. 0, 9/94]	Metals - organics

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW03 -- Analyze-Immediately Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW03.01000	NPW, SCM	Aqueous, Electrometric	[SW-846 9040B, Rev. 2, 1/95]	pH

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.05000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Aluminum
Applied	No	NJ	SHW04.05500	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Aluminum
Certified	Yes	NJ	SHW04.06500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Antimony
Certified	Yes	NJ	SHW04.07000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Antimony
Certified	Yes	NJ	SHW04.09000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Arsenic
Certified	Yes	NJ	SHW04.09500	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Arsenic
Certified	Yes	NJ	SHW04.11500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Barium
Certified	Yes	NJ	SHW04.12000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Barium
Certified	Yes	NJ	SHW04.13500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Beryllium
Certified	Yes	NJ	SHW04.14000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Beryllium
Certified	Yes	NJ	SHW04.15100	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Boron
Applied	No	NJ	SHW04.15101	NPW, SCM	ICP/MS	[SW-846 6020]	Boron
Certified	Yes	NJ	SHW04.15500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Cadmium
Certified	Yes	NJ	SHW04.16000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Cadmium
Certified	Yes	NJ	SHW04.17500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Calcium
Applied	No	NJ	SHW04.17505	NPW, SCM	ICP/MS	[SW-846 6020]	Calcium
Certified	Yes	NJ	SHW04.18500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Chromium
Certified	Yes	NJ	SHW04.19000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Chromium
Certified	Yes	NJ	SHW04.22500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Cobalt
Certified	Yes	NJ	SHW04.23000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Cobalt
Certified	Yes	NJ	SHW04.24500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Copper
Certified	Yes	NJ	SHW04.25000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Copper
Certified	Yes	NJ	SHW04.26000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Iron
Applied	No	NJ	SHW04.26005	NPW, SCM	ICP/MS	[SW-846 6020]	Iron
Certified	Yes	NJ	SHW04.27500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Lead

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW04 – Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.28000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Lead
Certified	Yes	NJ	SHW04.30500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Magnesium
Applied	No	NJ	SHW04.30505	NPW, SCM	ICP/MS	[SW-846 6020]	Magnesium
Certified	Yes	NJ	SHW04.31500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Manganese
Certified	Yes	NJ	SHW04.31600	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Manganese
Certified	Yes	NJ	SHW04.34000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Molybdenum
Applied	No	NJ	SHW04.34005	NPW, SCM	ICP/MS	[SW-846 6020]	Molybdenum
Certified	Yes	NJ	SHW04.35500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2, 12/96]	Nickel
Certified	Yes	NJ	SHW04.36000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 7/92]	Nickel
Certified	Yes	NJ	SHW04.38000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Potassium
Applied	No	NJ	SHW04.38505	NPW, SCM	ICP/MS	[SW-846 6020]	Potassium
Certified	Yes	NJ	SHW04.39000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Selenium
Certified	Yes	NJ	SHW04.40600	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Selenium
Certified	Yes	NJ	SHW04.41000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Silver
Certified	Yes	NJ	SHW04.41500	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Silver
Certified	Yes	NJ	SHW04.43000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Sodium
Applied	No	NJ	SHW04.43005	NPW, SCM	ICP/MS	[SW-846 6020]	Sodium
Certified	Yes	NJ	SHW04.44000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Strontium
Applied	No	NJ	SHW04.44001	NPW, SCM	ICP/MS	[SW-846 6020]	Strontium
Certified	Yes	NJ	SHW04.45000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Thallium
Certified	Yes	NJ	SHW04.45500	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Thallium
Certified	Yes	NJ	SHW04.47100	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Tin
Applied	No	NJ	SHW04.47105	NPW, SCM	ICP/MS	[SW-846 6020]	Tin
Applied	No	NJ	SHW04.47150	NPW, SCM	ICP/MS	[SW-846 6020]	Titanium
Applied	No	NJ	SHW04.47170	NPW, SCM	ICP/MS	[SW-846 6020]	Tungsten
Certified	Yes	NJ	SHW04.47500	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Vanadium
Certified	Yes	NJ	SHW04.47505	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Vanadium
Certified	Yes	NJ	SHW04.49000	NPW, SCM	ICP	[SW-846 6010B, Rev. 2 12/96]	Zinc
Certified	Yes	NJ	SHW04.49500	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Zinc

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	SHW05.05110	NPW, SCM	Microwave Extraction	[SW-846 3546]	Semivolatile organics
Applied	No	NJ	SHW05.07200	NPW, SCM	Vacuum Distillation	[SW-846 5032, Rev. 0, 12/96]	Volatile organics
Certified	Yes	NJ	SHW05.12000	NPW, SCM	Cleanup-Florisil	[SW-846 3620B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.13000	NPW, SCM	Cleanup-Silica Gel	[SW-846 3630C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.14000	NPW, SCM	Cleanup-Gel Permeation	[SW-846 3640A, Rev. 1, 9/94]	Semivolatile organics
Applied	No	NJ	SHW05.15000	NPW, SCM	Cleanup-Acid/Base Partition	[SW-846 3650B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.16000	NPW, SCM	Cleanup-Sulfur Removal	[SW-846 3660B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.17000	NPW, SCM	Cleanup-Sulfuric Acid/KMnO4	[SW-846 3665A, Rev. 1, 12/96]	Semivolatile organics
Applied	No	NJ	SHW05.18000	NPW, SCM	Headspace, GC or GC/MS Screen	[SW-846 3810, Rev. 0, 9/86]	Volatile organics

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.04500	NPW, SCM	Extraction, GC, FID	[SW-846 8015B, Rev. 2, 12/96]	Diesel range organic
Certified	Yes	NJ	SHW06.04520	NPW, SCM	Extraction, GC, FID	[OTHER NJ-OQA-QAM-025, Rev. 7]	Petroleum Organics
Certified	Yes	NJ	SHW06.12010	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Aldrin
Certified	Yes	NJ	SHW06.12020	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Alpha BHC
Certified	Yes	NJ	SHW06.12030	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Beta BHC
Certified	Yes	NJ	SHW06.12040	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Delta BHC
Certified	Yes	NJ	SHW06.12050	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Lindane (gamma BHC)
Certified	Yes	NJ	SHW06.12060	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (technical)
Certified	Yes	NJ	SHW06.12070	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (alpha)
Certified	Yes	NJ	SHW06.12080	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (gamma)
Certified	Yes	NJ	SHW06.12090	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDD (4,4'-)
Certified	Yes	NJ	SHW06.12100	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDE (4,4'-)
Certified	Yes	NJ	SHW06.12110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDT (4,4'-)
Certified	Yes	NJ	SHW06.12120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Dieldrin
Certified	Yes	NJ	SHW06.12130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan I
Certified	Yes	NJ	SHW06.12140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan II
Certified	Yes	NJ	SHW06.12150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan sulfate

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.12160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin
Certified	Yes	NJ	SHW06.12170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin aldehyde
Certified	Yes	NJ	SHW06.12180	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin ketone
Certified	Yes	NJ	SHW06.12190	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Heptachlor
Certified	Yes	NJ	SHW06.12200	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Heptachlor epoxide
Certified	Yes	NJ	SHW06.12210	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Methoxychlor
Certified	Yes	NJ	SHW06.12220	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Toxaphene
Certified	Yes	NJ	SHW06.13110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1016
Certified	Yes	NJ	SHW06.13120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1221
Certified	Yes	NJ	SHW06.13130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1232
Certified	Yes	NJ	SHW06.13140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1242
Certified	Yes	NJ	SHW06.13150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1248
Certified	Yes	NJ	SHW06.13160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1254
Certified	Yes	NJ	SHW06.13170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1260
Applied	No	NJ	SHW06.13200	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB Congeners (19)
Certified	Yes	NJ	SHW06.23010	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dalapon
Certified	Yes	NJ	SHW06.23020	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dicamba
Certified	Yes	NJ	SHW06.23021	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Dichlorprop
Certified	Yes	NJ	SHW06.23030	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dinoseb
Certified	Yes	NJ	SHW06.23040	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	D (2,4-)
Certified	Yes	NJ	SHW06.23041	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	DB (2,4-)
Certified	Yes	NJ	SHW06.23050	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	T (2,4,5-)
Certified	Yes	NJ	SHW06.23060	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	TP (2,4,5-) (Silvex)
Certified	Yes	NJ	SHW06.23061	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Dichlorobenzoic acid (3,5-)
Certified	Yes	NJ	SHW06.23063	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	MCPA
Certified	Yes	NJ	SHW06.23064	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	MCPP
Certified	Yes	NJ	SHW06.23065	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Nitrophenol (4-)
Certified	Yes	NJ	SHW06.23066	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Pentachlorophenol
Applied	No	NJ	SHW06.27080	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	D (2,4-)
Applied	No	NJ	SHW06.27110	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	DB (2,4-)
Applied	No	NJ	SHW06.27120	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	Dalapon
Applied	No	NJ	SHW06.27130	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	Dicamba

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Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW06 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	SHW06.27140	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	Dichlorprop
Applied	No	NJ	SHW06.27150	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	Dinoseb
Applied	No	NJ	SHW06.27160	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	MCPA
Applied	No	NJ	SHW06.27170	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	MCPP
Applied	No	NJ	SHW06.27180	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	T (2,4,5-)
Applied	No	NJ	SHW06.27210	NPW, SCM	HPLC, UV Detector	[SW-846 8321A] [SW-846 8321B]	TP (2,4,5-) (Silvex)
Certified	Yes	NJ	SHW06.28010	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	HMX
Certified	Yes	NJ	SHW06.28020	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	RDX
Certified	Yes	NJ	SHW06.28030	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Trinitrobenzene (1,3,5-)
Certified	Yes	NJ	SHW06.28040	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Dinitrobenzene (1,3-)
Certified	Yes	NJ	SHW06.28050	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Tetryl
Certified	Yes	NJ	SHW06.28060	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Nitrobenzene
Certified	Yes	NJ	SHW06.28070	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Trinitrotoluene (2,4,6-)
Certified	Yes	NJ	SHW06.28080	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Dinitrotoluene (4-amino-2,6-)
Certified	Yes	NJ	SHW06.28090	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Dinitrotoluene (2-amino-4,6-)
Certified	Yes	NJ	SHW06.28100	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Dinitrotoluene (2,4-)
Certified	Yes	NJ	SHW06.28110	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Dinitrotoluene (2,6-)
Certified	Yes	NJ	SHW06.28120	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Nitrotoluene (2-)
Certified	Yes	NJ	SHW06.28130	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Nitrotoluene (3-)
Certified	Yes	NJ	SHW06.28140	NPW, SCM	HPLC, UV Detector	[SW-846 8330, Rev. 0, 9/94]	Nitrotoluene (4-)

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04010	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Benzene
Certified	Yes	NJ	SHW07.04011	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromobenzene
Certified	Yes	NJ	SHW07.04012	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butyl benzene (n-)
Certified	Yes	NJ	SHW07.04013	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Sec-butylbenzene
Certified	Yes	NJ	SHW07.04014	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butylbenzene
Certified	Yes	NJ	SHW07.04020	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorobenzene

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04022	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorotoluene (2-)
Certified	Yes	NJ	SHW07.04023	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorotoluene (4-)
Certified	Yes	NJ	SHW07.04030	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SHW07.04040	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SHW07.04050	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SHW07.04060	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethylbenzene
Certified	Yes	NJ	SHW07.04065	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropylbenzene
Certified	Yes	NJ	SHW07.04067	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Propylbenzene (n-)
Certified	Yes	NJ	SHW07.04070	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Toluene
Certified	Yes	NJ	SHW07.04071	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropyltoluene (4-)
Certified	Yes	NJ	SHW07.04072	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,3-)
Certified	Yes	NJ	SHW07.04073	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	SHW07.04074	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	SHW07.04080	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylenes (total)
Certified	Yes	NJ	SHW07.04081	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (m-)
Certified	Yes	NJ	SHW07.04082	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (o-)
Certified	Yes	NJ	SHW07.04083	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (p-)
Certified	Yes	NJ	SHW07.04088	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Allyl chloride
Certified	Yes	NJ	SHW07.04089	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromochloromethane
Certified	Yes	NJ	SHW07.04090	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromodichloromethane
Certified	Yes	NJ	SHW07.04100	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromoform
Certified	Yes	NJ	SHW07.04110	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromomethane
Certified	Yes	NJ	SHW07.04115	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butadiene (2-chloro-1,3-)
Certified	Yes	NJ	SHW07.04120	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon tetrachloride
Certified	Yes	NJ	SHW07.04130	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethane
Certified	Yes	NJ	SHW07.04140	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethyl vinyl ether (2-)
Certified	Yes	NJ	SHW07.04150	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroform
Certified	Yes	NJ	SHW07.04160	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloromethane
Certified	Yes	NJ	SHW07.04170	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	SHW07.04180	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromochloromethane
Certified	Yes	NJ	SHW07.04185	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SHW07.04186	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromomethane

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Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04187	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SHW07.04190	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorodifluoromethane
Certified	Yes	NJ	SHW07.04200	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,1-)
Certified	Yes	NJ	SHW07.04210	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,2-)
Certified	Yes	NJ	SHW07.04220	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (1,1-)
Certified	Yes	NJ	SHW07.04230	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	SHW07.04235	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	SHW07.04240	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (1,2-)
Certified	Yes	NJ	SHW07.04241	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (1,3-)
Certified	Yes	NJ	SHW07.04242	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (2,2-)
Certified	Yes	NJ	SHW07.04249	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (1,1-)
Certified	Yes	NJ	SHW07.04250	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	SHW07.04255	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloro-2-butene (trans-1,4-)
Certified	Yes	NJ	SHW07.04260	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	SHW07.04270	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	SHW07.04280	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethene
Certified	Yes	NJ	SHW07.04282	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrahydrofuran
Certified	Yes	NJ	SHW07.04290	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	SHW07.04300	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	SHW07.04310	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethene
Certified	Yes	NJ	SHW07.04320	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorofluoromethane
Certified	Yes	NJ	SHW07.04322	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	SHW07.04325	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloropropane (1,2,3-)
Certified	Yes	NJ	SHW07.04327	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl acetate
Certified	Yes	NJ	SHW07.04330	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl chloride
Certified	Yes	NJ	SHW07.04340	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetone
Certified	Yes	NJ	SHW07.04350	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon disulfide
Certified	Yes	NJ	SHW07.04360	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butanone (2-)
Certified	Yes	NJ	SHW07.04367	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl methacrylate
Certified	Yes	NJ	SHW07.04370	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexanone (2-)
Certified	Yes	NJ	SHW07.04371	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methacrylonitrile
Certified	Yes	NJ	SHW07.04373	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl methacrylate

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30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04375	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl iodide
Certified	Yes	NJ	SHW07.04376	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Iso-butyl alcohol
Applied	No	NJ	SHW07.04379	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Pentachloroethane
Certified	Yes	NJ	SHW07.04380	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Pentanone (4-methyl-2-)
Certified	Yes	NJ	SHW07.04385	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Propionitrile
Certified	Yes	NJ	SHW07.04390	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl tert-butyl ether
Certified	Yes	NJ	SHW07.04395	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butyl alcohol
Applied	No	NJ	SHW07.04398	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetonitrile
Certified	Yes	NJ	SHW07.04400	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrolein
Certified	Yes	NJ	SHW07.04410	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrylonitrile
Certified	Yes	NJ	SHW07.04500	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SHW07.04540	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Naphthalene
Certified	Yes	NJ	SHW07.04550	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Styrene
Certified	Yes	NJ	SHW07.04560	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,1,2-)
Certified	Yes	NJ	SHW07.04570	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SHW07.04590	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dioxane (1,4-)
Certified	Yes	NJ	SHW07.04665	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acetophenone
Certified	Yes	NJ	SHW07.04670	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acetylaminofluorene (2-)
Certified	Yes	NJ	SHW07.04675	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Aminobiphenyl (4-)
Certified	Yes	NJ	SHW07.04680	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Aramite
Applied	No	NJ	SHW07.04702	NPW, SCM	GC/MS, Extract, or Direct Injection, Capillary	[SW-846 8270C]	Biphenyl (1,1'-)
Certified	Yes	NJ	SHW07.04705	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chlorobenzilate
Certified	Yes	NJ	SHW07.04715	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diallate (cis)
Certified	Yes	NJ	SHW07.04720	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diallate (trans)
Certified	Yes	NJ	SHW07.04755	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorophenol (2,6-)
Certified	Yes	NJ	SHW07.04760	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethoate
Certified	Yes	NJ	SHW07.04767	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethylaminoazobenzene
Certified	Yes	NJ	SHW07.04770	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethylbenz(a)anthracene (7,12-)
Certified	Yes	NJ	SHW07.04775	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethyl benzidine (3,3-)
Certified	Yes	NJ	SHW07.04795	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Famphur
Certified	Yes	NJ	SHW07.04810	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Isodrin
Certified	Yes	NJ	SHW07.04815	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Isosafrole (cis-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04820	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Isosafrole (trans-)
Certified	Yes	NJ	SHW07.04830	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methanesulfonate (Ethyl-)
Certified	Yes	NJ	SHW07.04835	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methanesulfonate (Methyl-)
Certified	Yes	NJ	SHW07.04840	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methapyrilene
Certified	Yes	NJ	SHW07.04845	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylcholanthrene (3-)
Certified	Yes	NJ	SHW07.04850	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Napthoquinone (1,4-)
Certified	Yes	NJ	SHW07.04855	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Napththylamine (1-)
Certified	Yes	NJ	SHW07.04860	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Napththylamine (2-)
Applied	No	NJ	SHW07.04866	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Nitrodiphenylamine (2-)
Certified	Yes	NJ	SHW07.04870	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitroso-di-n-butylamine
Certified	Yes	NJ	SHW07.04875	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosomorpholine
Certified	Yes	NJ	SHW07.04880	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosopiperidine
Certified	Yes	NJ	SHW07.04885	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Parathion
Certified	Yes	NJ	SHW07.04890	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Parathion methyl
Certified	Yes	NJ	SHW07.04895	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pentachlorobenzene
Certified	Yes	NJ	SHW07.04900	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pentachloroethane
Certified	Yes	NJ	SHW07.04905	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pentachloronitrobenzene
Certified	Yes	NJ	SHW07.04910	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenacetin
Certified	Yes	NJ	SHW07.04920	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenylethylamine (alpha, alpha-Dimethyl)
Certified	Yes	NJ	SHW07.04925	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phorate
Certified	Yes	NJ	SHW07.04930	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phosphorothioate (O,O,O-triethyl)
Certified	Yes	NJ	SHW07.04940	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Picoline (2-)
Certified	Yes	NJ	SHW07.04945	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pronamide
Certified	Yes	NJ	SHW07.04950	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Quinoline -1-Oxide (4-Nitro)
Certified	Yes	NJ	SHW07.04955	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Safrole
Certified	Yes	NJ	SHW07.04960	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Sulfotepp
Certified	Yes	NJ	SHW07.04975	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Tetrachlorobenzene (1,2,4,5-)
Certified	Yes	NJ	SHW07.04980	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Tetrachlorophenol (2,3,4,6-)
Certified	Yes	NJ	SHW07.04985	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Toluidine (2-) (2-Methylaniline)
Certified	Yes	NJ	SHW07.04990	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Toluidine (5-Nitro-2-)
Certified	Yes	NJ	SHW07.05004	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodiethylamine
Certified	Yes	NJ	SHW07.05005	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodimethylamine

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.05006	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitroso-di-n-propylamine
Certified	Yes	NJ	SHW07.05010	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodiphenylamine
Certified	Yes	NJ	SHW07.05011	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosomethylethylamine
Certified	Yes	NJ	SHW07.05012	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosopyrrolidine
Certified	Yes	NJ	SHW07.05020	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diphenylamine
Certified	Yes	NJ	SHW07.05030	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Carbazole
Certified	Yes	NJ	SHW07.05038	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzidine
Certified	Yes	NJ	SHW07.05040	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzidine (3,3'-)
Certified	Yes	NJ	SHW07.05045	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diphenylhydrazine (1,2-)
Certified	Yes	NJ	SHW07.05048	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Aniline
Certified	Yes	NJ	SHW07.05050	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chloraniline (4-)
Certified	Yes	NJ	SHW07.05060	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (2-)
Certified	Yes	NJ	SHW07.05062	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (3-)
Certified	Yes	NJ	SHW07.05063	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (4-)
Certified	Yes	NJ	SHW07.05070	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chloronaphthalene (2-)
Certified	Yes	NJ	SHW07.05080	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorobenzene
Certified	Yes	NJ	SHW07.05090	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SHW07.05100	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorocyclopentadiene
Certified	Yes	NJ	SHW07.05110	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachloroethane
Certified	Yes	NJ	SHW07.05115	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachloropropene
Certified	Yes	NJ	SHW07.05120	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SHW07.05130	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroethoxy) methane
Certified	Yes	NJ	SHW07.05132	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroethyl) ether
Certified	Yes	NJ	SHW07.05140	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroisopropyl) ether
Certified	Yes	NJ	SHW07.05150	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chlorophenyl-phenyl ether (4-)
Certified	Yes	NJ	SHW07.05160	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bromophenyl-phenyl ether (4-)
Certified	Yes	NJ	SHW07.05170	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrotoluene (2,4-)
Certified	Yes	NJ	SHW07.05180	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrotoluene (2,6-)
Certified	Yes	NJ	SHW07.05190	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Isophorone
Certified	Yes	NJ	SHW07.05200	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrobenzene
Certified	Yes	NJ	SHW07.05210	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Butyl benzyl phthalate
Certified	Yes	NJ	SHW07.05220	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-ethylhexyl) phthalate

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New Jersey Department of Environmental Protection

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ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.05230	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diethyl phthalate
Certified	Yes	NJ	SHW07.05240	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethyl phthalate
Certified	Yes	NJ	SHW07.05250	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Di-n-butyl phthalate
Certified	Yes	NJ	SHW07.05260	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Di-n-octyl phthalate
Certified	Yes	NJ	SHW07.05270	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acenaphthene
Certified	Yes	NJ	SHW07.05280	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Anthracene
Certified	Yes	NJ	SHW07.05290	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acenaphthylene
Certified	Yes	NJ	SHW07.05300	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)anthracene
Certified	Yes	NJ	SHW07.05310	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)pyrene
Certified	Yes	NJ	SHW07.05320	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(b)fluoranthene
Certified	Yes	NJ	SHW07.05330	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(ghi)perylene
Certified	Yes	NJ	SHW07.05340	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(k)fluoranthene
Certified	Yes	NJ	SHW07.05350	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chrysene
Certified	Yes	NJ	SHW07.05360	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	SHW07.05370	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Fluoranthene
Certified	Yes	NJ	SHW07.05380	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Fluorene
Certified	Yes	NJ	SHW07.05390	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	SHW07.05400	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylnaphthalene (2-)
Certified	Yes	NJ	SHW07.05410	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Naphthalene
Certified	Yes	NJ	SHW07.05420	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenanthrene
Certified	Yes	NJ	SHW07.05430	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pyrene
Certified	Yes	NJ	SHW07.05440	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methyl phenol (4-chloro-3-)
Certified	Yes	NJ	SHW07.05450	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chlorophenol (2-)
Certified	Yes	NJ	SHW07.05460	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorophenol (2,4-)
Certified	Yes	NJ	SHW07.05470	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethylphenol (2,4-)
Certified	Yes	NJ	SHW07.05480	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrophenol (2,4-)
Certified	Yes	NJ	SHW07.05490	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrophenol (2-methyl-4,6-)
Certified	Yes	NJ	SHW07.05500	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (2-)
Certified	Yes	NJ	SHW07.05510	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (4-)
Certified	Yes	NJ	SHW07.05520	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrophenol (2-)
Certified	Yes	NJ	SHW07.05530	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrophenol (4-)
Certified	Yes	NJ	SHW07.05540	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pentachlorophenol

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 10/09/2009 until 06/30/2010

Laboratory Name: TESTAMERICA LABORATORIES INC.- BURLINGTON Laboratory Number: VT972 Activity ID: NLC090002
30 COMMUNITY DR STE 11
SOUTH BURLINGTON, VT 05403

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.05550	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenol
Certified	Yes	NJ	SHW07.05560	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorophenol (2,4,5-)
Certified	Yes	NJ	SHW07.05570	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorophenol (2,4,6-)
Certified	Yes	NJ	SHW07.05590	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (3-)
Certified	Yes	NJ	SHW07.05600	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dibenzofuran
Certified	Yes	NJ	SHW07.05691	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SHW07.05692	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SHW07.05700	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,4-)
Applied	No	NJ	SHW07.05705	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Benzaldehyde
Certified	Yes	NJ	SHW07.05710	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzoic acid
Certified	Yes	NJ	SHW07.05720	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzyl alcohol
Certified	Yes	NJ	SHW07.05750	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pyridine
Applied	No	NJ	SHW07.05765	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Caprolactam
Applied	No	NJ	SHW07.05990	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Atrazine
Applied	No	NJ	SHW07.07584	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)anthracene
Applied	No	NJ	SHW07.07586	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)pyrene
Applied	No	NJ	SHW07.07588	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(b)fluoranthene
Applied	No	NJ	SHW07.07590	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(k)fluoranthene
Applied	No	NJ	SHW07.07594	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dibenzo(a,h)anthracene
Applied	No	NJ	SHW07.07598	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Indeno(1,2,3-cd)pyrene

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.05000	NPW, SCM	Colorimetric, Automated	[SW-846 9012A, Rev. 1, 12/96]	Cyanide
Certified	Yes	NJ	SHW09.09000	NPW, SCM	Redox Titration	[SW-846 9030B, Rev. 2, 12/96]	Sulfides, acid sol. & insol.
Certified	Yes	NJ	SHW09.10100	NPW, SCM	Titration	[SW-846 9034, Rev. 0, 12/96]	Sulfides, acid sol. & insol.
Certified	Yes	NJ	SHW09.14000	NPW, SCM	Electrometric	[SW-846 9040B, Rev. 2, 1/95]	pH - waste, >20% water
Certified	Yes	NJ	SHW09.34165	NPW, SCM	LC/MS or LC/MS/MS	[SW-846 6850]	Perchlorate

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Category: SHW10 -- Facility-Specific Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	SHW10.21100	NPW, SCM	GC/MS	[USER DEFINED No method specified]	Alkylated PAHs

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.03000	SCM	Acid Digestion, Soil Sediment & Sludge	[SW-846 3050B, Rev. 2, 12/96]	Metals
Certified	Yes	NJ	SHW04.33500	SCM	AA, Manual Cold Vapor	[SW-846 7471A, Rev. 1, 9/94]	Mercury - solid waste

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.03000	SCM	Soxhlet Extraction	[SW-846 3540C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.04000	SCM	Automatic Soxhlet Extraction	[SW-846 3541, Rev. 0, 9/94]	Semivolatile organics
Certified	Yes	NJ	SHW05.05000	SCM	Ultrasonic Extraction	[SW-846 3550B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.06000	SCM	Waste Dilution	[SW-846 3580A, Rev. 1, 7/92]	Organics
Applied	No	NJ	SHW05.06100	SCM	Waste Dilution, Volatile organics	[SW-846 3585]	Organics
Certified	Yes	NJ	SHW05.07300	SCM	Closed System Purge & Trap	[SW-846 5035L, Rev. 0, 12/96] [SW-846 5035A]	Volatile organics - low conc.
Certified	Yes	NJ	SHW05.07310	SCM	Methanol Extract, Closed System P & T	[SW-846 5035H, Rev. 0, 12/96] [SW-846 5035A]	Volatile organics - high conc.

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.16000	SCM	Mix with Water or Calcium Chloride	[SW-846 9045C, Rev. 3, 1/95]	pH - soil and waste
Certified	Yes	NJ	SHW09.29000	SCM	Flow-Through Paint Filter, Observation	[SW-846 9095, Rev. 0, 9/86]	Free liquid

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Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	SHW09.40000	SCM	Soils, Sodium Acetate	[SW-846 9081, Rev. 0, 9/86]	Cation-exchange capacity

Joseph F. Aiello, Chief

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