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CORRECTIVE MEASURES STUDY INVESTIGATION
REPORT 38-EH-0995-11
CAMP MOSCRIP SWMU 73
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
28 MARCH – 11 APRIL 2008, 11-16 JANUARY 2009, AND 31 JANUARY – 02 FEBRUARY 2011

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EXECUTIVE SUMMARY
CORRECTIVE MEASURES STUDY INVESTIGATION
REPORT 38-EH-0995-11
CAMP MOSCRIP SWMU 73
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO
28 MARCH – 11 APRIL 2008, 11-16 JANUARY 2009, AND 31 JANUARY – 02 FEBRUARY 2011

1.0 PURPOSE.

The purpose of this report is to provide the results of the site characterization and to assess the need for future action at Solid Waste Management Unit (SWMU) 73. Environmental media samples were collected and analyzed for suspect contaminants of concern (COCs) based on previous land uses and environmental studies. The data generated during this study, along with data collected during a May 2004 Environmental Condition of Property investigation, were used to determine potential risks to human health and the environment as a result of past activities on site. Corrective action objectives (CAOs) were not developed because no potential risks were identified.

2.0 METHODOLOGY AND OBJECTIVES.

The Corrective Measures Study (CMS) Investigation Report for SWMU 73 (the former Defense Reutilization and Marketing Office (DRMO) Scrap Metal Recycling Yard), Naval Activity Puerto Rico (NAPR), Ceiba, Puerto Rico was conducted by the U.S. Army Public Health Command during three field events. The first field event was conducted from 28 March 2008 through 11 April 2008, the second from12 January 2009 through 16 January 2009, and the third from 31 January 2011 through 2 February 2011. A draft report for the first two sampling events was submitted in August 2010. Regulatory comments on the August 2010 report were received in May 2010. The 2011 sampling was conducted in response to those regulatory comments. This revised draft was prepared to address the regulatory comments and provide an updated assessment that included the 2011 data. This report was prepared under the Resource Conservation and Recovery Act Administrative Order of Consent between the U.S. Environmental Protection Agency (EPA) and the Department of the Navy (EPA Docket No. 02-2007-7301).

The original report objective was to comply with the EPA Administrative Order on Consent which requires that a CMS be conducted at SWMU 73. The following individual objectives were addressed during the investigation to achieve the report objective.

- Characterize surface soils, subsurface soils, and groundwater to assess the levels and extent of COCs at SWMU 73.
- Develop and consider CAOs based on realistic ecological and health exposure pathways.
- Determine a corrective action, if required, for SWMU 73.

3.0 SITE DESCRIPTION AND HISTORICAL USE.

3.1 NAPR Description and History.

NAPR, formerly known as Naval Station Roosevelt Roads (NSRR), occupies over 8,800 acres on the northern side of the east coast of Puerto Rico. The installation is located within the town of Ceiba, approximately 35 miles southeast of San Juan and 5 miles south of Fajardo.

The installation was commissioned as a Naval Operations Base in 1943 and was re-designated as NSRR in 1957. The NSRR was permanently closed on March 31, 2004, and the U.S. Naval Forces Southern Command was relocated to the Naval Station Mayport, Florida. The mission of the NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal.

3.2 SWMU 73 Description and History.

The approximately 9-acre SWMU 73 is located inside of the loop formed by the three roads: Breton Road, Antietam Road, and Barnes Street at NAPR at geographic coordinates 18°13’51” latitude and 65°36’32” longitude. The site contains concrete pads, concrete storage bins, hardpacked gravel surfaces, and a wooded area; approximately 80 percent of SWMU 73 is wooded. The portion of the site outside of the wooded area is surrounded by a chain-link fence and is located along the eastern boundary. One small building is located within the cleared area.

SWMU 73 primarily served as the scrap metal recycling yard for the DRMO with active operations during the 1970s through 2004. Previous uses of the property are not known, but little activity outside of a road and possible staging area was observed from aerial photographs taken in 1936, 1958, 1961, and 1964. Beyond the boundary of the yard itself, it was decided that SWMU 73 would include the surrounding area of secondary growth bounded by Barnes Road to the east and partially encircled by Antietam Road and Breton Road to the north and west due to the amount of debris observed within the area.

4.0 FINDINGS.

4.1 Physical Results.

Three of four subsurface borings advanced during the CMS field investigation encountered subsurface water and were converted to monitoring wells 73MW01, 73MW02, and 73MW03. The remaining boring was sealed with bentonite grout and was abandoned.

At the former DRMO scrap metal yard, hardpacked gravel was encountered within inches of the ground surface. Deeper soils consisted of fill material to a depth of at least 15 feet below the ground surface (bgs). Groundwater was encountered at about 9 feet bgs at this location.

Within the wooded area, the top few inches of soil consisted of mostly organic topsoil containing plant rootlets. Deeper soils consisted of silty clay of varying color. Groundwater occurred at a depth of approximately 20 – 24 feet bgs in this area.

The direction of groundwater flow was confirmed to be toward the southeast based on water level data collected in 2009 and 2011.

4.2 Analytical Results.

4.3 Identification of Chemicals of Concern (COC).

COCs are those substances in media (i.e., surface soil, subsurface soil, and groundwater) that are evaluated during the risk assessment calculations. The following table provides a summary of COCs identified through the initial screening processes during the ecological and human health risk assessments.

4.4 Ecological Risk Assessment Summary.

A screening-level ecological risk assessment was conducted using sampling data for surface soil, subsurface soil, and groundwater at SWMU 73. Various chemicals were retained as COCs and further evaluated in a more refined Step 3a of the ERA. Based on the refined media-specific risk evaluations presented in this report, no chemicals were recommended for further evaluation for the surface soil, subsurface soil, or groundwater pathways, or for the terrestrial food web exposures for surface soil or subsurface soil.

4.5 Human Health Risk Assessment Summary.

The quantitative assessment indicated that the site hazard indices (HIs) for future adult and child residents (3.7 and 10.9, respectively) as well as construction workers (1.4) exceeded the safe level of 1.0. However, further evaluation shows that these findings are artificially elevated. The HI exceedences for all three receptors are due in large part to exposure point concentrations (EPCs) that are elevated due to one or more outliers being included in the dataset. Recalculating

TABLE E. CHEMICALS OF CONCERN RETAINED DURING INITIAL SCREENING PROCESS FOR ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENTS.

COC	Surface Soils			Subsurface Soils			Groundwater	
	Screening Level Ecological Risk	**Terrestrial Food Web Exposure**	**Human Health Risk**	**Ecological Risk**	**Terrestrial Food Web Exposure**	**Human Health Risk**	**Screening Level Ecological Risk**	**Human Health Risk**
Pesticides								
p,p'-DDD	X	X	Z	X	X	Z	X	Z
p,p'-DDE	X	X	Z	X	X	Z		Z
p,p'-DDT	X	X	Z	X	X	Z	X	Z
Chlordane	X	X	Z	X				
delta-BHC	X							
Dieldrin	X		Z					
endosulfan sulfate	X		Z					
Endrin				X	X			
endrin aldehyde	X	X	Z					
Heptachlor	X		Z					
heptachlor epoxide	X		Z					
Kepone (chlordecone)	X	X	Z					
Methoxychlor	X							
Polychlorinated Biphenyls (PCBs)								
Aroclor 1248	Y		Z					
Aroclor 1254	Y	X	Z					
Aroclor 1260	Y		Z					
Low Level Polycyclic Aromatic Hydrocarbons (PAHs)								
Acenaphthylene			Z			Z		
Benzo(a) anthracene	X		Z			Z		
Benzo(a)pyrene	X		Z			Z		
Benzo(b) fluoranthene	X		Z			Z		
Benzo(g,h,i) perylene	X		Z			Z		
Benzo(k) fluoranthene	X		Z					
Chrysene	X		Z					
Dibenz[a,h] anthracene			Z			Z		
Fluoranthene	X							
Indeno(1,2,3-cd) pyrene	X		Z					
Naphthalene								Z
Phenanthrene			Z					Z
Pyrene	X							

X – Analyte identified as ecological COC based on screening level risk calculation results with maxiumum concentrations exceeding the soil or groundwater screening value (target level hazard quotient (HQ)≥1), or had HQ≥1for one or more of the terrestrial avian receptors).

Y – Analyte identified as ecological COC based on the lack of soil screening values.

Z – Analyte identified as COC during initial human health risk assessment screening process.

TABLE E (continued). CHEMICALS OF CONCERN RETAINED DURING INITIAL SCREENING PROCESS FOR ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENTS.

COC	Surface Soils			Subsurface Soils			Groundwater	
	Screening Level Ecological Risk	**Terrestrial Food Web Exposure**	**Human Health Risk**	**Ecological Risk**	**Terrestrial Food Web Exposure**	**Human Health Risk**	**Screening Level Ecological Risk**	**Human Health Risk**
Metals								
Arsenic			Z					Z
Barium	X							
Cadmium							X	
Chromium	X	X		X	X	Z		
Cobalt	X	X		X		Z	X	
Copper	X	X		X	X		X	
Lead	X							
Molybdenum				Y	X			
Nickel	X						X	
Selenium				X				
Silver							X	
Sulfide	Y			Y				
Thallium	X							
Tin				Y				
Vanadium	X	X		X	X			
Zinc	X	X		X	X		X	
Mercury	X	X		X	X			
SVOC								
Bis(2-ethylhexyl) phthalate								Z
Volatile Organic Compounds (VOCs)								
2-butanone (MEK)	Y			Y				
Acetone	Y			Y				
Allyl chloride				Y				
Bromomethane	Y			Y				
Carbon disulfide	Y			Y				
Chloromethane				Y				
Methyl iodide	Y		Z	Y		Z		

X – Analyte identified as ecological COC based on screening level risk calculation results with maxiumum concentrations exceeding the soil or groundwater screening value (target level HQ≥1), or had HQ≥1for one or more of the terrestrial avian receptors).
Y – Analyte identified as ecological COC based on the lack of soil screening values.
Z – Analyte identified as COC during initial human health risk assessment screening process.

the EPCs with the outliers removed results in soil contact hazard quotients of 0.7, 0.08, and 0.8 for children, adults, and construction workers, respectively. The results of the carcinogenic evaluation are similar. While all of the calculated cancer risk levels were above the 1E-6 level, only the future child and adult resident exceeded 1E-4. However, as with the HI, both of these elevated results are due almost entirely to arsenic ingestion in groundwater and exposure to kepone in surface soil. Public drinking water is already provided to the site and the shallow groundwater sampled during the investigation is not a viable potable source. Using the adjusted EPC for kepone reduces the surface soil contact risk estimates to 3.7E-5, 1.8E-5, and 1.6E-6 for children, adults, and construction workers, respectively.

5.0 CONCLUSIONS.

A large number of COCs were identified using analytical data collected at the site for surface soil, subsurface soil, and groundwater during the initial risk assessment screening process.

The ecological risk assessment conducted for COCs concluded that no chemicals were recommended for further evaluation for the surface soil, subsurface soil, or groundwater pathways, or for the terrestrial food web exposures for surface soil or subsurface soil.

The human health risk assessment conducted for COCs concluded that most of the hazard index exceedences were due to the inclusion of outliers in the data set. Calculated cancer risk levels exceeded allowable levels due to arsenic ingestion in groundwater and exposure to kepone in surface soil.

Public drinking water is provided to the site and shallow groundwater sampled during the investigation is not a viable potable source. The planned site use is industrial with a paved parking lot built over the site. It is therefore unlikely that human health would be affected by remaining levels of COCs in surface soil, subsurface soil, or groundwater at the site.

6.0 RECOMMENDATION.

No further action is recommended at this site.

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ACRONYMS AND ABBREVIATIONS

AUF	Area Use Factor
BAF	Bioaccumulation Factor
$BAFi_x$	Surface Soil-Biota BAF for Chemical x and Food Item i
Ba_{mammal}	Biotransfer Factor for Mammals
BCF	Bioconcentration Factor
$BCFi_x$	Surface Soil-Biota BCF for Chemical x and Food Item i
$BCF_{s\text{-}om}$	Bioconcentration Factor for Soil to Omnivorous Mammals
$BCF_{tp\text{-}om}$	Bioconcentration Factor for Plants to Omnivorous Mammals
BERA	Baseline ecological risk assessment
BW	Body Weight
BW_j	Body Weight for Receptor j
CMS	Corrective Measures Study
CAO	Corrective Action Objective
CAO_x	Corrective Action Objective for Chemical x
COC	Contaminant of Concern
COPC	Chemical of Potential Concern
$C_{om,x}$	COPC Concentration in Omnivorous Mammals
C_{sx}	Maximum COPC Concentration in Soil
$C_{ti(x)}$	COPC Concentration in Invertebrates
C_{tp}	Maximum COPC Concentration in Terrestrial Plants
CSM	Conceptual Site Model
D	Day
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DEHP	Di(2-ethylhexyl)phthalate
DI_x	Dietary Intake for Chemical
DLS	Directorate of Laboratory Services
DRMO	Defense Reutilization and Marketing Office
Dw	dry weight
ECP	Environmental Condition of Property
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ERA	Ecological Risk Assessment
FCM	Food Chain Multiplier
FC_{xi}	Maximum Concentration of Chemical "x" in Food Item "i"
FIR	Food Ingestion Rate
FIR_j	Food Ingestion Rate for Receptor j
F_{tp}	Fraction of Diet Comprised of Terrestrial Plants
FW	Fresh Weight
HI	Hazard Index
HQ	Hazard Quotient
ICV	Initial Calibration Verification

IDW	Investigative Derived Waste
Ir_f	Ingestion Rate of Food
Kg	Kilogram
LCS	Laboratory Control Sample
LLPAH	Low Level Polycyclic Aromatic Hydrocarbon
LOAEL	Low Observable Adverse Effect Level
$\log K_{ow}$	Octanol-Water Partition Coefficient
MATC	Maximum Acceptable Toxicant Concentration
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
Mg	Milligram
MOA	Memorandum of Agreement
NAPR	Naval Activity Puerto Rico
NOAEL	No Observable Adverse Effect Level
NSRR	Naval Station Roosevelt Roads
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDF_i	Proportion of Diet Composed of Food Item i
PDF_{ij}	Proportion of Diet Composed of Food Item i for Receptor j
PDS	Proportion of diet composed of Surface Ssoil
PDS_j	Proportion of Diet Composed of Surface Soil for Receptor j
PID	Photo Ionization Detector
P_{ti}	Percentage of Invertebrates in Diet that is Contaminated
P_{tp}	Percentage of Plants in Diet that is Contaminated
P_s	Proportion of Soil in Diet that is Contaminated
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource, Conservation, and Recovery Act
RSL	Regional Screening Level
SC_x	Maximum Concentration of Chemical x in Surface Soil
SLERA	Screening level ecological risk assessment
SVOC	Semivolatile Organic Constituent
SV_x	Medium-Specific Screening Value
SV_{xj}	Ingestion Based Screening Value for Chemical i Applied to Receptor j
SWMU	Solid Waste Management Unit
TL2	Trophic Level 2
TL3	Trophic Level 3
TL4	Trophic Level 4
UCL	Upper Confidence Limit
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
VOC	Volatile Organic Constituent
w_x	Dry-To-Wet Weight Conversion Factor

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1.0 INTRODUCTION.

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The Department of the Army, Army Reserve Command and the Department of the Navy finalized a Memorandum of Agreement (MOA) wherein the Army accepted the parcel of land that contained SWMU 73 from the Navy during September 2009. As part of the MOA, the Department of the Army executed the environmental requirements under the Order between the EPA and Department of the Navy. All Army-generated documents for SWMU 73 were submitted to the EPA through the Navy.

1.1 Purpose of Report.

The purpose of this report is to provide the results of the site characterization and to assess the need for future action at SWMU 73. Environmental media samples were collected and analyzed for suspect contaminants of concern (COCs) based on previous land uses and environmental studies. The data generated during this study, along with data collected during a May 2004 Environmental Condition of Property (ECP) investigation were used to determine potential risks to human health and the environment as a result of past activities on site. Corrective action

objectives (CAOs) were not developed because potential risks from the evaluation of the data were not identified.

1.2 Objectives.

The report objective is to comply with the EPA Administrative Order on Consent which requires that a CMS be conducted at SWMU 73 (EPA, 2007). The following individual objectives were considered during the investigation to achieve the report objective.

- Characterize surface soils, subsurface soils, and groundwater to assess the levels and extent of COCs at SWMU 73.
- Develop and consider CAOs based on realistic ecological and health exposure pathways.
- Determine a corrective action, if required, for SWMU 73.

1.3 Organization of the CMS Investigation Report.

This CMS report is organized into 11 sections that fulfill the information elements outlined in Paragraph 4.0 of the CMS Work Plan. Sections 1 and 2 present the purpose and objectives of the CMS report and provide a brief summary of the background of NAPR. The physical setting for NAPR is discussed in Section 3. Section 4 provides a description of the 2008, 2009, and 2011 CMS investigation field work activities including soil and groundwater sampling, quality assurance/quality control (QA/QC) procedures, and other investigation considerations. Section 5 presents and discusses the physical results of the CMS investigation including the site geology/hydrogeology and other current conditions observed during the investigation. Section 6 presents the results of the chemical analyses performed on the environmental media samples and QA/QC samples collected during the CMS investigation. Analytical results from previous investigations are also included in this section for purposes of developing a comprehensive view of site contamination. Section 7 discusses the ecological risk assessment (ERA) and development of CAOs based on protection of potential ecological receptors. Similarly, Section 8 provides an evaluation of human health risks and develops CAOs based on protection of potential human receptors. A summary of the ecological and human health risk assessment is provided in Section 9. Section 10 provides recommendations.

1.4 References.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

EPA, 2007. RCRA § 7003 Administrative Order on Consent. In the Matter of: United States The Department of the Navy, Naval Activity Puerto Rico formerly Naval Station Roosevelt Roads, Puerto Rico. U.S. Environmental Protection Agency, EPA Docket No. 02-2007-7301. January 29, 2007.

2.0 BACKGROUND.

2.1 NAPR Description and History.

NAPR, formerly known as Naval Station Roosevelt Roads (NSRR), occupies over 8,800 acres on the northern side of the east coast of Puerto Rico (Figure 1) along Vieques Passage with Vieques Island lying to the east about 10 miles off of the harbor entrance. Noncontiguous property owned as part of the installation includes the islands of Piñeros and Cabeza de Perro. The installation is located within the town of Ceiba, approximately 35 miles southeast of San Juan and 5 miles south of Fajardo. Sensitive environments include wildlife habitat, wetlands, and mangrove which comprise approximately 4,955 acres within the installation (Baker, 2008).

The installation was commissioned as a Naval Operations Base in 1943 and was re-designated as NSRR in 1957. The NSRR was permanently closed on March 31, 2004, and the U.S. Naval Forces Southern Command was relocated to the Naval Station Mayport, Florida. The mission of the NAPR is to protect the physical assets remaining, comply with environmental regulations, and sustain the value of the property until final disposal (Baker, 2008).

2.2 SWMU 73 Description and History.

SWMU 73 is located inside of the loop formed by the three roads: Breton Road, Antietam Road, and Barnes Street at NAPR with geographic coordinates of 18°13’51” latitude and 65°36’32” longitude. The site contains concrete pads, concrete storage bins, hardpacked gravel surfaces, and a wooded area; approximately 80 percent of SWMU 73 is wooded. The portion of the site outside of the wooded area is surrounded by a chain-link fence and is located along the eastern boundary. One small building (approximately 12 feet by 12 feet), is located immediately to the left once inside the entrance gate to the cleared area.

SWMU 73 is located in the near-shore flatlands on NAPR and is approximately 9 acres in size. It’s an irregular-shaped parcel, roughly oriented along a northeast-southwest axis, in close proximity to, and at one point sharing a boundary with SWMU 6, which is approximately 2.5 acres in size (Figure 2).

SWMU 73 primarily served as the scrap metal recycling yard for the DRMO with active operations during the 1970s through 2004. Previous uses of the property are not known, but little activity outside of a road and possible staging area was observed from aerial photographs taken in 1936, 1958, 1961, and 1964. Beyond the boundary of the yard itself, it was decided that SWMU 73 would include the surrounding area of secondary growth bounded by Barnes Road to the east and partially encircled by Antietam Road and Breton Road to the north and west due to the amount of debris observed within the area.

2.3 Previous Investigations.

A Phase I Environmental Condition of Property (ECP) assessment commenced in 2004 (LANDTDIV, 2004a). The assessment identified a number of areas of presumed petroleum, oils, and lubricants stained surface soils and stressed vegetation within and surrounding the gravel storage area. Known as ECP Site 19 at the time, the site was determined to require a Phase II investigation.

A follow-up 2004 Phase II ECP was conducted to target locations determined to be suspect during the Phase I assessment (LANDTDIV, 2005). The Phase II work evaluated nine surface soil samples, three subsurface soil sample locations, and three groundwater samples from within the confines of SWMU 73 (Figure 2). Three surface soil locations (19E-03, 19E-SS06, and 19E-SS07) were concluded to contain levels of contamination above EPA Regional Screening Levels (Tables 1, 2, and 3) and warranted further investigation (LANTDIV, 2005).

2.4 References.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

Naval Facilities Engineering Command, Atlantic (LANTDIV), 2005. Final Phase I/II Environmental Condition of Property Report, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia. 15 July 2005.

3.0 PHYSICAL CHARACTERISTICS OF STUDY AREA.

3.1 Climatology.

Climate conditions at NAPR are typical of a tropical-marine climate. A tropical-marine climate is mainly characterized as having one wet and one dry season during the year. At NAPR the wet season generally occurs during May through November. Temperatures remain stable, humidity moderate, and rain showers occur with frequency throughout the year. NAPR is located on the windward side of the island where the prevailing winds are the Easterly Trade Winds. The annual mean temperature at NAPR is 85.6 degrees Fahrenheit (°F). August is the warmest month (82.4°F) and February is the coldest month (76.8°F). Easterly trade winds, which persist throughout the year, have a substantial moderating effect on the tropical heat. The relative humidity averages 65-78% with an average annual rainfall at approximately 58 inches. Hurricane season occurs from June 1 through November 30 (LANTDIV, 2005).

3.2 Topography.

The region encompassing NAPR consists of an interrupted, narrow coastal plain with small valleys extending from the Sierra de Luquillo range, which has been severely eroded by streams into valleys several hundreds of feet deep. Slopes of up to 60 percent are common (LANTDIV, 2005). In the immediate area of SWMU 73, topography is relatively flat with elevations ranging from just above sea level to approximately 15 feet above sea level (U.S. Geological Survey (USGS), 1982).

3.3 Geology, Hydrology, and Hydrogeology.

The following descriptions of soils, regional geology, hydrology, and hydrogeology are provided verbatim from Baker, 2008.

3.3.1 Soils.

The soil associations found at NAPR are predominantly of two types typical of humid areas, namely the Swamps-Marshes Association and the Mabi-Rio-Arriba-Cayagua Association, as well as the Descalabrado-Guayama Association, which is typical of dry areas. In addition, isolated areas of the Caguabo-Mucara-Naranjito Association, the Coloso-Toa-Bajura Association, and the Jacana Amelia-Fraternidad Association are found at NAPR.

The Swamps-Marshes and Mabi-Rio-Arriba-Cayagua associations cover over one-half of NAPR's surface area and are equally distributed. Primarily the Descalabrado-Guayama and Caguabo-Mucara-Naranjito associations cover the remaining area.

The Swamps-Marshes Association consists of deep, very poorly drained soils. This association is found in level or nearly level areas that are slightly above sea level but are wet, and when the tide is high, are covered or affected by saltwater or brackish water. The soils are sandy or clayey, and contain organic materials from decaying mangrove trees. Coral, shells, and marl at

varying depths underlie them. The high concentration of salt inhibits the growth of all vegetation except mangrove trees, and in small-scattered patches, other salt-tolerant plants.

The Mabi-Rio-Arriba-Cayagua Association consists generally of deep, somewhat poorly drained and moderately well drained, nearly level to moderately steep soils found on foot and side slopes, terraces, and alluvial fans. Soils of this association at NAPR are basically clayey.

The Descalabrado-Guayama Association generally consists of shallow, well drained, strongly sloping to very steep soils on volcanic uplands. Soils of this association are found primarily in the hilly areas located directly inland and adjacent to the soils of the Swamps-Marshes Association.

The Caguabo-Mucara-Naranjito Association consists generally of shallow and moderately deep, well drained, sloping to very steep soils on volcanic uplands. This association consists of soils that formed in residual material weathered from volcanic rocks. This association is represented at NAPR by soils of the Sabana series, which are found on the side slopes and the hilly terrain west of Langley Drive in the Fort Bundy area. These soils are suited for pasture and woodland. Steep slopes, susceptibility to erosion, and depth to bedrock are the main limitations for farming and for recreation and urban areas.

The Coloso-Toa-Bajura Association consists of deep, moderately well drained to poorly drained, nearly level soils found on flood plains. This soil association extends along the western boundary of NAPR and around the airfield. The soils of this association formed in fine-textured and moderately fine-textured sediment of mixed origin on flood plains. The Coloso soils are deep and somewhat poorly drained, the Toa soils are deep and moderately well drained, and the Bajura soils and Maunabo soils are deep and poorly drained. The Reilly soils, also part of this association, are shallow sand and gravel and are excessively drained; they lie adjacent to streams. The minor soils are Talante, Vivi, Fortuna, Vega Alta, and Vega Baja. The Talante, Vivi, Fortuna, and Vega Baja soils are found on flood plains, while the Vega Alta soils occupy slightly higher positions on terraces.

The Jacana-Amelia-Fraternidad Association consists generally of moderately deep and deep, well drained and moderately well drained, nearly level to strongly sloping soils on terraces, alluvial fans, and foot slopes. This association is represented at NAPR by soils of the Jacana series, which consist of moderately deep, well-drained soils found on the foot slopes and low rolling hills along Langley Drive and just east of the airfield. These soils formed in fine-textured sediment and residuum derived from basic volcanic rocks.

Soils in the immediate vicinity of SWMU 73 consist of Descalabrado clay loam (DeE2) and Made Land (Md). The Descalabro Series soils are typically shallow, well-drained, brown-green-grey soils. Soils identified as Made Land can consist of numerous soil types (U.S. Department of Agriculture (USDA), 1977).

3.3.2 Regional Geology.

The underlying geology of NAPR area is predominantly volcanic (composed of lava and tuff), as well as sedimentary (rocks derived from discontinuous beds of limestone). These rocks all range in age from early Cretaceous to middle Eocene. The volcanic rocks and interbedded limestone have been complexly faulted, folded, metamorphosed, and variously intruded by dioritic rocks. This complex geological structuring occurred sometime after the deposition of the limestone during the middle Tertiary, when Puerto Rico was separated from the other major Antillean Islands by block faulting, and was arched, uplifted, and tilted to the northeast. Culebra, Vieques, and the Virgin Islands are part of the Puerto Rican block; they are separated from the main island simply because of the drowning that resulted from the tilting. In addition to the predominant volcanic and sedimentary rock, unconsolidated alluvial and older deposits from the Quaternary period underlie the northwestern and western sectors of the base. The primary geologic formations on and near NAPR are various beach deposits, alluvium, quartz diorite and granodiorite, quartz keratophyre, the Daguao Formation, and the Figuera Lava. The Peña Pobre fault zone traverses NAPR.

3.3.3 Regional Hydrology.

The surface waters that flow across the northeastern plain of Puerto Rico, where NAPR is located, originate on the eastern slopes of the Sierra De Luquillo Mountains. Surface runoff is channeled into various rivers and streams that eventually flow into the Caribbean Sea. The Daguao River and Quebrada Seca Stream (a tributary to Rio Daguao) collect surface waters from the hills immediately north of NAPR and, in periods of heavy rain, flooding on NAPR occurs. The Daguao-Quebrada Seca watershed comprises an area of approximately 7.6 square miles (4,900 acres), and the river falls some 700 feet from its source to sea level. Increased development in the town of Ceiba, especially in areas adjacent to NAPR's northern boundary, has significantly increased the surface runoff reaching NAPR, causing ponding and erosion in the Boxer Drive area. Boxer Drive, for a major portion of its length, is subject to surface water flooding, as are Hangar 200 and Aircraft Intermediate Maintenance Department Hangar 379 and adjacent apron areas. This condition has been alleviated by the construction of a new highway (Route 3) immediately outside the fence and the realignment of Boxer Drive both with attendant storm water management features.

In the low-lying shore areas, seawater flooding results from storms, wind, and abnormally high tides. The tidal ranges in the NAPR area are rather small, with a maximum spring range of less than 3 feet. The tides are semidiurnal and have a usual range of about 1 foot in the main harbor of NAPR.

The quality of surface waters is variable, reflecting the drainage area through which the water flows. Generally, surface waters have high turbidities and bio-organics (naturally occurring organics, such as decay products of vegetable and animal matter) due to the periodic heavy rains that can easily erode soils from steep slopes, exposed areas, and disturbed streambeds. Water from alluvial aquifers along the coast of NAPR is of a calcium bicarbonate type, and has high

concentrations of iron and manganese. The source of these minerals is unknown, but they may be derived from buried swamp or lagoon deposits.

A seawater-freshwater interface is present in the aquifers throughout the coastal areas of Puerto Rico, usually within a short distance inland of the coastline.

The NAPR potable water treatment plant receives raw water from the Rio Blanco through a 27-inch reinforced concrete pipe that replaced the old, open channel. The intake is located at the foot of the El Yunque rain forest. This buried raw water line traverses a distance of 14 miles from the intake to the NAPR boundary. A raw water reservoir is located at the water treatment plant and has a 45 million gallon capacity. Additionally, there are two fire protection storage reservoirs with a total capacity of 520,000 gallons.

NAPR has been served for over 30 years by the present treatment facility. The plant (Building 88) has a capacity of 4.0 million gallons per day (MGD). Water flows by gravity into a 45-million gallon raw water storage basin from which the plant draws its supply at a rate of 1.3 MGD on average. Treatment consists of pre-chlorination, coagulation sedimentation, filtration, and post-chlorination.

3.3.4 Regional Hydrogeology.

Little information exists concerning the hydrogeology of NAPR. The only known potential sources of groundwater lie in lenticular beds of clay, sand and gravel, and rock fragments, which occur at a depth of less than 30 meters. No wells have been developed on site from these layers. Some wells had been developed upgradient of NAPR in Ceiba, some 3 kilometers from base headquarters, but were abandoned due to high levels of salinity.

In 2004, Baker conducted a Phase II ECP investigation involving 20 sites throughout NAPR (LANTDIV, 2005). Some consistent stratigraphic trends were observed during the ECP. The site hydrogeology can be better understood in the context of NAPR regional geology. For the sake of simplicity, the NAPR regional geology can be divided into three regions:

- Upland areas
- Near-shore flat lands
- Inland flat lands

The upland areas of NAPR include the hills encompassing the Tow Way Fuel Farm and hospital areas, and the hills encompassing the area behind the Exchange, the former Atlantic Fleet Weapons Training Facility Command, and Fort Bundy area. These upland areas are underlain by bedrock (predominately Gabbro) and exhibit varying degrees of weathering. Typically, the bedrock is overlain be a relatively thin residual soil (i.e., residuum). Residuum is unconsolidated soil, originating from weathered-in-place bedrock. This residuum generally consists of sand, silt, and clay. The near-shore areas include the mangrove swamp areas as well as the shores of Ensenada Honda and Puerca Bay.

The near-shore flat lands are typically underlain by marine sand layers (with coral and shell fragments), silt and clay layers, and occasional peat layers. In some near-shore areas, particularly by the harbor and Camp Moscrip in the southeastern portion of the base, fill material overlays the marine layers. The fill consists of rock fragments, debris (e.g., brick), sand, silt, and clay. The inland flat land area generally encompasses the airfield and golf course areas.

The inland flat land area is typically underlain by relatively thick residuum. The residuum generally consists predominately of clay. Fill material overlays the residuum in some areas, particularly the airfield, and generally consists of sand and gravel with lesser amounts of silt and clay. SWMU 69 (ECP Site 15) is located in the inland flat lands, in the airfield area. During the ECP investigation, approximately 1.3 to 3.0 feet of fill material (mainly sand and gravel) was observed. Residual clay was observed immediately below the fill material. The borings were not advanced beyond 5 feet below ground surface, and no bedrock or groundwater was encountered.

3.4 References.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

LANTDIV, 2005. Final Phase I/II Environmental Condition of Property Report, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia. 15 July 2005.

USGS, 1982. U.S. Department of the Interior, U.S. Geological Survey, Punta Puerca Quadrangle, Puerto Rico, 7.5 Minute Series Topographic Quadrangle, 1957, photorevised 1982.

USDA, 1977. Soil Survey of Humacao Area of Eastern Puerto Rico. U.S. Department of Agriculture, Soils Conservation Service in cooperation with University of Puerto Rico, College of Agricultural Sciences. January 1977.

4.0 CMS INVESTIGATION ACTIVITIES.

4.1 Utility Clearance.

Utility clearance was conducted in accordance with the CMS Work Plan. An excavation permit was issued by the NAPR Public Works Directorate, Maintenance Control Division for the first two sampling events. The permit included an as-built drawing with a utility plan.

4.2 Decontamination.

All reuseable (non-dedicated and non-disposable) soil sampling and monitoring well installation equipment (i.e. augers, bits, split-spoon and other soil samplers, etc.) were decontaminated in accordance with the CMS Work Plan between each sampling location.

4.3 Health and Safety Procedures.

The health and safety procedures previously presented in the RFI Management Plans (Baker, 1995) were employed during this investigation.

4.4 Surface Soil Sampling.

Surface soil samples were collected from three locations recommended for further investigation following the 2004 Phase II ECP. Surface soil samples were collected during two phases in March-April 2008 and January 2009 (see Figure 3 and Tables 4 through 9). Sample collection logs for the January-February 2011 sampling event are provided in Appendix A.

The sampling protocol and analyses followed the methods prescribed in the CMS Work Plan. Surface soil samples were defined as soils from the surface (removing vegetation and roots) to a depth of 1 foot. Samples were collected using a stainless steel sampler equipped with a polyvinyl chloride (PVC) liner using a weighted hammer. Field logs were prepared to indicate lithology, water occurrence, and other observations. The samples were field-screened using a photoionization detector (PID) from 0-6” and 6” to 1’ bgs. Samples were transferred into precleaned sample containers starting with volatile organic compounds (VOCs) by means of the Encore® sampler. The remaining soil was then composited in decontaminated stainless steel mixing bowls using precleaned polystyrene scoops. The samples for SVOCs, low level polycyclic aromatic hydrocarbons (LLPAHs), pesticides, and total metals were then collected from the composite soils, as applicable. Following the collection of each analyte, filled sample containers were placed in a sample cooler containing bagged ice.

The work plan indicated that each borehole would be backfilled with the remaining soil to the extent practicable, in order to minimize the burden of waste disposal. The surface of the borehole was then to be patched with bentonite grout.

4.4.1 March-April 2008 Sampling Event.

Thirty-six surface soil samples and three field duplicate surface soil samples were collected during the March-April 2008 sampling event. The samples were collected at three previous 2004 Phase II ECP sample locations, 19E-03, 19E-SS06, and 19E-SS07. At each of these locations, twelve samples were collected at 20-foot intervals along two roughly perpendicular lines radiating outward from the initial ECP sample location (Figure 3). Soil samples 73SB-01-00 through 73SB12-00 and field duplicate sample 73SB01A-00 were collected at sample location 19E-03. Soil samples 73SB13-00 through 73SB24-00 and field duplicate samples 73SB13A-00 and 73SB18A-00 were collected at sample location 19E-SS06. Soil samples 73SB25-00 through 73SB36-00 and field duplicate sample 73SB27A-00 were collected at sample location 19E-SS07. Tables 4-6 provide a summary of chemical results for analyses performed on surface soil samples collected during the March-April 2008 sampling event.

4.4.2 January 2009 Sampling Event.

Twenty-four additional surface samples were collected during a follow-up sampling event in January 2009. The samples were collected to further evaluate the lateral concentration of selected metals and LLPAHs in soils at the three 2004 ECP sample locations previously sampled during the March-April 2008 sampling event. Tables 7, 8, and 9 provide a summary of chemical results for analyses performed on surface soils collected during the January 2009 sampling event.

4.5 Subsurface Soil Sampling.

Subsurface soil samples were collected from three locations recommended for further investigation following the 2004 Phase II ECP. Subsurface soil samples were collected during three sampling events conducted in March-April 2008, January 2009, and January-February 2011 (see Figure 3 and Table 10).

The sampling protocol and analyses followed the methods prescribed in the CMS Work Plan except as described in paragraph 4.3.4. In the first two events, soil borings were advanced using direct push technology. Samples were collected continuously from the ground surface to the water table using a stainless steel Macro-Core® sampler equipped with a PVC liner. Following the completion of the boring, field screening measurements using a PID were used to determine which intervals would be selected for laboratory analysis. One subsurface soil sample was collected at each borehole from a depth of 1-3 feet bgs. The second subsurface soil sample at each location was collected from the depth of any suspected contamination, as determined during field screening using a PID; the second sample was to be collected at a depth above the water table or 10 feet bgs, whichever was shallower. Samples were transferred into pre-cleaned sample containers starting with VOCs by means of the Encore sampler. The remaining soil from each interval was composited in decontaminated stainless steel mixing bowls with precleaned

(Encore® is a registered trademark of En Novative Technologies, Inc., Green Bay, Wisconsin.)

polystyrene scoops. The samples for SVOCs, LLPAHs, pesticides, and total metals were then collected, as applicable. Following the collection of each analyte, samples were placed in a sample cooler containing bagged ice.

The work plan indicated that each borehole would be backfilled with the remaining soil to the extent practicable, in order to minimize the burden of waste disposal. The surface of the borehole was then to be patched with bentonite grout. In the final sampling event (February 2011), samples were collected using a Large Bore sampler that was 22 inches long with a 1-1/16 inch diameter core containing a clear plastic dedicated liner. The hole was pre-probed using a solid point to the interval just above the desired sample depth, with some intervals requiring removal of obstructing gravel with a hand auger. All samples were handled according to procedures in the Final CMS Work Plan for SWMU 73.

4.5.1 Subsurface Soil Sampling Location Selection.

Three subsurface soil sampling locations were selected in March-April 2008 using field screening for elevated VOCs and visual evidence of staining.

At former sampling site 19E-03, borehole SB02 was selected for subsurface sampling as the surface soil contained PID readings of 3.2 and 8.4 ppm at 0-6” and 6”-1’ feet bgs, respectively. None of the other boreholes at this location had positive PID readings.

At former sampling site 19E-SS06, none of the boreholes had positive PID readings, so borehole SB14 was selected for sampling as it is near former sampling location 19E-SS06.

At former sampling location 19E-SS07, borehole SB27 was selected for subsurface sampling as the surface soil contained 4.9 and 1.2 ppm PID readings at 0-6” and 6”-1’ feet bgs, respectively. None of the other boreholes at this location had positive PID readings.

During the January 2009 sampling event a fourth subsurface soil borehole sampling location, SB24, was selected at sampling location 19E-SS06 due to high pesticide levels detected in the surface soil sample taken from borehole SB24 in March-April 2008.

4.5.2 March-April 2008 Sampling Event.

Six subsurface soil samples were collected during the March-April 2008 sampling event from boreholes SB02, SB14, and SB27. At boreholes SB02 and SB14, subsurface samples were collected from 1 to 3 feet bgs, and from 7 to 9 feet bgs. At borehole SB27, a subsurface sample and field duplicate sample were collected at the 1- to 3-foot bgs interval, and a second subsurface sample was collected from 17 to 19 feet bgs.

(Macro-Core® is a registered trademark of Kejr, Inc., Salina, Kansas.)

4.5.3 January 2009 Sampling Event.

Four subsurface soil samples were collected during the January 2009 sampling event from boreholes SB02 and SB24. The samples were collected to support the analytical data results from March-April 2008. Two samples, 73SB02B-02 and 73SB02B-03, were collected from borehole SB02 at depths of 3 to 5 feet bgs and 5 to 7 feet bgs due to high pesticide levels present in the March-April 2008 sample taken from 1 to 3 feet bgs in that borehole. Two samples, 73SB24-01 and 73SB24-09, were collected from borehole SB24 due to high levels of LLPAHs and metals present in the surface soil sample from that location.

4.5.4 January-February 2011 Sampling Event.

Subsurface soil samples were collected immediately adjacent to MW02 and MW03 at the CMS Work Plan prescribed depth of approximately 9 to 11 feet bgs, or just above the water table, whichever was shallower. These samples were required to address EPA general comments 1 and 2 contained in the Evaluation of the August 24, 2011, Response to EPA Comments on the Draft Corrective Measure Study (CMS) for SWMU 73.

4.5.5 Subsurface Soil Sampling CMS Work Plan Departures.

There were several departures from the Work Plan during subsurface soil sampling events in March-April 2008 and January 2009.

- The work plan stated that two subsurface samples would be collected from each borehole selected for subsurface sampling. The first subsurface soil sample was to be collected from the 1-3 foot bgs interval. The second subsurface soil sample from each borehole was to be collected from an interval identified through field screening as being possibly contaminated, or at a depth of 10 feet, whichever occurred first. The 1- to 3-foot depth samples were collected as described in the work plan. However, samples 73SB27-09 and 73SB24-09 were collected from the 17 to 19 foot bgs interval, which is deeper than the maximum 10 foot interval. Location 73SB27 coincides with MW02; location 73SB24 coincides with MW03; both were sampled at the 9-11 foot interval during the January-February 2011 sampling event as prescribed in the work plan.

- The work plan stated that a total of six subsurface samples would be collected to evaluate the extent of vertical migration of organic compounds and/or metals at the former Phase II ECP sampling locations. In practice, a total of 29 subsurface soil samples were collected during the March-April 2008 sampling event, and an additional 14 subsurface soil samples were collected during the January 2009 sampling event. Following sample collection and borehole logging, at some point most of the samples were discarded and a total of six samples were analyzed from the March-April 2008 sampling event and four samples were analyzed from the January 2008 sampling event.

- The work plan stated that subsurface soil samples would be collected from three selected boreholes. During the March-April 2008 sampling event, three boreholes were selected and subsurface soils were collected for analysis from those boreholes. During the January 2009 sampling event, an additional borehole was sampled at former Phase II ECP sampling location 19E-SS06.

4.6 Monitoring Well Installation.

Three monitoring wells were installed, one in the DRMO storage yard (73MW01) and two in the wooded area to the north-northwest of the DRMO storage yard (73MW02 and 73MW03) as shown in Figure 3. Wells were installed to determine environmental impact, if any, to groundwater from site operations. The boreholes were advanced and monitoring wells were installed following the methods prescribed in the CMS Work Plan.

During March-April 2008, one monitoring well was intended to be installed at each of the three initial ECP sample location areas expanded as part of the CMS. Monitoring well placement was based on field screening results from the March-April 2008 sampling event as already described in Paragraph 4.3.1. Monitoring well 73MW01 was installed in borehole SB2 at initial sample location 19E-03, and monitoring well 73MW02 was installed in borehole SB27 at location 19E-SS07. Borehole SB14 at 19E-SS06 was drilled to a depth of 30 feet and abandoned due to lack of water present in the boring.

During January 2009, monitoring well 73MW03 was installed in borehole SB24 at the 19E-SS06 location based on the analytical results from the March-April 2008 event.

Borings for monitoring wells were advanced using 3¼-inch inside diameter hollow stem augers to overdrill the direct push technology subsurface soil sample borings. Wells were constructed using a 10-foot, 2-inch PVC well screen capped with a PVC plug at the bottom of the well and flush threaded to 2-inch PVC riser pipe to the surface. The well screens were installed to straddle the water table. The annulus surrounding the well screen and riser was filled with fine to medium sand from the bottom of the well to approximately 2 feet above the well screen. As the augers were withdrawn, sand was slowly added and constantly measured to prevent bridging. A 2-foot bentonite seal was added and hydrated with potable water above the sand pack. The remainder of the annulus was backfilled with a bentonite-cement grout to the surface. When not in use, each well was sealed with an expandable, locking, water-tight cap.

Monitoring wells were completed 2 feet above grade. Steel protective casing and bollards painted bright yellow for visibility were installed with a 2-foot by 2-foot concrete well pad around each well.

4.7 Monitoring Well Development.

The monitoring wells were developed following the methods prescribed in the CMS Work Plan. Monitoring wells were developed approximately 24 hours after grouting to allow for curing. Wells were surged and bailed using a stainless steel bailer throughout the entire saturated screened interval. Development water was monitored for visual clarity and field parameters (specific conductivity, pH, and temperature). Approximately 3-5 borehole volumes were removed along with stabilization of field parameters and noted visual improvement of water clarity prior to the completion of development activities.

4.8 Groundwater Measurements and Sampling.

Potentiometric surface measurements were measured on 16 January 2009 and again on 31 January 2011 from the three monitoring wells (73MW01, 73MW02, and 73MW03). Measurements were obtained to the nearest 0.01 foot from the marked portion of the top of the riser pipe as the point of reference utilizing a sounding water level meter.

Groundwater samples were collected during the March-April 2008, January 2009, and January 2011 sampling events. Groundwater samples were collected following the EPA Region II low-flow sampling technique as prescribed in the CMS Work Plan. Purge water was monitored with in-line instrumentation for specific conductivity, pH, temperature, dissolved oxygen, oxidation/reduction potential, and turbidity. During the first two sampling events, dissolved metals samples were field filtered utilizing an in-line 0.45µ particulate filter. No filtering was necessary during the January 2011 sampling event because all turbidity readings were below 10 Nephelometric Turbidity Units. Samples were collected in laboratory-supplied, precleaned sample bottles and were preserved with acidification and/or packing on ice prior to packaging and shipping samples to the analytical laboratory. Groundwater sampling logs for the January-February 2011 sampling event are presented in Appendix A.

The March-April 2008 groundwater samples 73MW01 and 73MW02 and field duplicate sample 73MW01A were analyzed for dissolved metals. Sample 73MW01 and duplicate sample 73MW01A were also analyzed for VOCs and SVOCs. The January 2009 groundwater samples 73MW02 and 73MW03 and duplicate sample 73MW03A were analyzed for dissolved metals. Sample 73MW03 and duplicate sample 73MW03A were also analyzed for LLPAHs. Since all the data from these first two events did not complete the prescribed analyses in Table 5-1 of the CMS work plan, the wells were resampled on 31 January 2011 for the parameters prescribed in the workplan. A summary of laboratory results from all three events is contained in Table 11.

The CMS work plan indicated that the groundwater sample IDs would correspond to the soil boring locations, for example groundwater collected from soil boring 73SB01 would have a groundwater sample ID of 73GW01. However, the investigator labeled the samples "73MW01, 73MW02, and 73MW03," without distinguishing between groundwater samples collected in 2008 and 2009. Essentially, the same numbering scheme was utilized in 2011 to avoid any additional confusion.

4.9 Investigative Derived Waste (IDW).

During the investigation, disposable sampling tools were used to the highest extent practicable to reduce liquid IDW as a result of the decontamination procedure. All wastewater (inclusive of development, decontamination, and well purge water) and drilling spoils were containerized in 55-gallon drums which were left at the investigation sites and have since been removed.

One soil composite sample (73IDW-01) and one water composite sample (73IDW-02) were collected from the drums produced in March-April 2008. The 2008 samples were analyzed for benzene and for RCRA metals.

One soil composite sample (73IDW-03) and one water composite sample (73IDW-04) were collected from the drums produced in January 2009. The 2009 IDW samples were analyzed for RCRA metals.

The January-February 2011 sampling event did not generate any soil IDW. Small quantities of purge water were generated at each monitoring well. This purge water was added to the 55-gallon drums remaining on site from the previous rounds of sampling. These drums have since been removed.

4.10 Surveying.

Initial sample location coordinates 19E-03, 19E-SS06, and 19E-SS07 were provided by Baker. Proposed sample locations were field measured and located accounting for the presence of abandoned equipment and materials.

Well and soil sample locations were surveyed using a handheld global positioning device. The World Geodedic System 84 served as the datum for horizontal coordinates. Well point of reference elevations were surveyed to an accuracy of 0.02 feet using a theatolite/survey stick from a known reference elevation. Surveying occurred on 4 April 2008 and 16 January 2009.

4.11 Chain of Custody.

Chain-of-custody procedures were followed to ensure a documented, traceable link between measurement results and the sample/parameter that they represent. A chain-of-custody form was completed for each shipment in which the samples were shipped. After the samples were properly packaged, the shipping containers were sealed and prepared for shipment to the analytical laboratory. Chain-of-custody forms for the January-February 2011 sampling event are provided in Appendix B.

4.12 QA/QC Sampling.

QA/QC samples collected in association with the SWMU 73 CMS investigation included:

- Field duplicates
- Trip Blanks
- Matrix Spikes/Matrix Spike Duplicates (MS/MSDs)
- Field Blanks
- Equipment Rinsate Samples

4.12.1 Field Duplicates.

In accordance with the CMS Work Plan, one field duplicate sample was collected for every 10 environmental samples in each media (surface soil, subsurface soil, and groundwater) per sampling event. During March-April 2008, four field duplicate samples were collected for 36 surface soil samples, one for six subsurface soil samples, one for two groundwater samples, and one for three field blank samples. During January 2009, three field duplicate samples were collected for 24 surface soil samples, two for four subsurface soil samples, one for two groundwater samples, and one for three field blank samples. During the January-February 2011 sampling event, one duplicate was collected for groundwater and one for soil. The field duplicates were analyzed for the same chemical parameters as the associated environmental sample. Field duplicate data are discussed in Paragraph 6.4.1.

4.12.2 VOC Trip Blanks.

One trip blank was included with each shipment containing VOC samples. Trip blanks were analyzed for 40 CFR Part 264 Appendix IX VOCs to evaluate whether samples were contaminated during the transport of the samples to the analytical laboratory. Trip blank results for the January-February 2011 sampling event are provided in the data validation package in Appendix B. Trip blank results for all three sampling events are discussed in Paragraph 6.4.4.

A total of five trip blanks were analyzed for the March-April 2008 sampling event. No VOC samples were taken during the January 2009 sampling event, so no VOC trip blanks were included with those sample shipments. One VOC trip blank was analyzed for the January-February 2011 sampling event.

4.12.3 Matrix Spikes/Matrix Spike Duplicates.

One matrix spike/matrix spike duplicate sample was run for every 20 environmental samples each of soil and groundwater and analyzed for the same 40 CFR Part 264 Appendix IX VOCs parameters as the environmental samples. MS/MSD results for the January-February 2011 sampling event are presented in Appendix B.

4.12.4 Equipment Rinsate Samples.

Equipment rinsate samples were collected for reusable (non-dedicated and non-disposable) equipment and disposable sampling tools. Equipment and materials sampled included Macro-Core sample liners, Macro-Core cutting shoes, aluminum foil, vinyl gloves, groundwater sampling tubing, and polystyrene scoops. At least one rinsate sample was collected from one selected piece of equipment each day during sampling. Seven rinsate samples were collected during the March-April 2008 sampling event and 3 rinsate samples were collected during the January 2009 sampling event. Two rinsate samples were collected during the January-February 2011 sampling event. Rinsate results are further discussed in Paragraph 6.4.2 and are provided in Tables 12 and 13.

4.12.5 Field Blanks.

Three field blanks and one duplicate were collected during each of the sampling events, for a total of six field blanks and two duplicates. The field blanks and duplicates were analyzed to characterize water used during the decontamination process. One sample was collected for each deionized water, distilled water, and NAPR tap water during each sampling event. The duplicate samples were collected on the tap water samples. These samples were analyzed for each of the analytes requested during the appropriate sampling event. Field blank results are further discussed in Paragraph 6.4.3 and are provided in Tables 14 and 15.

4.13 Laboratory Analysis.

Laboratory analyses were contracted through the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) (now the US Army Public Health Command) Directorate of Laboratory Services (DLS) at Aberdeen Proving Ground, Maryland. Samples for 40 CFR Part 264 Appendix IX VOCs, semivolatile organic constituents (SVOCs), LLPAHs, and organochlorine pesticides were analyzed by Lancaster Laboratories, Lancaster, Pennsylvania. Samples for metals were analyzed by Microbac Laboratories, Baltimore, Maryland and USACHPPM DLS. The data from all sampling events were certified by a Puerto Rico certified chemist.

4.14 Data Validation.

AE Environmental, LLC from Frederick, Maryland, an independent third party, performed data validation for all sampling events. The EPA Region II Data Validation Standard Operating Procedures, in conjunction with the EPA National Functional Guidelines for Data Review were used. The laboratory data validation report for the January-Feburary 2011 sampling event is provided in Appendix B. Laboratory data validation reports for all of the data are discussed in section 6.5 and qualified data are shown on Tables 4-15.

4.15 Reference.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

5.0 PHYSICAL RESULTS.

5.1 Current Conditions.

SWMU 73 comprises the former DRMO scrap metal recycling yard and the wooded area to the north, east, and south. The former DRMO scrap metal recycling yard consists of a hard gravel-packed surface with concrete storage bins and pads and is surrounded by chain link fencing. The scrap metal recycling yard represents approximately 20 percent of SWMU 73 and is presently vacant due to base closure. The wooded area represents the remaining 80 percent of SWMU 73. Within the wooded area are a number of dump sites containing dilapidated equipment, such as an abandoned barge, tire rims, and construction material. No evidence of a roadway that formerly bisected the wooded area was observed.

The topographic high is located at the northeast portion of SWMU 73 adjacent to the former pesticide storage building. The topographic low appears to be located at the far northwestern portion of the property where a small mangrove wetland exists based on visual observation. Surface water presence in the low lying area of SWMU 73 would seem to be intermittent.

Stormwater runoff appears to flow from the northwestern edge of SWMU 73 along Breton Street to the northeast where the terrain flattens within the confines of the SWMU borders. Most precipitation events likely result in percolation of water into the shallow subsurface to be utilized by vegetation present at the site.

5.2 Site Geology/Hydrogeology.

5.2.1 Geology.

Four subsurface borings (SB02, SB14, SB27, and 73MW03) were advanced during the CMS field investigation. Three of the four brings encountered subsurface water and were converted to monitoring wells 73MW01 (SB02), 73MW02 (SB27), and 73MW03 (73MW03). The remaining boring, SB14, was abandoned and sealed with bentonite grout.

SWMU 73 is located within the near shore flatland associated with Ensenada Honda and Puerca Bay as described in Section 3.3.4. At the former DRMO scrap metal yard, hardpacked gravel was encountered within the first few inches. Deeper soils consisted of fill material to the total depth of 15 feet below surface grade. During drilling, groundwater was encountered at approximately 9 feet in borehole SB02. Within the wooded area, the first few inches of soil consisted of a mostly organic topsoil that contained plant rootlets. Deeper soils consisted mostly of silty clay of varying colors. It was difficult to determine if shallow subsurface silty clay soils consisted of natural materials within the wooded area. During drilling, groundwater, when encountered, occurred at approximately 20-24 feet below the surface grade within a sandy layer.

5.2.2 Hydrogeology.

Groundwater is estimated to flow toward the southeast based on water level data collected on 16 January 2009 from 73MW01, 73MW02, and 73MW03 within a 20-minute timeframe (Figure 4). This direction of flow was confirmed based on water level data collected on 31 January 2011 (Figure 5). The water table inside of the fenced area at the former DRMO scrap metal yard was encountered at approximately 9 feet below surface grade, and the water level in the well (73MW01) was measured at approximately 7.5 feet below surface grade. Within the wooded area to the west, groundwater was encountered ranging from approximately 20-24 feet below surface grade within a fine to medium sand below silty clay. Monitoring well water levels at 73MW02 and 73MW03 were measured at approximately 8-10 feet below surface grade. No significant drawdown was observed during well development and well purging activities at any well location.

5.3 References.

LANTDIV, 2005. Final Phase I/II Environmental Condition of Property Report, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia. 15 July 2005.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

6.0 ANALYTICAL RESULTS.

6.1 Surface Soil.

6.1.1 March-April 2008 Sampling Event.

Thirty-six surface soil samples and four field duplicates were collected during the March-April 2008 sampling event. Surface soil samples 73SB01-00 through 73SB24-00 and field duplicate samples 73SB01A-00, 73SB13A-00, and 73SB18A-00 were analyzed for 40 CFR Part 264 Appendix IX VOCs, SVOCs, LLPAHs, PCBs, organochlorine pesticides, and metals. Surface soil samples 73SB25-00 through 73SB36-00 and field duplicate sample 73SB27A-00 were analyzed for 40 CFR Part 264 Appendix IX metals. Surface soil analytical results for the March-April 2008 sampling event are presented in Tables 4-6.

6.1.1.1 VOCs in Surface Soils, March-April 2008.

Nine VOCs were detected in surface soil samples 73SB01-00 through 73SB24-00 and in field duplicate samples 73SB01A-00, 73SB13A-00, and 73SB18A-00 (Tables 4 and 5).

2-Butanone was detected in 12 samples and in two duplicate samples at levels ranging from 5J micrograms per kilogram (µg/Kg) to 41J µg/Kg. 2-Hexanone was detected in sample 73SB09-00 at 6J µg/Kg. Acetone was detected in 23 samples and in three duplicate samples at levels ranging from 19J to 160J µg/Kg. Carbon disulfide was detected in 9 samples at levels ranging from 2J to 6J µg/Kg. Methyl iodide was detected in sample 73SB23-00 at 11J µg/Kg and in sample 73SB09-00 at 22J µg/Kg. Toluene was detected in samples 73SB04-00, 73SB12-00, and 73SB13-00 at 2J µg/Kg. None of these values exceed applicable screening levels.

Benzene was detected in 17 samples and in 2 field duplicate samples at levels ranging from 0.7J to 3J µg/Kg. All of the detections exceed the EPA groundwater protection risk-based soil screening level (SSL) for benzene of 0.21 µg/Kg.

Bromomethane was detected in samples 73SB03-00, 73SB09-00, and 73SB19-00 at 4J µg/Kg. The three detections exceed the EPA groundwater protection SSL for bromomethane of 2.2 µg/Kg.

Methylene chloride was detected in 5 samples at levels ranging from 3J to 6J µg/Kg. All five detections exceed the EPA groundwater protection SSL for methylene chloride of 1.2 µg/Kg.

All VOC data were J-qualified as estimates with a negative bias during data validation resulting from failure to meet temperature preservation requirements. None of the VOC data were rejected during data validation.

1136 6.1.1.2 SVOCs in Surface Soils, March-April 2008.

1137 Three SVOCs not categorized as polycyclic aromatic hydrocarbons (PAHs) were detected in
1138 surface soil samples 73SB01-00 throguh 73SB24-00 and in field duplicate samples 73SB01A-00,
1139 73SB13A-00, and 73SB18A-00 (Tables 4 and 5).

1140 Acetophenone was detected in sample 73SB20-00 at 140J µg/Kg, which does not exceed any
1141 applicable soil screening levels.

1142 Butylbenzylphthalate was detected in three samples, 73SB01-00 (83J µg/Kg), 73SB15-00 (890
1143 µg/Kg), and 73SB18-00 (130J µg/Kg). The sample 73SB15-00 detection exceeds the EPA
1144 groundwater protection SSL for butylbenzylphthalate of 510 µg/Kg.

1145 Di(2-ethylhexyl)phthalate (DEHP) was detected in every sample and in all three field duplicate
1146 samples at levels ranging from 120J to 2,900 µg/Kg. The EPA groundwater protection risk-
1147 based screening level for DEHP is 1,100 µg/Kg, which is exceeded by detections in 11 samples
1148 and in one field duplicate sample.

1149 Additional SVOC results are discussed in paragraph 6.1.1.3 below.

1150 Results for analyses of several SVOC compounds, including 1,4-phenylenediamine, 2,4-
1151 dinitrophenol, 2-naphthylamine, 4-nitroquinone-1-oxide, isosafrole, hexachlorocyclopentadiene,
1152 and methapyriline, were rejected during data validation.

1153 6.1.1.3 LLPAHs in Surface Soils, March-April 2008.

1154 Eighteen LLPAHs were detected in surface soil samples 73SB01-00 through 73SB24-00 and in
1155 field duplicate samples 73SB01A-00, 73SB13A-00, and 73SB18A-00 (Tables 4 and 5).

1156 2-Methylnaphthalene was detected in 14 samples and in two field duplicate samples at levels
1157 ranging from 0.74J to 86J µg/Kg. Acenapthene was detected in 10 samples and in 2 field
1158 duplicate samples at levels ranging from 0.81J to 63 µg/Kg. Acenaphthylene was detected in 21
1159 samples and in three field duplicate samples at levels ranging from 0.59J to 720 µg/Kg.
1160 Anthracene was detected in all 24 soil samples and in the three field duplicate samples at levels
1161 ranging from 0.46J to 820 µg/Kg. Fluorene was detected in 13 samples and in one field
1162 duplicate sample at levels ranging from 0.77J to 41 µg/Kg. Phenanthrene was detected in 22
1163 samples and in all three field duplicate samples at levels ranging from 0.78J to 450J µg/Kg.
1164 None of these detections exceed applicable soil screening levels for any of these compounds.

1165 1-Methylnaphthalene was detected in 8 samples and in two field duplicate samples at levels
1166 ranging from 0.92J to 14 µg/Kg. The EPA groundwater protection SSL for 1-methylnaphthalene
1167 is 12 µg/Kg. Sample 73SB09-00 results exceed the groundwater protection SSL.

1168 Benz(a)anthracene was detected in all 24 samples and in all three field duplicate samples at
1169 levels ranging from 0.81J to 4000 µg/Kg. The EPA groundwater protection risk-based SSL for

benz(a)anthracene is 10 µg/Kg. Detections in fifteen samples and in all three duplicate soil samples exceed the groundwater protection SSL for benz(a)anthracene. Detections in four soil samples and in one duplicate soil sample exceed the EPA residential SSL of 150 µg/Kg for benz(a)anthracene. Sample 73SB24-00 results exceed both the Screening Level developed for NAPR as shown in Table 5-1 of the CMS Work Plan of 1,200 µg/Kg (hereinafter referred to as NAPR Table 5-1) and the EPA industrial SSL of 2,100 µg/Kg for benz(a)anthracene in soil.

Benzo(a)pyrene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 1.2J to 3400 µg/Kg. Detections in three field duplicates and in all but one of the surface soil samples exceed the EPA groundwater protection SSL of 3.5 µg/Kg for benzo(a)pyrene. Detections in seventeen samples and in two field duplicates exceed the EPA residential SSL of 15 µg/Kg for benzo(a)pyrene. Detections at three 19E-SS06 soil samples and one field duplicate sample exceed the EPA industrial SSL of 210 µg/Kg for benzo(a)pyrene. Sample 73SB24-00 results exceed the NAPR Table 5-1 screening level of 1,200 µg/Kg for benzo(a)pyrene in soil.

Benzo(b)fluoranthene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 2.2J to 4800 µg/Kg. The EPA groundwater protection SSL for benzo(b)fluoranthene is 35 µg/Kg. Detections in thirteen samples and in one field duplicate exceed the EPA groundwater protection SSL for benzo(b)fluoranthene. Detections in five samples and one field duplicate sample exceed the EPA residential SSL of 150 µg/Kg for benzo(b)fluoranthene. Sample 73SB24-00 results exceed both the NAPR Table 5-1 screening level of 1,200 and the EPA industrial SSL of 2,100 µg/Kg for benzo(b)fluoranthene in soil.

Benzo(g,h,i)perylene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 0.84J to 1800 µg/Kg. Sample 73SB24-00 results exceed the NAPR Table 5-1 screening level of 1,200 µg/Kg for benzo(g,h,i)perylene in soils.

Benzo(k)fluoranthene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 0.77J to 1900 µg/Kg. The EPA groundwater protection SSL for benzo(k)fluoranthene in soils is 350 µg/Kg, the residential SSL is 1,500 µg/Kg, and the NAPR Table 5-1 screening level is 1,200 µg/Kg. Sample 73SB24-00 results exceed all three screening levels. Sample 73SB18-00 and field duplicate 73SB18A-00 results exceed the groundwater protection SSL.

Chrysene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 1.1J to 4200 µg/Kg. The EPA groundwater protection SSL for chrysene is 1,100 µg/Kg and the NAPR Table 5-1 screening level is 1,200 µg/Kg. Sample 73SB24-00 results exceed both of these screening levels for chrysene.

Dibenz(a,h,)anthracene was detected in 23 samples and in all three field duplicate samples at levels ranging from 0.78J to 560 µg/Kg. The EPA groundwater protection SSL for dibenz(a,h)anthracene is 11 µg/Kg, the residential SSL is 15 µg/Kg, and the industrial SSL is 210 µg/Kg. The NAPR Table 5-1 screening level is 1,200 µg/Kg. Detections in seven samples

and one field duplicate sample exceed the groundwater protection SSL. Detections in four samples and one field duplicate sample exceed the residential SSL. Sample 73SB24-00 results exceed all four screening levels.

Fluoranthene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 0.94J to 1900 µg/Kg. Sample 73SB24-00 results exceed the NAPR Table 5-1 screening level for fluoranthene of 1,200 µg/Kg.

Indeno(1,2,3-cd)pyrene was detected in all 24 samples and in all three field duplicate samples at levels ranging from 0.73J to 1700 µg/Kg. The EPA groundwater protection SSL for indeno(1,2,3-cd)pyrene is 120 µg/Kg, the residential SSL is 150 µg/Kg, and the NAPR Table 5-1 screening level is 1,200 µg/Kg. Results for samples 73SB15-00 and 73SB18-00 and duplicate sample 73SB18A exceed the groundwater protection and residential SSLs for indeno(1,2,3-cd)pyrene. Sample 73SB24-00 results exceed all three soil screening levels.

Napthalene was detected in 16 samples and in two field duplicate samples at levels ranging from 0.83 to 320 µg/Kg. All of the detections exceed the EPA groundwater protection SSL of 0.47 ug/Kg for naphthalene.

Pyrene was detected in all 24 samples and in all three field duplicates at levels ranging from 0.91J to 3,100 µg/Kg. Sample 73SB24-00 results exceed the NAPR Table 5-1 screening level of 1,200 µg/Kg for pyrene.

As a result of some matrix spike recoveries being outside of the specified target range, some LLPAH data was qualified as Jm (estimated due to matrix spike recoveries outside the specified window) during data validation as shown in Tables 4 and 5. None of the LLPAH results were rejected during data validation. Therefore, completeness goals were achieved for analysis of LLPAHs in soils during the March-April 2008 sampling event.

6.1.1.4 Organochlorine Pesticides in Surface Soils, March-April 2008.

Fourteen organochlorine pesticides were detected in surface soil samples 73SB01 through 73SB24 and in field duplicate samples 73SB01A-00, 73SB13A-00, and 73SB18A-00 (Tables 4 and 5).

Delta BHC was detected in sample 73SB01-00 at 0.48J ug/Kg and in field duplicate 73SB01A-00 at 0.81J µg/Kg. Endosulfan sulfate was detected in sample 73SB19-00 at 0.51J µg/Kg, and in field duplicate sample 73SB01A-00 at 1.7J µg/Kg. Endrin was detected in sample 73SB08-00 at 1J µg/Kg. Endrin aldehyde was detected in sample 73SB18-00 at 1.6J µg/Kg, and in field duplicate sample 73SB18A-00 at 1.2J µg/Kg. Endrin aldehyde was also detected in sample 73SB24-00 at 3.3J µg/Kg. Methoxychlor was detected in sample 73SB15-00 at 11J µg/Kg, and in sample 73SB19-00 at 3.2J µg/Kg. None of the detections exceed the applicable screening levels for these compounds.

Chlordane was detected in 7 samples and in two field duplicates at levels ranging from 12J to 480 µg/Kg. The EPA groundwater protection SSL for chlordane is 13 µg/Kg, and the NAPR Table 5-1 screening level is 100 µg/Kg. Detections in six samples and two field duplicates exceed the groundwater protection SSL, and results for three samples and one field duplicate sample exceed the NAPR Table 5-1 screening level. None of the detections exceed other applicable screening levels for chlordane.

Dieldrin was detected in six soil samples and in one field duplicate sample at levels ranging from 0.52J to 13J µg/Kg. All of the detections exceed the EPA groundwater protection SSL for dieldrin of 0.17 µg/Kg.

Gamma BHC was detected in sample 73SB15-00 at 0.59Jq µg/Kg, which exceeds the EPA groundwater protection SSL of 0.53 µg/Kg.

Heptachlor was detected in four samples and in one field duplicate sample at levels ranging from 0.23J to 16J µg/Kg. The detection in sample 73SB10-00 exceeds the EPA groundwater protection SSL for heptachlor of 1.2 µg/Kg.

Heptachlor epoxide was detected in 6 soil samples and in one field duplicate sample at levels ranging from 0.79J to 6.2 µg/Kg. All of the detections exceed the EPA groundwater protection SSL for heptachlor epoxide in soils of 0.15 µg/Kg.

Kepone was detected in 8 samples and in one field duplicate sample at levels ranging from 2.8J to 66J µg/Kg. All of the detections exceed the EPA groundwater protection SSL for kepone in soils of 0.24 µg/Kg. Sample 73SB05-00 results exceed the the residential SSL for kepone of 49 µg/Kg.

P,p'-DDD was detected in four soil samples, 73SB02-00, 73SB03-00, 73SB04-00, and 73B11-00, at levels ranging from 2.2J to 5,500 µg/Kg. The sample 73SB02-00 result exceeds the EPA groundwater protection SSL of 66 µg/Kg, the NAPR Table 5-1 screening level of 401 µg/Kg, and the residential SSL of 2,000 µg/Kg for that compound.

P,p-DDE was detected in 20 soil samples and in all three field duplicate samples at levels ranging from 0.45J to 9,600 µg/Kg. Detections in three of the samples and in one field duplicate exceed the EPA groundwater protection SSL of 47 µg/Kg for p,p'-DDE. Sample 73SB02-00 results exceed the NAPR Table 5-1 screening level of 401 µg/Kg, the residential SSL of 1,400 µg/Kg, and the industrial SSL of 5,100 µg/Kg for p,p'-DDE.

P,p-'DDT was detected in 21 samples and in all three field duplicates at levels ranging from 0.61J to 77,000 µg/Kg. Detections in three of the samples and in one field duplicate exceed the EPA groundwater protection SSL of 67 µg/Kg for p,p'-DDT. Sample 73SB02-00 results exceed the NAPR Table 5-1 screening level of 401 µg/Kg, the residential SSL of 1,700 µg/Kg, and the industrial SSL of 7,000 µg/Kg for p,p'-DDT.

Sample 73SB02-00 had extremely high reporting limits for all of the organochlorine pesticides compounds, and most of the results were reported as non-detect.

Most of the non-detect results for samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were rejected during data validation due to extremely low MS recoveries. Positive detections of pesticides in those samples were flagged "J".

6.1.1.5 PCBs in Surface Soils, March-April 2008.

Two PCB compounds, Aroclor 1254 and Aroclor 1260, were detected in 14 out of 24 surface soil samples and in two field duplicates (Tables 4 and 5).

Aroclor 1254 was detected in 5 samples at levels ranging from 12.1J to 146 µg/Kg. All five detections exceed the EPA groundwater protection SSL of 8.8 µg/Kg.

Aroclor 1260 was detected in 13 samples and in two field duplicate samples at levels ranging from 10.1J to 345 µg/Kg. The EPA groundwater protection SSL for aroclor 1260 is 24 µg/Kg, and the residential SSL is 220 µg/Kg. Seven of the detections exceed the groundwater protection SSL, and sample 73SB03-00 and 73SB05-00 results exceed the residential SSL.

It should be noted that the lowest reporting limit for Aroclor 1260 is 17.5 µg/Kg, which exceeds the groundwater protection SSL for that compound. Additionally, sample 73SB02-00 had extremely high reporting limits for both PCB compounds, with both results reported as non-detect. The sample 73SB02-00 reporting limits exceed EPA groundwater protection, residential, and industrial SSLs for both compounds.

Three Aroclor 1260 results (73SB01A-00, 73SB10-00, and 73SB24-00) were flagged J+s (estimated with a positive bias) due to surrogate recoveries greater than the upper QC limit.

6.1.1.6 Metals in Surface Soils, March-April 2008.

Fifteen metals were detected in 36 surface soil samples (73SB01 through 73 SB36) and in field duplicate samples 73SB01A-00, 73SB13A-00, 73SB18A-00, and 73SB27A-00 (Tables 4, 5, and 6).

Arsenic was detected in 33 samples and in four field duplicate samples at levels ranging from 2J to 12 mg/Kg. All of the detections exceed the EPA groundwater protection SSL of 0.0013 mg/Kg, the residential SSL of 0.39 mg/Kg, and the the industrial SSL of 1.6 mg/Kg. Detections in 31 samples and in four field duplicates exceed the NAPR background level for arsenic of 2.65 mg/Kg.

Barium was detected in all 36 samples and in all four field duplicate samples at levels ranging from 23 to 430 mg/Kg. Samples 73SB26-00 and 73SB34-00 contained 230 and 250 mg/Kg barium, respectively, both of which exceed the NAPR background level of 199 mg/Kg. Sample 73SB28-00, 73SB30-00, and 73SB32-00 results exceed the NAPR background level, the EPA

1312 groundwater protection SSL of 300 mg/Kg, and the NAPR Table 5-1 screening level of 330
1313 mg/Kg.

1314 Cadmium was detected in 23 samples and in three field duplicate samples at levels ranging from
1315 0.12 to 19J mg/Kg. Sample 73SB10-00 and 73SB18-00 results exceed the NAPR background
1316 level of 1.02 mg/Kg. Results for samples 73SB02-00, 73SB03-00, and 73SB06-00 and for field
1317 duplicate 73SB01A-00 exceed the EPA groundwater protection SSL of 1.4 mg/Kg.

1318 Chromium was detected in all 36 samples and in all four field duplicate samples at levels ranging
1319 from 0.8J to 180J mg/Kg. All of the detections exceed the EPA groundwater protection SSL of
1320 0.0083 mg/Kg and the NAPR Table 5-1 screening level of 0.4 mg/Kg. Six samples and one field
1321 duplicate sample also exceed the NAPR background level of 49.8 mg/Kg for chromium in soil.

1322 Cobalt was detected in all 36 soil samples and in all four field duplicate at levels ranging from
1323 4.9J to 290 J mg/Kg. All of the detections exceed the EPA groundwater protection SSL of 0.49
1324 mg/Kg for cobalt. All but 7 of the detections exceed the NAPR Table 5-1 screening level of 13
1325 mg/Kg. Nine samples and one field duplicate contained levels of cobalt that exceed the EPA
1326 residential SSL of 23 mg/Kg. Results for five samples exceed the NAPR background level of
1327 46.2 mg/Kg.

1328 Copper was detected in all 36 of the soil samples and in all four field duplicates at levels ranging
1329 from 31 to 280 mg/Kg. The EPA groundwater protection SSL for copper is 51 mg/Kg; the
1330 NAPR Table 5-1 screening level is 70 mg/Kg, and the NAPR background level is 168 mg/Kg.
1331 Detections in all of the samples but two exceed the groundwater protection SSL. Results for
1332 thirty-two samples and all four field duplicates exceed the NAPR Table 5-1 screening level, and
1333 results for 19 soil samples and two field duplicate samples exceed the background level for
1334 copper.

1335 Lead was detected in all 36 soil samples and in all four field duplicate samples at levels ranging
1336 from 1.5J to 370J mg/Kg. The EPA groundwater protection SSL for lead is 14 mg/Kg; the
1337 NAPR background level is 22 mg/Kg, and the NAPR Table 5-1 screening level is 120 mg/Kg.
1338 Detections in twenty of the samples and in two field duplicate samples exceed the groundwater
1339 protection SSL. Detections in seventeen of the samples and in two field duplicates exceed the
1340 background level for lead. Results for two samples plus one field duplicate exceed the NAPR
1341 Table 5-1 screening level.

1342 Nickel was detected in all 36 samples and in all four field duplicate samples at levels ranging
1343 from 5.1 to 63 mg/Kg. Detections in eight samples and in one field duplicate sample exceed the
1344 NAPR background level of 20.7 mg/Kg. Results for five samples and one field duplicate exceed
1345 the NAPR Table 5-1 screening level for nickel in soil of 30 mg/Kg. Sample 73SB06-00 and
1346 field duplicate 73SB01A-00 results exceed the EPA groundwater protection SSL of 48 mg/Kg.

Selenium was detected in five samples and one field duplicate sample at levels ranging from 1 to 1.8 mg/Kg. The detections all exceed the EPA groundwater RSL of 0.95 mg/Kg and the NAPR Table 5-1 screening level of 1 mg/Kg.

Silver was detected in sample 73SB13-00 at 0.38 mg/Kg, which does not exceed any applicable screening levels.

Thallium was detected in samples 73SB13-00 and 73SB28-00 at 0.51 and 0.48 mg/Kg, respectively. Both of these detections exceed the EPA MCl-based Groundwater Protection SSL of 0.14 mg/Kg. This screening level is discussed here because there are no residential, industrial, or other SSLs for Thallium.

Zinc was detected in all 36 samples and in all four field duplicate samples at levels ranging from 25 to 500 mg/Kg. All of the detections except for one exceed the NAPR Table 5-1 screening level of 50 mg/Kg for zinc. Results for sixteen samples and one field duplicate exceed the NAPR background level of 115 mg/Kg for zinc.

Mercury was detected in 34 samples and in all four field duplicate samples at levels ranging from 0.015 to 4.31 mg/Kg. The EPA groundwater protection SSL is 0.03 mg/Kg; the NAPR Table 5-1 screening level is 0.1 mg/Kg, and the NAPR background level is 0.109 mg/Kg for mercury. Results for 24 samples and four field duplicates exceed the groundwater protection SSL. Results for sixteen samples and one field duplicate sample exceed the NAPR Table 5-1 screening level, and results for fifteen samples and one field duplicate sample exceed the background level for mercury.

Non-detect results for arsenic, selenium, and several of the thallium samples had reporting limits that exceeded one or more soil screening levels.

All of the antimony detections were rejected during data validation due to method blank contamination and/or matrix spike recoveries less than 30%. Some, but not all, results for beryllium and selenium were likewise rejected due to poor MS recoveries. None of the samples were analyzed for molybdenum.

6.1.2 January 2009 Sampling Event.

Twenty-four surface soil samples and three field duplicate samples were collected during the January 2009 sampling event. Select 40 CFR Part 264 Appendix IX metals were analyzed at locations associatied with samples 73SB09, 73SB10, 73SB12, 73SB21, 73SB23, 73SB24, 73SB33, 73SB34, 73SB35, and 73SB36 from the March-April 2008 field event. Surface soil samples and field duplicate sample 73SB246A-00, collected from sample locations associated with 73SB24, were analyzed for LLPAHs. No surface soil samples were collected during January 2009 for 40 CFR Part 264 Appendix IX VOCs, SVOCs, or organochlorine pesticides. Analytical results are presented in Tables 7, 8, and 9.

1383 6.1.2.1 Metals in Surface Soils, January 2009.

1384 Twenty-four surface soil samples and three field duplicate samples were analyzed for chromium,
1385 cobalt, copper, nickel, vanadium, zinc, and/or mercury (Tables 7, 8, and 9). Each sample was
1386 analyzed for a different combination of metals. All of the samples were diluted during analysis,
1387 elevating the reporting limits for each metal.

1388 Six samples and two field duplicate samples were analyzed for chromium. All of the samples
1389 and duplicates contained chromium, at levels ranging from 12 to 28 mg/Kg. All of the detections
1390 exceed the EPA groundwater protection SSL of 0.083 mg/Kg and the NAPR Table 5-1 screening
1391 level of 0.4 mg/Kg for chromium.

1392 Six samples and two field duplicates were analyzed for cobalt. All of the samples and duplicates
1393 contained cobalt, at levels ranging from 19J to 53J mg/Kg. The EPA groundwater protection
1394 SSL for cobalt is 0.49 mg/Kg, and the residential SSL is 23 mg/Kg. The NAPR Table 5-1
1395 screening level for cobalt is 13 mg/Kg, and the NAPR background level is 46.2 mg/Kg. All of
1396 the detections exceed the groundwater protection SSL and the NAPR Table 5-1 screening level
1397 for cobalt. Detections in four samples and two field duplicate samples exceed the EPA
1398 residential SSL for cobalt. Results for sample 73SB362-00 and field duplicate 73SB352A-00
1399 also exceed the background level for cobalt.

1400 Ten samples and one field duplicate were analyzed for copper. All of the samples and the field
1401 duplicate contained copper, at levels ranging from 16J to 250J mg/Kg. The EPA groundwater
1402 protection SSL is 51 mg/Kg for copper; the NAPR Table 5-1 screening level is 70 mg/Kg, and
1403 the NAPR background level is 168 mg/Kg. Results for six samples and the field duplicate
1404 exceed both the groundwater protection SSL and the NAPR Table 5-1 screening level. Results
1405 for four samples also exceeded the background level for copper.

1406 Samples 73SB091-00 and 73SB092-00 were analyzed for nickel, which was detected at 39J and
1407 40J mg/Kg, respectively. No field duplicate samples were analyzed for nickel. The detections
1408 exceed both the NAPR background level of 20.7 mg/Kg and the NAPR Table 5-1 screening level
1409 for soil of 30 mg/Kg.

1410 Four samples were analyzed for vanadium. No field duplicates were analyzed for vanadium. All
1411 four samples contained vanadium at levels ranging from 230J to 300J mg/Kg, which exceed the
1412 NAPR Table 5-1 screening level of 2 mg/Kg and the EPA groundwater protection SSL of 180
1413 mg/Kg. Sample 73SB332-00 results exceed the NAPR background level of 259 mg/Kg.

1414 Sixteen samples and three field duplicate samples were analyzed for zinc. All of the samples and
1415 duplicates contained zinc at levels ranging from 14 to 360 mg/Kg. Results for ten samples and
1416 the three field duplicates exceed the NAPR Table 5-1 screening level of 50 mg/Kg for zinc.
1417 Results for seven samples and one field duplicate also exceed the NAPR background level of
1418 115 mg/Kg.

Twelve samples and two field duplicates were analyzed for mercury. Ten samples and the two field duplicates contained mercury at levels ranging from 0.15 to 4.4 mg/Kg. All of the detections exceed the EPA groundwater protection SSL of 0.03 mg/Kg, the NAPR Table 5-1 screening level of 0.1, and the NAPR background level of 0.109.

Some results for copper, cobalt, and nickel were J qualified (estimated concentrations with a positive bias) during data validation due to matrix spike sample recoveries being greater than the upper control limit. Some vanadium results were also J-qualified (estimates) due to matrix spike and laboratory control sample failures. None of the metals results were rejected during data validation.

6.1.2.2 LLPAHs in Surface Soils, January 2009.

Six surface soil samples and one field duplicate sample were analyzed for LLPAHs (Table 8). Eighteen LLPAH compounds were detected in the samples and in the field duplicate sample. Most of the results did not exceed applicable screening levels, with the following exceptions.

1-Methylnaphthalene was detected in five soil samples and in the field duplicate at levels ranging from 1.4J to 6.6 µg/Kg. 2-Methylnaphthalene was detected in five soil samples and in the field duplicate at levels ranging from 1.8J to 8.4 µg/Kg. Acenapththene was detected in five soil samples and in one field duplicate at levels ranging from 1.6J to 27 µg/Kg. Acenaphthylene was detected in all of the soil samples and in the field duplicate at levels ranging from 14 to 140 µg/Kg. Anthracene was detected in all of the soil samples and in the field duplicate at levels ranging from 10 to 210 µg/Kg. Benzo(g,h,i)perylene was detected in all of the soil samples and in the field duplicate at levels ranging from 25 to 650 µg/Kg. Fluorene was detected in all of the soil samples and in the field duplicate at levels ranging from 0.89J to 26 µg/Kg. Phenanthrene was detected in each of the soil samples and in the field duplicate at levels ranging from 5.8 to 210 µg/Kg. None of the detections exceeded any applicable soil screening levels.

Benz(a)anthracene was detected in each of the surface soil samples and in the field duplicate at levels ranging from 37 to 910 µg/Kg, all of which exceed the EPA groundwater protection SSL of 10 µg/Kg. Detections in four samples and the field duplicate also exceed the EPA residential soil screening level of 150 µg/Kg.

Benzo(a)pyrene was detected in all of the soil samples and in the field duplicate at levels ranging from 50 to 930 µg/Kg, all of which exceed the EPA groundwater protection SSL of 3.5 µg/Kg and residential SSL of 15 µg/Kg. Results for four samples and the field duplicate also exceed the EPA industrial SSL of 210 µg/Kg.

Benzo(b)fluoranthene was detected in all of the soil samples and in the field duplicate at levels ranging from 100 to 1900 µg/Kg. All of the detections exceed the EPA groundwater protection SSL of 35 µg/Kg. Results for five of the samples and the field duplicate also exceed the EPA residential SSL of 150 µg/Kg. Additionally, sample 73SB245-00 results exceed the NAPR Table 5-1 screening level for benzo(b)fluoranthene in soils of 1,200 µg/Kg.

Benzo(k)fluoranthene was detected in all of the soil samples and in the field duplicate at levels ranging from 35 to 950 µg/Kg. Sample 73SB245-00 and field duplicate sample 73SB246A-00 results exceed the EPA groundwater protection SSL of 350 µg/Kg.

Chrysene was detected in all of the soil samples and in the field duplicate at levels ranging from 50 to 1,300 µg/Kg. Sample 73SB245-00 results exceed the EPA groundwater protection SSL of 1,100 µg/Kg and the NAPR Table 5-1 screening level of 1,200 µg/Kg for chrysene in soil.

Dibenz(a,h,)anthracene was detected in each of the surface soil samples and in the field duplicate at levels ranging from 8.8 to 170 µg/Kg. Results for five samples and the field duplicate exceed both the EPA groundwater protection SSL of 11 µg/Kg and residential SSL of 15 µg/Kg.

Fluoranthene was detected in each of the surface soil samples and in the field duplicate sample at levels ranging from 47J to 1,300J µg/Kg. All of the fluoranthene results were flagged Jd due to sample dilution during preparation and analysis. Sample 73SB245-00 results exceed the NAPR Table 5-1 screening level of 1,200 µg/Kg for fluoranthene in soil.

Indeno(1,2,3-cd)pyrene was detected in each of the soil samples at levels that range from 25 to 570 µg/Kg. Results for four samples and the field duplicate exceed the EPA groundwater protection SSL of 120 µg/Kg, and results for three samples and the field duplicate also exceed the EPA residential soil SSL of 150 µg/Kg.

Naphthalene was detected in each of the soil samples and in the field duplicate at levels ranging from 0.93J to 8.7 µg/Kg, all of which exceed the EPA groundwater protection SSL of 0.47 µg/Kg.

Pyrene was detected in each of the soil samples at levels ranging from 51J to 1,300J µg/Kg. All of the pyrene results were flagged J+m due to matrix spike recoveries outside of the specified range; the results are estimated to have a positive bias. Sample 73SB245-00 results exceed the NAPR Table 5-1 screening level of 1,200 µg/Kg for pyrene.

None of the LLPAH results were rejected during data validation.

6.2 Subsurface Soil.

6.2.1 March-April 2008 Sampling Event.

Six subsurface soil samples and one duplicate soil sample were collected during the March-April 2008 sampling event. Samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for 40 CFR Part 264 Appendix IX VOCs, SVOCs, LLPAHs, PCBs, and organochlorine pesticides. No field duplicate was collected from any of the subsurface sampling locations for these analytes. The soil samples and the field duplicate sample, with the exception of sample 73SB14-04, were analyzed for metals. Field duplicate sample 73SB27A-01 was collected at

location 73SB27 at 1-3 feet in depth, and was analyzed only for metals. Analytical results are presented in Table 10.

6.2.1.1 VOCs in Subsurface Soils, March-April 2008.

Subsurface soil samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for 40CFR Part 264 Appendix IX VOCs. Eight VOCs were detected in the samples.

2-Butanone was detected in two samples at 5J µg/Kg. Acetone was detected in all four samples at levels ranging from 12J to 120J. Carbon disulfide and toluene were detected in sample 73SB02-01 at 2J and 1J µg/Kg, respectively. Chloromethane was detected in sample 73SB14-04 at 3J µg/Kg. None of these detections exceed any applicable soil screening levels.

Allyl chloride was detected in sample 73SB02-04 at 1J µg/Kg, which exceeds the EPA groundwater protection SSL of 0.21 µg/Kg.

Benzene was detected in sample 73SB02-01 at 2J µg/Kg, which exceeds the EPA groundwater protection SSL of 0.21 µg/Kg for that compound.

Bromomethane was detected in sample 73SB14-04 at 4J µg/Kg, which exceeds the EPA groundwater protection SSL of 2.2 µg/Kg for that compound.

Some of the reporting limits for the 2-hexanone and methylene chloride non-detects, and all of the reporting limits for allyl chloride, benzene, and bromomethane non-detects, exceed the applicable EPA groundwater protection SSLs.

Virtually the entire VOC data set was impacted by failure to meet holding time requirements and were flagged Jh (estimated due to holding time failure) and a negative bias is indicated.

6.2.1.2 SVOCs in Subsurface Soils, March-April 2008.

Subsurface soil samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for SVOCs.

One SVOC (DEHP) not categorized as an LLPAH was detected in the four subsurface soil samples at levels ranging from 330J to 1,500 µg/Kg. Sample 73SB02-01 and 73SB14-04 results exceed the EPA groundwater protection SSL of 1,100 for DEHP.

Additional SVOC results are discussed in paragraph 6.2.1.3, below.

Results for several SVOC compounds, including 1,4-phenylenediamine, 2,4-dinitrophenol, 2-naphthylamine, 4-nitroquinone-1-oxide, isosafrole,methapyriline, diallate, and hexachlorocyclopentadiene, were rejected during data validation due to either LCS, MS, or ICV

recoveries less than half the lower control limit. J flags (indicating estimated concentrations) were applied to several additional SVOCs.

All of the non-detect results for samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were rejected during data validation due to extremely low MS recoveries.

6.2.1.3 LLPAHs in Subsurface Soils, March-April 2008.

Subsurface soil samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for LLPAHs. No LLPAHs were detected in samples 73SB02-04, 73SB14-01, or 73SB14-04. Sample 73SB02-01 contained thirteen LLPAHs, most of which were present at levels that do not exceed applicable screening levels.

Benz(a)anthracene was detected at 5.1 µg/Kg during the LLPAH analysis, and at 82J µg/Kg in the SVOC analysis of sample 73SB02-01. The EPA groundwater protection SSL for benz(a)anthracene is 10 µg/Kg, which is exceeded by the SVOC result.

Benzo(a)pyrene was detected at 6.4 µg/Kg during the LLPAH analysis, and at 69J µg/Kg during the SVOC analysis of sample 73SB02-01. The EPA groundwater protection SSL is 3.5 µg/Kg, and the residential SSL is 15 ug/Kg. Both of these screening levels are exceeded by the SVOC result.

Benzo(b)fluoranthene was detected at 12 ug/Kg during the LLPAH analysis, and at 110J ug/Kg during the SVOC analysis of sample 73SB02-01. The EPA groundwater protection SSL for this compound is 35 µg/Kg, which is exceeded by the SVOC result.

The EPA groundwater protection SSL for naphthalene is 0.47 µg/Kg. It should be noted that the reporting limit for naphthalene in the four samples ranged from 1.8 to 2 µg/Kg, which exceeds the groundwater protection SSL.

Results for a variety of PAHs were J-qualified (estimated concentrations) during data validation due to matrix spike anomalies.

6.2.1.4 Organochlorine Pesticides in Subsurface Soils, March-April 2008.

Subsurface soil samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for organochlorine pesticides. Six compounds were detected in three of the samples.

Chlordane was detected in samples 73SB02-01 and 73SB02-04 at 900J and 12J µg/Kg, respectively. The EPA groundwater protection SSL for chlordane is 13 µg/Kg, and the NAPR Table 5-1 screening level for this compound is 100 µg/Kg. The detected level in sample 73SB02-01 exceeds both of these screening levels.

Endosulfan II was detected in sample 73SB14-04 at 0.51J µg/Kg, which does not exceed any applicable soil screening levels for that compound.

Endrin was detected in sample 73SB02-01 at 1,100J µg/Kg, which exceeds the NAPR Table 5-1 screening level of 401 µg/Kg and the EPA groundwater protection SSL of 440 µg/Kg.

P,p'-DDD was detected in samples 73SB02-01 and 73SB02-04 at 1,100J and 0.58J µg/Kg, respectively. The EPA groundwater protection SSL for p,p'-DDD is 66 µg/Kg, and the NAPR Table 5-1 screening level is 401 µg/Kg. The detected level in sample 73SB02-01 exceeds both screening levels.

P,p'-DDE was detected in samples 73SB02-01 and 73SB02-04 at 3,100Jm and 4.9Jm µg/Kg, respectively. The EPA groundwater protection SSL for p,p'-DDE is 47 µg/Kg; the NAPR Table 5-1 screening level for soil is 401 µg/Kg, and the EPA residential SSL is 1,400 µg/Kg. The detected level in sample 73SB02-01 exceeds all three screening levels.

P,p'-DDT was detected in samples 73SB02-01, 73SB02-04, and 73SB14-04 at 14,000J, 4.6J, and 2.7J µg/Kg, respectively. The detected level in sample 73SB02-01 exceeds the EPA groundwater protection SSL of 67 µg/Kg, the NAPR Table 5-1 screening level of 401 µg/Kg, the EPA residential SSL of 1,700 µg/Kg, and the EPA industrial SSL of 7,000 µg/Kg.

Most of the results for organochlorine pesticides were rejected during data validation due to extremely low MS recoveries. All positive detections were flagged Jm due to matrix spike recoveries outside of the specified window

6.2.1.5 PCBs in Subsurface Soils, March-April 2008.

Subsurface soil samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were analyzed for PCBs. All PCB results for subsurface soil samples taken from locations 73SB02 and 73SB14 were rejected during data validation due to matrix spike recoveries outside the specified window.

6.2.1.6 Metals in Subsurface Soils, March-April 2008.

Samples 73SB02-01, 73SB02-04, 73SB14-01, 73SB27-01, 73SB27-09, and field duplicate 73SB27A-01 were analyzed for metals. Fourteen metals were present in all five subsurface soil samples and in the duplicate sample73SB27A-01.

No detections of antimony were reported, as all detected values were rejected during data validation. Sample 73SB02-01 and 73SB27-01 were reported as non-detects with a reporting limit of 1 mg/Kg, which exceeds the EPA groundwater protection SSL of 0.66 mg/Kg. It is possible that levels of antimony exceeding the EPA groundwater protection SSL were not identified due to data quality issues and/or elevated reporting limits.

Arsenic was detected in samples 73SB02-01 and 73SB14-01 at 0.96J and 0.74J mg/Kg, respectively. The EPA groundwater protection SSL for arsenic is 0.0013 mg/Kg. Both detections exceed the groundwater protection SSL. The lowest reporting limit for the non-detect results is 0.39 mg/Kg, which exceeds the groundwater protection SSL.

Barium was detected in all five samples and in the field duplicate sample at levels ranging from 86 to 210 mg/Kg. The NAPR background levels are 207 mg/Kg for silty subsurface soils and 220 mg/Kg for clayey subsurface soils. Samples 73SB02-01 (silt) and 73SB27-01 (silt/clay mix) each contain 210 mg/Kg barium, which exceeds the background level for silty subsurface soils.

Cadmium was detected in three samples and in one field duplicate at levels ranging from 0.15 to 0.75 mg/Kg. Sample 73SB02-01 (silt) results exceed both the silt and clay NAPR background levels for subsurface soils (0.54 and 0.57 mg/Kg, respectively).

Chromium was detected in all five samples and in the field duplicate at levels ranging from 18J to 46J mg/Kg. The EPA groundwater protection SSL for chromium is 0.0083 mg/Kg, and the NAPR Table 5-1 screening level is 0.4 mg/Kg. All of the detected values exceed both screening levels.

Cobalt was detected in all five samples and in the field duplicate at levels ranging from 20J to 55 J mg/Kg. The EPA groundwater protection SSL for cobalt is 0.49 mg/Kg; the NAPR Table 5-1 screening level for cobalt is 13 mg/Kg, the residential SSL is 23, and the NAPR background level for subsurface clay soils is 26.9 mg/Kg. Sample 73SB14-01 (silt/clay mix) results exceed all four of these screening levels. Sample 73SB02-04 and field duplicate 73SB27A-01 results exceed the groundwater protection and residential soil SSLs and the NAPR Table 5-1 screening level for cobalt. The remaining detections exceeded the EPA groundwater protection SSL and the NAPR Table 5-1 screening level.

Copper was detected in all five samples and in the field duplicate sample at levels ranging from 100 to 460 mg/Kg. The EPA groundwater protection SSL for copper is 51 mg/Kg, the NAPR Table 5-1 screening level is 70 mg/Kg, the NAPR background levels are 120 mg/Kg for subsurface silty soils, and 246 mg/Kg for subsurface clayey soils. Sample 73SB27-01 (silt/clay mix) and field duplicate sample 73SB27A-01 (silt/clay mix) results exceed all four of these screening levels. Sample 73SB02-04 (silt), 73SB14-01 (silt/clay mix), and 73SB27-09 (silt/clay mix) results exceed the EPA groundwater protection SSL, the NAPR Table 5-1 screening level, and the background level for subsurface silty soils. Sample 73SB02-01 results exceed the EPA groundwater protection SSL and the NAPR Table 5-1 screening level.

Lead was detected in all five samples and in the field duplicate sample at levels ranging from 0.74 to 56 mg/Kg. The NAPR background levels for lead in subsurface soils are 6.2 mg/Kg for silty soils and 6.3 mg/Kg for clayey soils; and the EPA groundwater protection SSL is 14 mg/Kg. Sample 73SB02-01 (silt) results exceed both background levels and the EPA groundwater protection SSL.

Sample 73SB27-09 and field duplicate 73SB27A-01 were analyzed for molybdenum. Field duplicate 73SB27A-01 contained 82 mg/Kg molybdenum, which exceeds the EPA groundwater protection SSL of 3.7 mg/Kg.

Nickel was detected in three soil samples and in the field duplicate at levels ranging from 7.7J to 13J mg/Kg, which do not exceed any applicable soil screening levels.

Selenium was detected in sample 73SB27-01 at 1.1 mg/Kg, which exceeds the EPA groundwater protection SSL of 0.95 mg/Kg and the NAPR Table 5-1 screening level of 1 mg/Kg. The lowest detection level for selenium, 0.97 mg/Kg, exceeds the groundwater protection SSL.

Vanadium was detected in all five soil samples and in the field duplicate at levels ranging from 140 to 300 mg/Kg. The NAPR Table 5-1 screening level for soils is 2 mg/Kg vanadium; the NAPR background levels for subsurface soils are 4 mg/Kg (clay) and 256 mg/Kg (silt); and the EPA groundwater protection SSL for vanadium in soils is 180 mg/Kg. Results for soil sample 73SB27-01 (silt/clay mix) and its field duplicate 73SB27A-01 (silt/clay mix) exceed all four of these soil screening levels. Results for soil samples 73SB02-04 (silt) and 73SB14-01(silt/clay mix) exceed the NAPR Table 5-1 screening level, the background levels for subsurface clayey soils, and the EPA groundwater protection SSL. Sample 73SB02-01 (silt) and 73SB27-09 (silt/clay mix) results exceed the NAPR Table 5-1 screening level and the background level for subsurface clayey soils.

Zinc was detected in all five soil samples and in the field duplicate sample at levels ranging from 57 to 600 mg/Kg. The NAPR Table 5-1 screening level for soil is 50 mg/Kg, and the NAPR background levels for subsurface soils are 88 mg/Kg (clay), and 92 mg/Kg (silt). Results for samples 73SB02-01 (silt) and sample 73SB27-01 and field duplicate 73SB27A-01 (both a silt/clay mix) exceed all three screening levels. Results for samples 73SB02-04, 73SB14-01, and 73SB27-09 exceed the NAPR Table 5-1 screening level for zinc.

Mercury was detected in sample 73SB02-01 at 0.102 to 0.15 mg/Kg, and in sample 73SB14-01 at 0.031 to 0.041 mg/Kg (there were two sets of mercury data for these samples). The EPA groundwater protection SSL for mercury is 0.03 mg/Kg, the NAPR background levels for subsurface soils are 0.067 (silt) and 0.108 mg/Kg (clay), and the NAPR Table 5-1 screening level for soil is 0.1 mg/Kg. Both detects exceed the EPA groundwater protection SSL. Sample 73SB02-01 (silty soil) results exceed the background level for silty subsurface soils and the NAPR Table 5-1 screening level.

Antimony results were either rejected or qualified as biased extremely low, due to matrix spike recoveries. Some beryllium and selenium results were also rejected for this reason.

6.2.2 January 2009 Sampling Event.

Four subsurface soil samples were collected in January 2009. Samples collected from 3-5 and 5-7 foot depths at subsurface soil sample location 73SB02B were analyzed for 40 CFR Part 264 Appendix IX organochlorine pesticides. Samples collected from 1-3 and 17-19 foot depths at subsurface soil sample location 73SB24 were analyzed for 40 CFR Part 264 Appendix IX LLPAHs and select metals. No subsurface soil samples were analyzed for 40 CFR Part 264 Appendix IX VOCs or SVOCs. Analytical results are presented in Table 10.

6.2.2.1 LLPAHs in Subsurface Soils, January 2009.

Two samples, 73SB24-01 and 73SB24-09, were analyzed for LLPAHs. Eighteen LLPAHs were detected in subsurface sample 73SB24-01, and three LLPAHs were detected in sample 73SB24-09.

Benz(a)anthracene, benzo(a)pyrene, and naphthalene were detected in sample 73SB24-01 at 25 µg/Kg, 19 µg/Kg, and 1.4 µg/Kg, respectively. These detections exceed the applicable EPA groundwater protection SSLs for each compound, as well as the residential SSL for benzo(a)pyrene. No other applicable SSLs were exceeded for LLPAHs in the two samples.

6.2.2.2 Organochlorine Pesticides in Subsurface Soils, January 2009.

Two samples, 73SB02B-02 and 73SB02B-03, were analyzed for organochlorine pesticides. Five organochlorine pesticides were detected in the samples.

Chlordane was detected at 220 µg/Kg in 73SB02B-02 and at 9.8J µg/Kg in 73SB02B-03. The sample 73SB02B detection exceeds both the EPA groundwater protection SSL of 13 µg/Kg and the NAPR Table 5-1 screening level of 100 µg/Kg.

Heptachlor epoxide was detected at 2.7J µg/Kg in sample 73SB02B-02 and at 0.33J µg/Kg in sample 73SB02B-03. Both detections exceed the EPA groundwater protection SSL of 0.15 µg/Kg for heptachlor epoxide.

Sample 73SB02B-02 contained 4J µg/Kg p,p'-DDD, which does not exceed any applicable soil screening levels.

P,p'-DDE was detected in sample 73SB02B-02 at 81 ug/Kg, and in sample 73SB02B-03 at 0.96J µg/Kg. The sample 73SB02B-02 detection exceeds the the EPA groundwater protection SSL of 47 µg/Kg.

P,p'-DDT was detected in sample 73SB02B-02 at 270J µg/Kg, and in sample 73SB02B-03 at 1.9J µg/Kg. The 72SB02B-02 detection exceeds the EPA groundwater protection SSL of 67 µg/Kg.

Results were J-qualified (estimated concentrations) during data validation in 73SB02B-02 due to calibration recoveries above the upper QC limit.

6.2.2.3 Metals in Subsurface Soils, January 2009.

Samples 73SB24-01 and 73SB24-09 (both of which are silt/clay mixes) were analyzed for arsenic, copper, zinc, and mercury, all of which were detected in at least one sample. All soil samples analyzed for metals were diluted during analysis and were flagged "D".

Arsenic was detected in sample 73SB24-01 at 1.4 mg/Kg. The reporting limit for arsenic in sample 73SB24-09 was 0.99 mg/Kg. The EPA groundwater protection SSL for arsenic is 0.0013 mg/Kg and the residential SSL is 0.39 mg/Kg. The sample 73SB24-01 result exceeds both screening levels. The non-detect result has a reporting limit that exceeds the groundwater protection SSL.

Copper was detected in sample 73SB24-01 at 170J mg/Kg and in sample 73SB24-09 at 420 mg/Kg. The EPA groundwater protection SSL for copper is 51 mg/Kg. The NAPR Table 5-1 screening level for soil is 70 mg/Kg. The NAPR background levels for subsurface soils are 120 mg/Kg (silty soils) and 246 mg/Kg (clayey soils). The sample 73SB24-01 detection exceeds the EPA groundwater protection SSL, NAPR Table 5-1 screening level, and the background level for silty subsurface soils. The sample 73SB24-09 detection exceeds all four of these screening levels.

Zinc was detected in sample 73SB24-01 at 53 mg/Kg and in sample 73SB24-09 at 90 mg/Kg. The NAPR Table 5-1 screening level is 50 mg/Kg and the NAPR background level for zinc in clayey soils is 88 mg/Kg. The 73SB24-01 detection exceeds the NAPR Table 5-1 screening level, and the 73SB24-09 detection exceeds both the NAPR Table 5-1 screening level and the background level.

Mercury was detected in sample 73SB24-01 at 0.090D mg/Kg, which exceeds the EPA groundwater protection SSL of 0.03 and the NAPR background level of 0.067 mg/Kg for subsurface silty soils.

Copper was J-qualified during data validation as the result of matrix spike recoveries greater than the upper control limits and method blank contamination. Negative bias is indicated for these samples.

6.2.3 February 2011 Sampling Event.

6.2.3.1 VOCs in Subsurface Soils, February 2011.

One subsurface soil sample 73SB01-05 (9-11 feet bgs), at location of 73SB24 (MW03) was analyzed for 40CFR Part 264 Appendix IX VOCs. Two VOCs were detected in the sample and five in the duplicate (73SB01-05D).

Acetone was detected in sample 73SB01-05D (duplicate) at 350 µg/Kg and was undetected at 98 µg/Kg (after data validation). Neither of these concentrations exceeded any applicable soil screening levels. Chloromethane was detected in 73SB01-05 and 73SB01-05D at 3J µg/Kg and 5J µg/Kg, respectively. The detection in the duplicate exceeds the NAPR Table 5-1 screening level of 4.9 µg/Kg. 2-Butanone and methyl iodide were each detected in 73SB01-05D at 15J µg/Kg. They were not detected in 73SB01-05. Neither of these detections exceeded any applicable soil screening levels. Data validation comments can be found on Table 10.

6.2.3.2 SVOCs in Subsurface Soils, February 2011.

One subsurface soil sample 73SB01-05 (9-11 feet bgs), at location of 73SB24 (MW03) was analyzed for SVOCs. No duplicate sample was collected do to a lack of soil volume. No SVOCs were detected in this single sample.

6.2.3.3 LLPAHs in Subsurface Soils, February 2011.

One subsurface soil sample 73SB01-05 (9-11 feet bgs), at location of 73SB24 (MW03) was analyzed for LLPAHs. No duplicate sample was collected do to a lack of soil volume. No LLPAHs were detected in this single sample.

6.2.3.4 Pesticides in Subsurface Soils, February 2011.

One subsurface soil sample 73SB01-05 (9-11 feet bgs), at location of 73SB24 (MW03) was analyzed for pesticides. Endosulfan II was detected in sample 73SB01-05 at 1J µg/Kg and 2.2 µg/Kg in the duplicate. There are no applicable soil screening levels for endosulfan II. For a general comparison, screening levels for endosulfan I are all substantially greater than the measured concentrations of endosulfan II. No other pesticides were detected.

Reporting limits for the alpha BHC, beta BHC, dieldrin, heptachlor epoxide and toxaphene non-detects, exceed the applicable EPA groundwater protection SSLs.

6.2.3.5 Metals in Subsurface Soils, February 2011.

Two subsurface soil samples 73SB03-05 (9-11 feet bgs), at location of 73SB27 (MW02), and 73SB01-05 (9-11 feet bgs), at location of 73SB24 (MW03), were analyzed for metals. A duplicate sample was collected at sample location 73SB03-05 (MW02). All soil samples analyzed for metals were diluted during analysis and were flagged "D". Laboratory data for 13 of the 18 metals analyzed should be considered estimated. Data validation comments can be found on Table 10. Metals where screening criteria may have been exceeded are discussed below.

Arsenic was detected in sample 73SB01-05 at 0.63 mg/Kg. Arsenic was not detected in sample 73SB03-05 or the duplicate (73BS03-05D) at the reporting limits of 0.50 mg/Kg and 0.48 mg/Kg, respectively. The EPA groundwater protection SSL for arsenic is 0.0013 mg/Kg and the residential SSL is 0.39 mg/Kg. Sample 73SB01-05 exceeds both screening levels. The non-detect results have reporting limits that exceed the groundwater protection SSL and residential SSL.

Chromium was detected in sample 73SB01-05 at 12 mg/Kg and in sample 73SB03-05 at 7.2 mg/Kg. Both results should be considered estimated according to the data validation report. The duplicate (73BS03-05D) concentration was 7.4 mg/Kg. The EPA groundwater protection SSL for chromium is 0.0083 mg/Kg and the NAPR Table 5-1 screening level is 0.4 mg/Kg. Both samples and the duplicate exceed both screening levels.

Cobalt was detected in sample 73SB01-05 at 13 mg/Kg and in sample 73SB03-05 at 28 mg/Kg. The duplicate (73BS03-05D) concentration was 17 mg/Kg. These results should be considered estimated according to the data validation report. The EPA groundwater protection SSL for cobalt is 0.49 mg/Kg and the NAPR Table 5-1 screening level is 13 mg/Kg. Both samples and the duplicate exceed the EPA SSL. Sample 73SB03-05 and its duplicate exceed the NAPR Table 5-1 screening level.

Copper was detected in sample 73SB01-05 at 200 mg/Kg and in sample 73SB03-05 at 140 mg/Kg. The duplicate (73BS03-05D) concentration was 180 mg/Kg. These results should be considered estimated according to the data validation report. The EPA groundwater protection SSL for copper is 51 mg/Kg and the NAPR Table 5-1 screening level is 70 mg/Kg. Both samples and the duplicate exceed both screening levels.

Mercury was detected in sample 73SB01-05 at 0.48 mg/Kg. The EPA groundwater protection SSL for mercury is 0.03 mg/Kg. Mercury was non-detect in sample 73SB03-05 and its duplicate.

Vanadium was detected in sample 73SB01-05 at 160 mg/Kg and in sample 73SB03-05 at 76 mg/Kg. The duplicate (73BS03-05D) concentration was 76 mg/Kg. These results should be considered estimated according to the data validation report. The NAPR Table 5-1 screening level is 2 mg/Kg. Both samples and the duplicate exceed this screening level.

Zinc was detected in sample 73SB03-05 at 120 mg/Kg and in its duplicate (73BS03-05D) at 110 mg/Kg. These results should be considered estimated according to the data validation report. The NAPR Table 5-1 screening level is 50 mg/Kg. Both the sample and the duplicate exceed this screening level.

Reporting limits for the antimony and selenium non-detects, exceed the applicable EPA groundwater protection SSLs.

6.3 Groundwater.

6.3.1 March-April 2008 Sampling Event.

Two monitoring wells (73MW01 and 73MW02) were sampled during the March-April 2008 sampling event. Duplicate sample 73MW01A was collected from 73MW01. The groundwater sample and field duplicate from 73MW01 were analyzed for 40 CFR Part 264 Appendix IX VOCs, SVOCs and dissolved metals. The 73MW01 sample was analyzed only for dissolved metals. Analytical results are presented in Table 11.

6.3.1.1 VOCs in Groundwater, March-April 2008.

Two VOCs were detected in sample 73MW01 and its field duplicate. Acetone was detected at 4.4J µg/L in the sample and at 3.8J µg/L in the field duplicate. Ethylbenzene was detected at

0.1J in both the sample and the field duplicate. None of the detected concentrations exceed any applicable screening levels.

6.3.1.2 SVOCs in Groundwater, March-April 2008.

Two SVOCs were detected in sample 73MW01 and its field duplicate. 1-Methylnaphthalene was detected in the field duplicate at 0.011J µg/L, which does not exceed any applicable screening levels. Di(2-ethylhexyl)phthalate (DEHP) was detected at 55 µg/L in the sample and at 110 µg/L in the field duplicate. Both values exceed the EPA regional screening level (RSL) for tap water of 4.8 µg/L and the Federal drinking water maximum contaminant level (MCL) of 6 µg/L.

SVOC results for several compounds were rejected during data validation due to either LCS, MS, or ICV recoveries less than half the lower control limit.

6.3.1.3 Metals in Groundwater, March-April 2008.

Ten dissolved metals were detected in the two groundwater samples and in the field duplicate sample. All metals concentrations are considered "dissolved" because all samples were filtered utilizing an in-line 0.45µ particulate filter.

Arsenic was detected in the sample from 73MW02 at 35.1J µg/L, which exceeds the EPA tap water RSL of 0.045 µg/L, the Federal drinking water MCL of 10 µg/L, and the NAPR background level of 14.03 µg/L. It does not exceed the NAPR Table 5-2 groundwater screening value of 36 µg/L.

Barium was detected in the two samples and field duplicate at levels ranging from 132J µg/L to 154J µg/L, which do not exceed any applicable screening levels.

Cadmium was detected in the sample from 73MW02 at 12.8 µg/L, which exceeds the Federal drinking water MCL of 5 µg/L and the NAPR Table 5-2 groundwater screening value of 8.85 µg/L.

Chromium was detected in the sample from 73MW01 at 6.69 µg/L and in the field duplicate at 7.02 µg/L, both of which exceed the NAPR background level of 6.5 µg/L, but not the NAPR Table 5-2 groundwater screening value of 50.4 µg/L.

Cobalt was detected in the 73MW02 sample at 277 µg/L, which exceeds both the EPA tap water RSL of 11 µg/L and the NAPR Table 5-2 groundwater screening value of 45 µg/L.

Copper was detected in the 73MW02 sample at 57.6 µg/L, which exceeds both the NAPR Table 5-2 groundwater screening value of 3.73 µg/L and the NAPR background level of 29 µg/L.

Nickel was detected in sample 73MW02 at 140 µg/L, which exceeds both the NAPR Table 5-2 groundwater screening value of 8.28 µg/L and the NAPR background level of 84.1 µg/L.

Selenium was detected in sample 73MW02 at 61.6J µg/L and in the field duplicate at 18.8 J µg/L. The 73MW02 detection exceeds the NAPR background level of 23.92 µg/L, the Federal drinking water MCL of 50 µg/L, and the NAPR Table 5-2 groundwater screening value of 71.1 µg/L.

Silver was detected in sample 73MW02 at 5.98 µg/L, which exceeds the NAPR Table 5-2 groundwater screening value of 0.23 µg/L and the NAPR background level of 3.67 µg/L.

Zinc was detected in sample 73MW01 at 7.65J µg/L and in sample 73MW02 at 154J µg/L. The 73MW02 detection exceeds the NAPR Table 5-2 groundwater screening value of 85.6 µg/L.

Non-detect reporting limits for dissolved arsenic, copper, lead, mercury, nickel, silver, and thallium exceed one or more screening levels.

Some dissolved metals results were J-qualified (estimated concentrations) during data validation due to spike and or laboratory control sample anomalies.

6.3.2 January 2009 Sampling Event.

Two monitoring wells (73MW02 and 73MW03) were sampled during the January 2009 sampling event. Duplicate sample 73MW03A was collected from 73MW03. Sample 73MW02 was analyzed for dissolved arsenic, copper, nickel, and silver. Sample 73MW03 and the field duplicate were analyzed for LLPAHs and dissolved arsenic, copper, mercury, nickel, and silver. Analytical results are presented in Table 11.

6.3.2.1 LLPAHs in Groundwater, January 2009.

Fluoranthene was detected in the field duplicate at 0.010J µg/L, which does not exceed any applicable screening levels.

Most of the LLPAH data was rejected during data validation due to very low recoveries of matrix spike samples. Data rejected for sample 73MW03 and field duplicate 73MW03A include 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene.

6.3.2.2 Metals in Groundwater, January 2009.

Four dissolved metals were detected in each of the samples. All of the dissolved arsenic, copper, nickel, and silver samples were diluted during analysis. Dissolved mercury was not detected in sample 73MW02 or its field duplicate. All metals concentrations are considered “dissolved” because all samples were filtered utilizing an in-line 0.45µ particulate filter.

Arsenic was detected in the two groundwater samples and in the field duplicate at levels ranging from 26 µg/L to 31 µg/L, which exceed the Federal drinking water MCL of 10 µg/L and the NAPR background level of 14.03 µg/L. These concentrations do not exceed the NAPR Table 5-2 groundwater screening value of 36 µg/L.

Copper was detected in the two groundwater samples and in the field duplicate at levels ranging from 61 µg/L to 130 µg/L, which exceed the NAPR 5-2 groundwater screening value of 3.73 µg/L and the NAPR background level of 29 µg/L.

Nickel was detected in the samples and field duplicate at levels ranging from 73 µg/L to 130 µg/L. All of the detections exceed the NAPR Table 5-2 groundwater screening value of 8.28 µg/L. The 73MW02 result also exceeds the NAPR background level of 84.1 µg/L.

Silver was detected in the samples and field duplicate at levels ranging from 3.6 µg/L to 5.2 µg/L. All of the detections exceed the NAPR Table 5-2 groundwater screening value of 0.23 µg/L. The detections at 73MW02 and in field duplicate 73MW03A also exceed the NAPR background level of 3.67 µg/L.

6.3.3. January 2011 Sampling Event.

All three monitoring wells were sampled on 31 January 2011. Duplicate sample 73MW01D was collected from 73MW01. The groundwater sample and field duplicate from 73MW01 and the sample from 73MW03 were analyzed for 40 CFR Part 264 Appendix IX VOCs, SVOCs and metals. They were also analyzed for LLPAHs. The groundwater sample from 73MW02 was analyzed for 40 CFR Part 264 Appendix IX metals. These analytical parameters for each well comply with the Final CMS Work Plan, Table 3-1, *Summary of Sampling and Analytical Program*. Analytical results and data validation comments are presented in Table 11. The January 2011 laboratory data packages are provided in Appendix C.

6.3.3.1 VOCs in Groundwater, January 2011.

Ethylbenzene and toluene were detected in 73MW01 and 73MW01D at the very low concentration of 0.3J µg/L. The data validation report changed low level (estimated) concentrations of acetone and carbon disulfide to undetected. The ethylbenzene and toluene detections did not exceed any applicable screening levels. Nor would the low level acetone and carbon disulfide detections, if those concentrations had remained unchanged.

6.3.3.2 SVOCs in Groundwater, January 2011.

Bis(2-ethylhexyl)phthalate (DEHP) was detected at 28 µg/L in sample 73MW03 and 3J in 73MW01 and its duplicate 73MW01D. These were changed to undetected at 28 µg/L and 5 µg/L by the data validator. 28 µg/L exceeds the Federal drinking water MCL of 6.0 µg/L, but is substantially below the NAPR Table 5-2 groundwater screening value of 360 µg/L. No other SVOCs were detected.

1897 6.3.3.3 LLPAHs in Groundwater, January 2011.

1898 Naphthalene was detected in samples from 73MW03, 73MW01 and 73MW01D at
1899 concentrations from 0.014J µg/L to 0.020J µg/L. Phenanthrene was detected in 73MW03 at
1900 0.011J µg/L. These estimated concentrations were changed by the data validator to undetected at
1901 the reporting limit. Therefore, the only LLPAH detected was pyrene from 73MW03 at a
1902 concentration of 0.10J µg/L. Neither the single pyrene detection nor the undetected at the
1903 reporting limit results exceed any applicable screening levels.

1904 6.3.3.4 Metals in Groundwater, January 2011.

1905 Metals from all three wells were analyzed for metals. A duplicate sample was collected at
1906 sample location 73MW01. None of samples were filtered, because the turbidity at the time of
1907 sampling was less than 10 NTU. Screening criteria for dissolved metals have been used for
1908 camparison, any exceedences are discussed below.

1909 Arsenic was detected in the three groundwater samples and in the field duplicate at levels
1910 ranging from 2J µg/L to 21 µg/L. Concentrations in 73MW02 (19 µg/L) and 73MW03
1911 (21 µg/L) exceed the Federal drinking water MCL of 10 µg/L and the NAPR background level
1912 of 14.03 µg/L. These concentrations do not exceed the NAPR Table 5-2 groundwater screening
1913 value of 36 µg/L. These results are consistent with levels observed in the previous sampling
1914 events.

1915 Cadmium was detected in groundwater samples collected from 73MW02 and 73MW03 at
1916 concentrations of 15 µg/L and 9.0 µg/L, respectively. These concentrations exceed the Federal
1917 drinking water MCL of 5 µg/L and the NAPR 5-2 groundwater screening value of 8.85 µg/L.
1918 No cadmium was detected in the sample collected from 73MW01 or it's duplicate. These results
1919 are consistent with levels observed in the previous sampling events.

1920 Chromium was detected in groundwater samples collected from 73MW02 and 73MW03 at
1921 concentrations of 9.4J µg/L and 2.4 µg/L, respectively. The concentration from 73MW02 is
1922 greater than the NAPR background level of 6.5 µg/L. No cadmium was detected in the sample
1923 collected from 73MW01 or it's duplicate. These results are consistent with levels observed in
1924 the previous sampling events.

1925 Cobalt was detected in groundwater samples collected from 73MW02 and 73MW03 at
1926 concentrations of 120 µg/L and 240 µg/L, respectively. These concentrations exceed the EPA
1927 tap water RSL of 11 µg/L and the NAPR Table 5-2 groundwater screening value of 45 µg/L, but
1928 are below the NAPR background level of 580.5 µg/L. No cobalt was detected in the sample
1929 collected from 73MW01 or it's duplicate. These results are consistent with levels observed in
1930 the previous sampling events.

1931 Copper was detected in all three groundwater samples and in the field duplicate. Samples from
1932 MW01 and its duplicate were less than 3 µg/L. Samples from 73MW02 and 73MW03 contained
1933 67 µg/L and 140 µg/L of copper, respectively. These concentrations exceed the NAPR Table 5-

2 groundwater screening value of 3.73 µg/L and the NAPR background level of 29 µg/L. These results are consistent with levels observed in the previous sampling events.

Nickel was detected in all three groundwater samples, but not in the field duplicate. The concentration in the sample from MW01 was 1.1J µg/L and it's duplicate was non-detect with a reporting limit of 5.0 µg/L. Samples from 73MW02 and 73MW03 contained 120 µg/L and 47 µg/L of nickel, respectively. These concentrations exceed the NAPR Table 5-2 groundwater screening value of 8.28 µg/L. The concentration in 73MW02 is greater than the NAPR background level of 84.1 µg/L. These results are consistent with levels observed in the previous sampling events.

Selenimum was detected in groundwater samples collected from 73MW02 and 73MW03 at concentrations of 69 µg/L and 63 µg/L, respectively. These concentrations exceed the Federal drinking water MCL of 50 µg/L and the NAPR background level of 23.92 µg/L. No selenimum was detected sample 73MW01. The duplicate concentration was 0.81J µg/L. These results are consistent with levels observed in the previous sampling events.

Silver was detected in groundwater samples collected from 73MW02 and 73MW03 at concentrations of 3.5 µg/L and 1.1 µg/L, respectively. These concentrations exceed the NAPR Table 5-2 groundwater screening value of 0.23 µg/L, but are below the NAPR background level of 3.67 µg/L. No silver was detected in the sample collected from 73MW01 or it's duplicate. These results are consistent with levels observed in the previous sampling events.

Zinc was detected in groundwater samples collected from 73MW02 and 73MW03 at concentrations of 190 µg/L and 90 µg/L of zinc, respectively. These concentrations exceed the NAPR Table 5-2 groundwater screening value of 85.6 µg/L, but are below the NAPR background level of 360.64 µg/L. No zinc was detected in the sample collected from 73MW01. A detection of 2.8 µg/L was reported for 73MW01D, but was changed by the data validator to undetected at the reporting limit of 5.0 µg/L. These results are consistent with levels observed in the previous sampling events.

6.4 Laboratory Data Validation Summary.

Qualified data as the result of data validation are flagged as shown in Tables 4-15. Field duplicate, equipment rinsate, field blank, and trip blank samples were collected as part of QA/QC sampling. The samples were analyzed for chemical constituents associated with the field samples they represented. The results are discussed in the following paragraphs.

6.4.1 Field Duplicate Samples.

The collection and analysis of field duplicate samples is a means by which to evaluate sampling procedures as wells as analytical precision (extraction procedures and analytical systems). A field duplicate sample set consists of a thoroughly homogenized sample collected from one desired location that has been split between two sets of bottleware. True field duplicates cannot be collected for the VOC in soil analysis due to potential analyte loss during the homogenization

process. For VOCs in soil, two samples are collected from the same site at the same time; the same procedure is used for all groundwater samples. When samples are collected from the same site at the same time, the samples are considered field replicates. For comparison purposes, field duplicates and field replicates have been evaluated by the same criteria.

Field duplicate samples may be collected and analyzed as an indication of overall precision. These analyses measure both sampling and laboratory precision; therefore, the results may have more variability that laboratory duplicates which measure laboratory performance. The precision of both the field duplicate and laboratory duplicate samples will be affected by the sample matrix homogeneity. Generally, solid matrices results will have greater variance than aqueous matricies results due to difficulties associated with homogenization of the samples. The following subsections briefly summarize the data validation reports for each sampling event. The January-February 2011 laboratory data validation report is provided in Appendix B.

6.4.1.1 April 2008

Two aqueous and two soil field duplicates were collected. For the aqueous samples, the relative percent difference (RPD) results were almost universally less than 50 percent. In the soil duplicates, duplicate pair 73SB01-00/73SB01A-00 displayed several analytes with RPDs approaching or greater than 50 percent in the pesticide, SVOC, and metals fractions. In the duplicate pair 73SB13-00/73SB13A-00, acetone displayed an RPD approaching 100 percent and in the PAH fraction most analytes displayed RPD greater than 50 percent with a number approaching or exceeding 100 percent. In accord with USEPA Region 2 protocols, no data qualification was performed.

Laboratory analytical precision was generally quite good with only a very limited number of results flagged due to laboratory duplicate or matrix spike duplicate results. One of two soil field duplicates displayed significantly different results. The data validation report advised that data flagged with a “d” reason code and soil samples of a similar nature to 73SB13-00 should be used conservatively. The reported results *may* have a range of ±100% in some cases.

Very significant matrix interferences were observed in the quality control data and in the chromatography for numerous samples in all the organic fractions. This has resulted in the application of numerous qualifiers explained in the data tables and data validation reports. In comparing qualified data to fixed threshold values, biases must be kept in mind such that when the value in the sample approaches the threshold on either the lower or higher side, the worst-case scenario should be assumed unless a detailed analysis of the direction and magnitude of bias attributed to each datum is applied.

Blank and duplicate performance was generally good and the representativeness of these data is largely acceptable. However, the field duplicate pair 73SB13-00/73SB13A-00 suggests that for some samples, representativeness is questionable; though the data remain usable.

Completeness was generally acceptable. However, in the soil data, the pesticide and PCB fraction, as well as some individual metals, display completeness less than 95 percent.

6.4.1.2 January 2009

Only one analyte, fluoranthene, was flagged for duplicate imprecision. Overall the precision on these data are acceptable.

Aqueous samples for pesticides and PAHs contained a large number of calibration anomalies (pesticides) and matrix spike failures (PAHs). Soil accuracy results appear to be generally acceptable. The one exception to this observation is in the metals fraction where significant numbers of results were affected by positive biases.

Representativeness as displayed in field duplicates is acceptable. Completeness for field and equipment blanks is less than 95 percent for the pesticides and PAHs. Other analytes display acceptable completeness.

6.4.1.3 January – February 2011

The precision of these data was generally found to be acceptable. Minor to modest duplicate imprecision was observed in metals.

The accuracy of these data was found to be generally acceptable. Nonetheless, matrix effects contributed to some biased results in the VOC, SVOC and metals data. Of particular concern are those instances in which recoveries were found to be depressed to a point where one cannot exclude the potential for false negatives. These results include antimony in the metals fraction, styrene in the VOC fraction, and 1,4-phenylenediamine, 2-napthylamine, 3,3-dimethylbenzene, methapyrilene, phentermine (a,a-dimethylphenethylamine) and methyl methanesulfonate in the SVOC fraction. In addition, phenolic compounds in sample MW-3 were also rejected. These results represent data gaps and may not be used for decision making. Less severe biases, both positive and negative were observed for a variety of other analytes but these results may be used as reported.

Overall, completeness is acceptable. However, on an analyte specific basis there are some data gaps.

6.4.2 Equipment Rinsate Samples.

Equipment rinsate samples were collected daily from selected equipment used as part of the sampling process. Samples 73ER-01, 73ER-02, 73ER-03, 73ER-04, 73ER-05, 73ER-06, and 73ER-07 were collected from split spoon cutting shoes and liners, aluminum foil, vinyl gloves, scoops, and groundwater sampling tubing during the March-April 2008 sampling event. Equipment rinsate sample data for this event are included in Table 14.

Samples 73ER-08, 73ER-09, and 73ER-10 were collected from unidentified equipment during the January 2009 sampling event. A 'hold' was placed on some equipment rinsate samples (73ER-02, 73ER-05, and 73ER-08). If the environmental samples associated with the samples on 'hold' detected levels of chemical analytes outside what was suspected, then the 'hold' samples were to be analyzed. None of the equipment rinsate samples requested to be held were analyzed, with the exception of sample 73ER-05, which was analyzed for metals. Portions of rinseate sample 73ER-06 were lost, and could only be analyzed for metals. Results from the equipment rinsate samples do not indicate significant contamination as a result of sampling equipment or the decontamination process used for the project. Equipment rinsate sample data for this event are included in Table 15.

An equipment rinseate blank for groundwater (EQ Blk GW) and equipment rinseate blank for soil (EQ Blk Soil) were collected during the January-February 2011 sampling event. EQ Blk GW was collected by pumping locally procured distilled water through sample tubing using the peristaltic pump. EQ Blk Soil was collected by pouring locally procured distilled water through a large-bore sample tube (with cutting shoe) into sample containers. Low detections of several analytes were observed and are shown in Table 15. None of these very low detections affected any site decisions.

6.4.3 Field Blank Samples.

Field blank samples were collected from the NAPR tap water, from locally procured distilled water and from laboratory-provided deionized water. Results from the field blank samples (73FB01-03 from March-April 2008 and 73FB04-06 from January 2009) do not indicate significant contamination as a result of water sources used during the project. Field blank sample data are included in Tables 14 and 15.

Field blanks from the March-April 2008 sampling event detected minor concentrations of VOCs and LLPAHs from the deionized and distilled water samples. Concentrations of VOCs and metals were observed in the NAPR tap water sample. Data qualifications were made for environmental samples detecting toluene and 2-methylnaphthalene due to its presence in the blank samples.

Many of the field blank LLPAH results from the January 2009 sampling event were rejected as the result of matrix spike failures. NAPR tap water organochlorine pesticides data were rejected due to calibration verification failures. There were no issues identified for metals.

6.4.4 VOC Trip Blank Samples.

Trip blank samples accompanied all VOC samples in transit from the field to the laboratory during the March-April 2008 and January-February 2011 sampling events. No VOCs were detected at levels above the limit of quantitation in the March-April 2008 trip blanks, so no soil sample results affected by the analysis of the VOC trip blanks. Two VOCs were detected at very low concentrations in the 2011 monitoring event; 2-Butanone (1.2J µg/L) and carbon disulfide (2.2 µg/L). These very low detections do not affect any site decisions.

6.5 References.

LANTDIV, 2005. Final Phase I/II Environmental Condition of Property Report, Former U.S. Naval Station Roosevelt Roads, Ceiba, Puerto Rico. Norfolk, Virginia. 15 July 2005.

Baker, 2008. Final Corrective Measures Study Work Plan for SWMU 73. Naval Activity Puerto Rico, Ceiba, Puerto Rico. January 2008.

7.0 SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT AND STEP 3a OF THE BASELINE ECOLOGICAL RISK ASSESSMENT.

7.1 Background.

The primary focus of the ERA is to evaluate the potential for impacts to ecological receptors from contaminants at SWMU 73, the scrap metal recycling yard on NAPR (Figures 1-3), via a screening level ecological risk assessment (SLERA), and Step 3a of the baseline ecological risk assessment (BERA).

The ERA for SWMU 73 was performed according to the concepts and technical recommendations of the documents below as specified by the Final CMS Work Plan for SWMU 73 (Baker, 2008).

- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (EPA, 1997)

- Navy Guidance for Conducting Ecological Risk Assessments (Chief of Naval Operations (CNO), 1999)

This ERA evaluated the likelihood that adverse ecological effects may occur as a result of exposure to contaminants in various media (surface soil, subsurface soil, and groundwater). Adverse responses can range from subtle chronic effects in an individual organism to a loss of an ecosystem function. A risk does not exist unless the particular substance acts on an ecological component long enough and at a sufficient intensity to elicit an adverse effect. Tier 1 (Steps 1 and 2) of the Navy ERA process (Figure 5-1 of the Final CMS Work Plan for SWMU 73) represents the SLERA, which utilizes conservative assumptions and includes:

- Screening-level problem formulation and ecological effects evaluation (Step 1).

- Screening-level exposure estimate and risk calculation (Step 2).

If, in the Tier 1 SLERA, there are chemicals present in the environmental media that may present a risk to receptor species/communities, the ERA process proceeds to a BERA, or Tier 2 (Step 3a). Conservative exposure assumptions used in Tier 1 are refined, and risk estimates are recalculated. The evaluation of risks in Step 3a may also include consideration of background data, chemical bioavailability, and the frequency of detection. If the re-evaluation of conservative exposure assumptions does not support an acceptable risk determination, corrective measures will be recommended to address potential ecological risks at SWMU 73.

7.2 Environmental Setting.

As described in section 2.2, SWMU 73 is located in the near-shore flatlands on NAPR and is approximately 9 acres in size. The SMWU 73 scrap metal recycling yard, consists of a large flat-lying, gravel-covered, scrap metal storage yard and secondary growth vegetative

communities around its perimeter. Debris (i.e., wood, metal, etc.) has been observed in the vegetative areas and spills and stains of petroleum oils and lubricant are characteristic of the scrap metal yard (Baker, 2008). The following sections describe the habitats and biota that may exist at SWMU 73. Information from various reports (identified below) was used to describe the habitats and biota at this site.

7.2.1 Site Description and Physical Features.

See Section 3.0 of the CMS Investigation Report for SWMU 73.

7.2.2 Terrestrial Habitats.

The land use at Site 73 is mostly urban (existing development) with sporadic coastal scrub forest vegetative communities. The secondary growth of thick scrub is dominated by leadtree (*Leucaena spp.*), box briar (*Randia aculeate*), sweet acacia (*Acacia farnesiana*), and Australian corkwood tree (*Sesbania grandiflora*) that grew in areas that were cleared for grazing prior to acquisition by the Navy. Tree species include ucar (*Bucida buceras*), sandbox (*Hura crepitans*), figs (*Ficus sp.*) flamboyant tree (*Delonix regia*), Puerto Rican royal palm (*Roystonea borinquena*), ginep (*Melicococus bijugatus*), and Indian almond (*Terminalia catappa*) (U.S. Navy, 1998). Areas within SWMU 73 that contain scrub forest act as buffers for sensitive tidal and marine ecosystems (Department of the Navy, 2007).

7.2.3 Aquatic Habitats.

Mangroves exist to the north of SWMU 73 but are not of concern since the groundwater flow is to the southeast as shown on Figures 4 and 5. The marine environment adjacent to the site is typical of tropical, shallow, coastal waters (U.S. Navy, 1998) and an open water marine habitat exists beyond a non-operational dry dock, which is located approximately 300 feet southeast of SWMU 73 (Department of the Navy, 2007). SWMU 73 is upgradient of Puerca Bay, an open water marine habitat, which represents a possible discharge point for groundwater. Puerca Bay is located approximately 1,200 feet from SWMU 73 and contains areas of seagrass beds.

7.2.4 Biota.

Specific biota occurring at SWMU 73 has not been documented to date. However, the biota at NAPR is described using the Environmental Assessment for the Disposal of Naval Activity Puerto Rico (Department of the Navy, 2007) and other available sources. Wildlife at NAPR consists of native avian, reptile, and amphibian species as well as many introduced mammalian species.

7.2.4.1 Mammals.

The mammal population is predominantly made up of introduced species to include: mongoose, dogs, cats, Norway and grey-bellied rats, and mice (U.S. Navy, 2004). These nonindigenous mammals have been implicated in the decline of native bird and reptile populations (USFWS,

1996 and USGS, 1999). Thirteen bat species are known to inhabit Puerto Rico but are not exclusive to the island (USGS, 1999). The West Indian manatee is also known to occur in the marine environment surrounding NAPR, and historical sightings indicate that manatees are concentrated in areas with dense seagrass beds. Seagrass (i.e., turtle grass) beds occur within the small cove of Puerca Bay, but to a lesser extent near the non-operational dry dock.

7.2.4.2 Birds.

A total of 239 bird species are native to Puerto Rico (Raffaele, 1989). This total includes breeding permanent residents and nonbreeding migrants. In addition, many nonindigenous bird species have been introduced to Puerto Rico, including the Shiny cowbird (*Molothrus bonariensis*) and several parrot species, such as the budgerigar (*Melopsittacus undulates*), Orange-fronted parrot (*Aratinga canicularis*), and Monk parrot (*Myiopsitta monaqchus*). Of the 239 species native to Puerto Rico, 12 are endemic to the island (Raffaele, 1989). Numerous native and migratory bird species have been reported at NSRR (Geo-Marine, Inc., 1998). A list of bird species reported at NSRR or having the potential to occur is provided in Table 16. Some of the threatened and endangered avian species are listed below.

Commonwealth Listed Threatened and Endangered Species

- Peregrine falcons (*Falco peregrines*)
- Least tern (*Sterna antillarum*)
- Least grebe (*Tachybaptus dominicus*)
- West Indian whistling duck (*Dendrocygna arborea*)
- Caribbean coot (*Fulica caribea*)
- Snowy plover (*Charadrius alexandris*).

Peregrine falcons are not expected to nest at NAPR and use is expected to be limited to transient individuals. The Least grebe and Caribbean coot feed on aquatic vegetation and small invertebrates primarily in freshwater habitats although they have been documented in brackish water as well. Snowy plover and Least terns nest and feed on sandy beaches and mudflats, whereas the West Indian whistling duck uses mangroves and other forested wetlands.

Federally Listed Species

- Yellow-shouldered blackbirds (*Agelaius xanthomus*)
- Piping plover (*Charadrius melodus*)
- Roseate tern (*Sterna dougalii dougalii*)

Suitable habitat exists at SWMU 73 for the Yellow-shouldered blackbird since they forage in canopy and subcanopy of coastal scrub forests (U.S. Fish and Wildlife Service (USFWS), 1996). Only incidental observations (i.e., less than 20 individuals) of Yellow-shouldered blackbirds have been reported at NAPR (Geo-Marine, Inc., 2005). No Piping plovers were reported at NAPR during the late 1990s or during surveys conducted in 2002 and 2004 (Geo-Marine Inc., 2005), and historical evidence of the Roseate tern inhabiting NAPR does not exist (Department of the Navy, 2007).

7.2.4.3 Reptiles and Amphibians.

Puerto Rico's native reptile species include 31 lizards, 8 snakes, 1 freshwater turtle, 5 sea turtles, and 23 amphibians. Approximately six species of snakes are known to occur at NAPR to include: the Puerto Rican boa (*Epicrates inornatus*), Virgin Island tree boa (*Epicrates monesis granti*), Puerto Rican racer (*Alsophis portoricnesis*), Puerto Rican garden snake (*Arrhyton exiguum*), Virgin Island blindsnake (*Typhlops richardi*), and Puerto Rican wetland blindsnake (*Typhlops rostellatus*) (U.S. Navy, 1998). Two snake species, the Puerto Rican boa and the Virgin Islands tree boa are Federally and commonwealth-listed species that are known to inhabit NAPR. Numerous frog (i.e., 16 species of coquis) and toad species also inhabit NAPR. Mongoose populations have been the culprits for the reduction of much of the reptile population (Department of the Navy, 2007).

7.2.4.4 Fish and Aquatic Invertebrates.

A diverse fish and invertebrate community can be found in the marine environment surrounding NAPR. In general, the fish can be divided into three different associations, based on their preferred habitat. These associations include fish inhabiting the seagrass beds and sandflats, those inhabiting coral reefs, and open water or pelagic fish. There is overlap among the associations, as some fish in one association also use habitats in another.

The fish community is represented by stingrays, herrings, groupers, needlefish, mullets, barracudas, jacks, snappers, grunts, snooks, lizardfishes, parrotfishes, gobies, filefishes, wrasses, damselfishes, and butterflyfish (Geo-Marine, Inc., 1998). The benthic invertebrate community includes sponges, corals, anemones, sea cucumbers, sea stars, urchins, and crabs. Marine invertebrates observed within the small cove of Puerca Bay during the marine reconnaissance survey included sea urchins (*Echinometra lucunter* and *Echinometra viridis*), encrusting fire coral (*Millipora alcicormus*), common sea fan (*Gorgonia venalina*), starlet coral (*Siderastrea ammulatta*), pincushin starfish (*Oreaster reticulates*), and corkscrew anemone (*Bartholomea annulatta*), as well as two species of sea cucumbers (*Actinopyga agassizii* and *Holothuria mexicana*). In addition to invertebrates, 16 fish species were observed within the Puerca Bay. The specific species encountered included the sergeant major (*Abudefduf saxatillis*), dusky damselfish (*Stegates fuscus*), tomtate (*Haemulon aurolineatum*), gray snapper (*Lutjanus griseus*), squirrelfish (*Holocentrus sp.*), yellow fin mojarra (*Gerres cinereus*), and silver jenny (*Eucinostomus gula*).

7.2.4.5 Threatened and Endangered Species.

Threatened and endangered species are typically found in less disturbed and more unique communities. Federally listed and Commonwealth-listed plant and animal species found at NAPR are included in Table 17. A discussion of threatened and endangered bird species are described in section 7.2.4.2.

7.3 Screening-Level Problem Formulation.

The screening-level problem formulation is a process for establishing the goals, scope, and focus of the SLERA. The problem is defined, the plan for analyzing exposure and effects and other data is outlined, and the methods for characterizing risks are described. The outcome of this phase that forms the structure of this SLERA is the conceptual site model and assessment and measurement endpoints. This stage of the risk assessment provides the foundation on which the entire analysis depends.

7.3.1 Integration of Available Information.

Integrating available information is an iterative process throughout problem formulation. All relevant information on the source of the stress and the environment potentially at risk is presented here.

7.3.2 Conceptual Site Model.

A conceptual site model (CSM) is a written description (risk hypothesis) and visual representation (diagram) of predicted responses of ecological entities to stress (EPA, 1998). The risk hypothesis statement follows:

Chemicals in the media at SWMU 73 may accumulate in the environment to sufficient levels to induce the following effects:

- Increased stress on individual organisms that may reduce population densities (e.g., through reduced reproductive performance, less resistance to disease, or impaired development).
- Stressed populations of organisms.
- Altered structure and function and decreased productivity of ecological communities.
- Altered and potentially decreased biological diversity.

The bulleted points in this hypothesis are arranged as a cascade of events. It is believed that toxicological effects that decrease reproductive potential and impair development of organisms can lead to stressed populations of organisms if those effects become sufficiently prevalent. Such stressed populations are then expected to potentially lead to changes in population

dynamics and community interactions that can alter the actual kinds of species (structure) and processes (function) within the affected ecological community. In general, the assumption is that such changes can lead to decreased community productivity and biological diversity. As this is SLERA, the analysis focused upon the first link in this chain (i.e., the potential for toxicological effects in organisms).

In addition to the above risk hypothesis, the CSM consists of the three diagrams (Figures 6-8). Figure 6 presents the preliminary CSM for SWMU 73. The CSM identifies the source, transport pathways, exposure media, and environmental fate of chemicals in this SLERA. Figure 7 illustrates the hypothesized ecological consequences that such outcomes may have on terrestrial communities. Figure 8 illustrates the same phenomena for aquatic communities.

7.3.3 Selection of Receptors.

Lower and upper trophic level receptors were chosen for evaluation as part of the SLERA.

<u>Lower Trophic Level Receptors</u>

Lower trophic level receptor species (i.e., terrestrial community receptors) were evaluated based on taxonomic groupings (e.g., terrestrial plants and invertebrates) for which screening values were developed and evaluated on a community level via a comparison to media-specific screening values.

<u>Upper Trophic Level Receptors</u>

Upper trophic bird species were selected for dietary exposure modeling. These species are known to inhabit, have the potential to occur at NAPR, or are selected as surrogate species to represent birds from NAPR with similar feeding habits and dietary preferences.

Evaluating potential adverse effects in wildlife involves selection of species that represent protected, highly exposed, and/or sensitive animals within various ecological guilds. In a general sense, a guild is a group of species with similar functional roles within a community (Simberloff and Dayan, 1991). For the purposes of the SLERA, a guild refers more specifically to a group of species that have similar foraging (i.e., feeding) behavior and are within the same taxonomic class. Guild associates are individual species within a particular guild. The design of this SLERA assumes that, as defined, guild associates are taxonomically related, and they are more similar in terms of toxicological sensitivity to chemicals of potential concern (COPCs).

By focusing on guilds, the SLERA can narrow the number of potentially exposed species into manageable and ecologically significant groups. Risk estimates for terrestrial wildlife were focused on bird guilds, since mammals are limited to nonindigenous nuisance species and life history information for native bat species is lacking. Few data exist to assess exposure and effects to amphibians and reptiles (Sample et al., 1997), therefore they were not evaluated in the SLERA. Terrestrial food webs were the primary focus for this SLERA since limited data and

information exists for addressing groundwater exposure to ecological receptors. The following terrestrial habitat guilds were evaluated in the SLERA:

- Terrestrial avian herbivore (i.e., Mourning dove)
- Terrestrial avian omnivore (i.e., American robin)
- Terrestrial avian carnivore (i.e., Red-tailed hawk)

The mourning dove and red-tailed hawk are known to occur in Puerto Rico (Raffaele, 1989) and have also been reported at NAPR (Table 16). The American robin was selected as a surrogate species to the yellow-shouldered blackbird although the robin feeds on earthworms on the ground whereas the blackbird forages within the canopy of trees (USFWS, 1996). Because earthworms will bioaccumulate soil contaminants at higher concentrations than arboreal invertebrates consumed by the yellow-shouldered blackbird, modeled dietary intakes for the robin will result in a conservative estimate of food web exposures for the blackbird. In addition, modeled dietary intake of soil by the robin will also result in a conservative estimate of food web exposures for the yellow-shouldered blackbird.

7.3.4 Assessment Endpoints.

Assessment endpoints were selected based on the known habitat types and species present or likely to be present at SWMU 73. Assessment endpoints are explicit expressions of the actual environmental values that are to be protected, operationally defined by an ecological entity and its attributes (EPA 1998). The ecological entities within each assessment endpoint are those that are considered to be susceptible to the stress. Assessment endpoints structure the SLERA to ensure that management concerns are addressed and that the SLERA can support management decisions. Measurement endpoints are measureable ecological characteristics that are related to the value chosen as the assessment endpoint. Measurement endpoints can be used to evaluate the degree of impact that may occur. The specific assessment and measurement endpoints for the SLERA follow:

- <u>Assessment Endpoint</u>: Survival, growth, and reproduction of terrestrial community receptors [soil biota (e.g., soil invertebrates, terrestrial plants)]

  <u>Measurement Endpoint</u>: Comparison of maximum chemical concentrations in surface and subsurface soil with soil screening values.

- <u>Assessment Endpoint</u>: Development and reproductive success of wildlife populations (i.e., avians)

  <u>Measurement Endpoint</u>: Comparison of No Observable Adverse Effect Level (NOAEL) values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.

- Assessment Endpoint: Development and reproductive success of individuals of threatened or endangered species (i.e., avians).

  Measurement Endpoint: Comparison of NOAEL values for survival, growth, and/or reproductive effects with modeled dietary exposure doses based on maximum chemical concentrations in surface and subsurface soil.

7.4 Screening-Level Effects Evaluation.

Media-specific screening values and ingestion-based screening values were chosen for use in this SLERA. Media-specific screening values were chosen for ecologically relevant media (e.g., surface soil), whereas ingestion-based screening values were developed for upper trophic level food web (dietary) exposures.

7.4.1 Media-Specific Screening Values.

Various criteria and toxicological benchmarks were used to select appropriate screening-level benchmarks for surface soil, (0 to 1 foot in depth), subsurface soil (1 to 3 feet in depth), and groundwater. These media-specific screening values represent conservative exposure thresholds above which adverse ecological effects may occur.

7.4.1.1 Soil Screening Values.

Surface and subsurface soil screening values were chosen based on a hierarchy of preferable sources listed in Section 5.2.1.1 of the Final CMS Work Plan for SWMU 73. Table 5-1 of the Final CMS Work Plan for SWMU 73 also presents the surface and subsurface soil screening values that were accepted by the EPA for use in ERAs at NAPR (Baker, 2006a and 2006b).

7.4.1.2 Groundwater Screening Values.

Groundwater screening values were chosen based on a hierarchy of preferable sources listed in Section 5.2.1.2 of the Final CMS Work Plan for SWMU 73. Table 5-2 of the Final CMS Work Plan for SWMU 73 also presents the groundwater screening values that were accepted by the EPA for use in ERAs at NAPR (Baker, 2006a and 2006b).

7.4.2 Ingestion-Based Screening Values.

Ingestion-based screening values were chosen and discussed in Section 5.2.2 of the Final CMS Work Plan for SWMU 73. Table 5-3 of the Final CMS Work Plan for SWMU 73 also presents ingestion-based screening values that were accepted by the EPA for use in ERAs at NAPR (Baker, 2006a and 2006b).

Ingestion-based screening values for upper trophic level dietary exposures were derived for each receptor species and chemical evaluated for food web exposures. As mentioned previously, only avian species were evaluated for upper trophic level food web exposures. Additionally, the only

chemicals that are evaluated for food web exposures are those with the potential to bioaccumulate (e.g., VOCs and SVOCs). Bioaccumulative chemicals are those with a maximum reported octanol-water partition coefficient (log K_{ow}) greater than or equal to 3.0. This approach has been accepted by the EPA for the selection of organic chemicals evaluated for upper trophic level food web exposures (Baker, 2006a and 2006b). For conservatism, all metals were also evaluated for food web exposures.

7.5 Analysis Methodology – Exposure Assessment.

This section presents the details of the planned analysis. Analysis is a process that examines the interrelationships between the two primary components of risk, exposure and effects, and their relationships to ecosystem characteristics (EPA, 1998).

Exposure is defined as the contact or co-occurrence between stressor and receptor. Exposure of ecological receptors to COPCs in media is evaluated through consideration of exposure pathways. For an exposure pathway to be complete and be considered for evaluation in a risk assessment four elements must exist (EPA, 1989):

- A source and mechanism of chemical release,
- A retention or transport medium,
- A point of potential contact with the contaminated medium, and
- An exposure route (e.g., ingestion) at the contact point.

Exposure assessment consists of quantifying exposure of an ecological receptor to a COPC. Exposure to community and class-specific guild measurement receptors is assessed using different approaches. These community receptors were assessed based on estimates of direct uptake pathways of a COPC from media. Class-specific receptors (i.e., birds) were assessed based on estimates of ingestion of organisms or media containing concentrations of the selected COPCs.

The following exposure pathways were not evaluated due to the limitation of data: wildlife inhalation and dermal exposure to COPCs, and wildlife ingestion of COPCs via grooming and preening (EPA, 1999).

Due to the chemical properties and physiological interactions of some substances, the potential for adverse effects to occur from exposure through the food chain can be the most important exposure pathway to animals. For example, vascular plant uptake may expose wildlife ingesting these plants to concentrations of substances that are greater than in soil and water. Some substances may bioaccumulate and be of more concern than other nonbioaccumulating substances. The greater the octanol-water partition coefficient (K_{ow}) of a COPC, the more likely the substance is to partition to octanol (a lipid surrogate) than water (i.e., it accumulates in fatty tissues). As mentioned previously, bioaccumulation was considered during the assessment when

the log $K_{ow} \geq 3.0$ for any organic chemicals. See Table 18 for log K_{ow} values for the organic chemicals.

7.6 Screening-Level Exposure Estimation.

This section presents the analytical data, exposure assumptions, and the exposure models and input parameters that were used to estimate the potential exposure of ecological receptors to chemicals in the media (e.g., surface soil).

7.6.1 Selection Criteria for Analytical Data.

Selection criteria exist for the available analytical data (Tables 1-11) for the various media to include:

- Data must be validated and rejected (R) values will not be used in the SLERA. Unqualified data and data qualified as J will be treated as detected. Data qualified as U or UJ will be treated as nondetected.
- Maximum reporting limits will be conservatively used to estimate exposure for nondetected chemicals.
- For duplicate samples, the higher of the two concentrations will be used in the screening (when both values are detects or both values are nondetects). In cases where one result is a detection and the other a nondetect, the detected value will be used in the assessment.
- For surface soil, analytical data for samples collected from the surface to a maximum depth of 1 foot below ground surface and from 1 to 3 feet below ground surface will be used.
- For groundwater, total dissolved (filtered) metals data will be used in the medium-specific screening evaluation.

7.6.2 Exposure Estimation.

Maximum detected concentrations in media (e.g., surface soil) were used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints.

7.6.2.1 Terrestrial and Aquatic Receptors – Abiotic Media.

Maximum detected concentrations in abiotic media (e.g., surface soil) were used to estimate potential chemical exposures to the selected ecological receptors. This conservative assessment evaluated the potential for adverse ecological effects to the lower trophic level receptor groups (e.g., terrestrial plants and invertebrates) from COPCs.

2431 7.6.2.2 Upper Trophic Level Receptors – Prey Items.

2432 Exposures for upper trophic level receptor species via the food web were determined by
2433 estimating chemical-specific concentrations in each dietary component. Incidental ingestion of
2434 surface soil was also included when calculating the total intake for each receptor, however,
2435 drinking water exposures were not. Tissue concentrations were modeled for terrestrial plants
2436 (food item for American robin and mourning dove), soil invertebrates (food item for American
2437 robin), and small mammals (food item for red-tailed hawk). An omnivore was used to represent
2438 the small mammals present in Puerto Rico that function as potential food items (e.g., rats) for the
2439 hawk.

2440 The uptake of chemicals from the abiotic media into terrestrial and aquatic food items is based
2441 (when available) on conservative (e.g., maximum or 90th percentile) bioconcentration factors
2442 (BCFs) or bioaccumulation factors (BAFs) from the literature. A BCF indicates the degree to
2443 which a chemical may accumulate in organisms coincident with the concentration of the
2444 chemical in the surrounding media. BAF values consider both direct exposures to the
2445 surrounding media, as well as uptake from dietary exposures and were given preference over
2446 BCFs when estimating prey item tissue concentrations. Default factors of 1.0 were used only
2447 when data were unavailable for chemicals in the literature. The methods and models used to
2448 derive exposure estimates are described below:

2449 *7.6.2.2.1 Terrestrial Plants.*

2450 Tissue concentrations in the aboveground vegetative portion of terrestrial plants were estimated
2451 by multiplying the maximum surface soil concentration for each chemical by chemical-specific
2452 soil-to-plant BCFs obtained from the literature. The BCF values used were based on root uptake
2453 from soil and were reported as dry-weight soil and dry-weight plant tissue. The soil-to-plant
2454 BCFs used in the SLERA are summarized in Table 19.

2455 *7.6.2.2.2 Soil Invertebrates.*

2456 Tissue concentrations in soil invertebrates (i.e., earthworms) were estimated by multiplying the
2457 maximum surface soil concentration for each chemical by chemical-specific BCFs or BAFs
2458 obtained from the literature. BAFs based on depurated analyses (soil was purged from the gut of
2459 the earthworm prior to analysis) were given preference over undepurated analyses when
2460 selecting BAF values since direct ingestion of surface soil is accounted for separately in the food
2461 web model. The BCF/BAF values used in the SLERA were reported as dry-weight soil and dry-
2462 weight earthworm tissue and are summarized in Table 19.

2463 *7.6.2.2.3 Small Mammals.*

2464 BCFs/BAFs for plant-to-omnivorous mammals (Table 20) and soil-to-omnivorous mammals
2465 (Table 21) were obtained in order to estimate whole-body tissue concentrations in small
2466 mammals. Soil-to-omnivorous mammal BAF values obtained from the literature were used
2467 when available, and a value of 1 was assumed when a value could not be obtained.

Plant-to-omnivorous mammal tissue concentrations were calculated using a biotransfer factor for mammals ($Ba_{mammals}$), which is defined as the ration of a compound concentration in animal tissue to the daily intake of a compound by the animal through ingestion of food items and media (i.e., soil). Biotransfer factors, in conjunction with receptor-specific ingestion rates, can be used to calculate food-item- and media-to-animal BCFs. Appendix D presents the algorithm that identifies the sources that were used to obtain Ba_{mammal} values, and Table 20 presents the actual values. The plant-to-omnivorous mammal BCFs are calculated using the equation below:

$$BCF_{tp-om} = Ba_{mammal} \cdot \left(\frac{IR_f}{1 - w_x} \cdot F_{tp} \right)$$

Where:

BCF_{tp-om} = bioconcentration factor for plants to omnivorous mammals (unitless)
Ba_{mammal} = biotransfer factor for mammals (day/kg/FW tissue)
IR_f = ingestion rate of food (kg/d dw)
F_{tp} = fraction of diet comprised of terrestrial plants (unitless)
w_x = dry-to-wet weight conversion factor (unitless)

Estimates of COPC concentrations in omnivorous mammals, trophic level 3 (TL3) that serve as food items for higher order predators (TL4) were modeled using the BCF-food chain multiplier (FCM) approach (EPA, 1999). A ratio of FCMs was applied to the animal food item ingested (i.e., terrestrial invertebrates) to account for the increase in COPC concentration occurring between the trophic level of prey item and the trophic level of the omnivore (TL3). In general, the COPC concentration in omnivores depends on the COPC concentration in each food item ingested. The maximum COPC concentrations in omnivorous mammals were calculated using the equation below:

$$C_{om,x} = (C_{ti(x)} \cdot FCM_3 / FCM_2 \cdot P_{ti}) + (C_{tp(x)} \cdot BCF_{tp-om} \cdot P_{tp}) + (Cs_x \cdot BCF_{s-om} \cdot P_s)$$

Where:

$C_{om,x}$ = COPC concentration in omnivorous mammals (milligrams per kilogram (mg/kg) dw)
$C_{ti(x)}$ = maximum COPC concentration in invertebrates (mg/kg dw)
FCM_3 = food chain multiplier for trophic level 3 predators (unitless)
FCM_2 = food chain multiplier for trophic level 2 prey (unitless)
P_{ti} = percentage of invertebrates in diet that is contaminated (unitless)
C_{tp} = maximum COPC concentration in terrestrial plants (mg/kg dw)
BCF_{tp-om} = bioconcentration factor for terrestrial plants to omnivorous mammals (unitless)
P_{tp} = percentage of plants in diet that is contaminated (unitless)
C_{sx} = maximum COPC concentration in soil (mg/kg)

$BCF_{s\text{-}om}$ = bioconcentration factor for soil-to-omnivorous mammal (unitless)
P_s = proportion of soil in diet that is contaminated (unitless)

Dietary Intakes

Dietary intakes for each upper trophic level receptor species were calculated using the following equation modified (EPA, 1993).

$$DI_x = \frac{[[\sum_i [(FIR)\ (FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [AUF]}{BW}$$

Where:
DI_x = Dietary intake for chemical x (mg/kg BW/d)
FIR = Food ingestion rate (kg/day dw)
FC_{xi} = Maximum concentration of chemical x in food item i (mg/kg dw)
PDF_i = Proportion of diet composed of food item i (mg/kg dw)
SC_x = Maximum concentration of chemical x in surface soil (mg/kg dw)
PDS = Proportion of diet composed of surface soil (dw basis)
BW = Body weight (kg wet weight)
AUF = Area use factor (unitless)

Conservative, receptor-specific exposure parameters (maximum food ingestion rates and minimum body weights) for the American robin, mourning dove, red-tailed hawk, and small mammal omnivore (evaluated as the hawk's prey) are provided in Table 22. The food items selected for each species and the percent contribution to their total diet is provided in Table 23.

For the SLERA, an AUF of 1.0 was assumed (i.e., each receptor is assumed to spend 100 percent of its time on the site). As such, receptor-specific home ranges were not considered in the estimation of dietary intakes.

7.7 Screening-Level Risk Calculation.

The screening-level risk calculation is the final step in the SLERA. In this step, maximum chemical concentrations in abiotic media, or maximum exposure doses, for upper trophic level receptor species are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of potential ecological COPCs for each media-pathway-receptor combination evaluated or a conclusion of negligible risk.

7.7.1 Selection of Ecological Chemicals of Potential Concern.

COPCs are those substances in media (i.e., surface soil, subsurface soil, and groundwater) that are evaluated in the SLERA. The purpose of identifying COPCs is to focus the risk assessment on those compounds that are likely to pose potential risk to ecological receptors exposed to SWMU 73 contaminants.

Ecological COPCs were selected using the hazard quotient (HQ) method. For a given chemical, an HQ was calculated by dividing the maximum chemical concentration in the medium being evaluated by the corresponding media-specific screening value or, in the case of upper trophic level receptors, by dividing the maximum exposure dose by the corresponding ingestion-based screening value. The following conservative methodology was used to identify ecological COPCs for abiotic media:

- The maximum detected concentration in surface soil, subsurface soil, and groundwater were used to calculate media-specific HQs. For a given medium, chemicals with HQs greater than or equal to 1.0 based on maximum detected concentrations were identified as ecological COPCs.

- For nondetected chemicals, maximum reporting limits were used to calculate media-specific HQ values. Nondetected chemicals with HQs greater than or equal to 1.0 based on maximum reporting limits were identified as ecological COPCs.

- Detected and nondetected chemicals without media-specific screening values were identified as ecological COPCs.

To select ecological COPCs by evaluating food web exposures, maximum chemical concentrations in surface soil and subsurface soil were used to estimate dietary doses for each receptor. For the SLERA, chemicals (detected and nondetected) with NOAEL-based HQs greater than or equal to 1.0 were identified as ecological COPCs. Identical to the media-specific screening evaluation, detected and nondetected chemicals without ingestion-based screening values were identified as ecological COPCs for upper trophic level receptor exposures.

HQs greater than or equal to 1.0 indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). The HQ ratio is not an actual risk estimate, since it is not a forecast of the probability (or frequency) of an event. The HQ ratio is commonly used as an indicator of concern in screening-level assessments. Screening values and exposure doses are derived using intentionally conservative assumptions (maximum media concentrations, maximum ingestion rates, and minimum body weights); therefore, HQs greater than or equal to 1.0 do not necessarily indicate that risks are present or impacts are occurring. Rather, they identify chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs less than 1 indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

It is noted that the SLERA considers independent effects of chemicals. However, the potential does exist for multiple chemicals in environmental media to interact. Much uncertainty is involved with the interpretation of chemical interactions due to the complexity of potential effects (e.g., synergistic, antagonistic, or additive), and due to varying toxicities of compounds in different species. For these reasons, cumulative effects were not addressed as part of the SLERA.

7.7.2 Screening-Level Risk Calculation for Surface Soil, Subsurface Soil, Groundwater, and Terrestrial Food Web Exposures.

Screening-level risk calculations for SWMU 73 surface soil, subsurface soil, and groundwater are presented in Tables 24, 25, and 26 whereas the terrestrial food web exposures are presented in Table 27 (surface soil) and Table 28 (subsurface soil). Various chemicals were retained as ecological COPCs and identified in the tables mentioned above.

7.7.2.1 Screening-Level Risk Calculation for Surface Soil.

Table 24 presents the screening-level risk calculation results for surface soil and indicates which chemicals were retained as ecological COPCs. No SVOCs were retained as COPCs at SWMU 73. However, 12 pesticides (p,p'-DDD, p,p'-DDE, p,p'-DDT, chlordane, delta-BHC, dieldrin, endosulfan sulfate, endrin aldehyde, heptachlor, heptachlor epoxide, kepone, and methoxychlor), 9 low level PAHs (benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene), and 10 metals (barium, chromium, cobalt, copper, lead, nickel, thallium, vanadium, zinc, and mercury) had maximum concentrations that exceeded the soil screening value thus target level (HQ≥1). Additionally, three PCBs (Aroclor 1248, Aroclor 1254, and Aroclor 1260), five VOCs (2-butanone, acetone, bromomethane, carbon disulfide, and methyl iodide), and one metal (sulfide) were identified as ecological COPCs based on the lack of soil screening values.

7.7.2.2 Screening-Level Risk Calculation for SubSurface Soil.

Table 25 presents the screening-level risk calculation results for subsurface soil and indicates which chemicals were retained as ecological COPCs. No SVOCs were retained as COPCs at SWMU 73; however, five pesticides (endrin, chlordane, p,p'-DDD, p,p'-DDE, and p,p'-DDT) and seven metals (chromium, cobalt, copper, selenium, vanadium, zinc, and mercury) had maximum concentrations that exceeded the soil screening value thus target level (HQ≥1). Additionally, three metals (molybdenum, sulfide, and tin), and seven VOCs (2-butanone, acetone, bromomethane, carbon disulfide, chloromethane, methyl iodide, and allyl chloride) were identified as ecological COPCs based on the lack of soil screening values.

7.7.2.3 Screening-Level Risk Calculation for Groundwater.

Table 26 presents the screening-level risk calculation results for groundwater and indicates which chemicals were retained as ecological COPCs. No SVOCs, VOCs, or PAHs were retained as COPCs at SWMU 73; however, two pesticides (p,p'-DDD and p,p'-DDT) and six metals

(cadmium, cobalt, copper, nickel, silver, and zinc) had maximum concentrations that exceeded the groundwater screening value thus target level (HQ≥1).

7.7.2.4 Terrestrial Food Web Exposures.

Results of the screening-level risk calculation for terrestrial food web exposures are presented in Tables 27 and 28, respectively.

7.7.2.4.1 Terrestrial Food Web Exposures: Surface Soil.

Results of the risk calculation for food web exposures to chemicals in surface soil are presented in Table 27. Based on the comparison of maximum exposure doses to NOAEL-based screening values, six pesticides (chlordane, endrin aldehyde, kepone, p,p'-DDD, p,p'-DDE, and p,p'-DDT), one PCB (Aroclor 1254), and six metals (chromium, cobalt, copper, vanadium, zinc, and mercury) had HQ values greater than or equal to 1.0 for one or more of the terrestrial avian receptors. These chemicals were retained as ecological COPCs for terrestrial food web exposures.

7.7.2.4.2 Terrestrial Food Web Exposures: SubSurface Soil.

Results of the risk calculation for food web exposures to chemicals in subsurface soil are presented in Table 28. Based on the comparison of maximum exposure doses to NOAEL-based screening values, four pesticides (endrin, p,p'-DDD, p,p'-DDE, and p,p'-DDT) and seven metals (chromium, copper, molybdenum, zinc, vanadium, and mercury) had HQ values greater than or equal to 1.0 for one or more of the terrestrial avian receptors. These chemicals were retained as ecological COPCs for terrestrial food web exposures.

7.8 Uncertainties Associated with the Screening-Level Risk Assessment.

Uncertainty is a description of the imperfect knowledge of the true value of a particular variable or its real variability in an individual or a group (EPA, 1999). Uncertainty is expected in any process where limitations of the available data and the need to make assumptions and extrapolations based on incomplete information exist. The uncertainties associated with the SLERA for SWMU 73 are identified in Table 29.

7.9 SLERA Decision Point and Recommendations.

The results of the SLERA for SWMU 73 indicate that further evaluation of the chemicals selected as COPCs in the various media (surface soil, subsurface soil, and groundwater) is warranted. Under Navy policy, if the results of Steps 1 and 2 (Tier 1 SLERA) indicate that there are chemicals present in media that have the potential to harm the ecological receptors evaluated, the SLERA proceeds to the BERA (i.e., Step 3a).

7.10 Step 3a of the BERA.

The results of the SLERA indicated that one or more chemicals in each medium evaluated may have the potential to cause adverse health effects to ecological receptors evaluated. Therefore, the ERA process at SWMU 73 proceeded to the BERA.

The problem formulation phase of the BERA (Tier 2) or Step 3 of the Superfund guidance (EPA, 1997) is initiated, the conservative assumptions from the SLERA (Tier 1) are refined, and HQs are recalculated using the same conceptual site model. Step 3a also considers background data and chemical bioavailability.

The specific assumptions, parameters, and methods that will be modified for the recalculation of media-specific and food web HQ values are identified below, along with justification for each modification. These refinements and methods will be used in Step 3a of the BERA to weigh the evidence of potential risk for each ecological COPC identified for each media and receptor to determine whether the development of CAOs is warranted.

- Refined HQs will be derived using 95% Upper Confidence Limit (UCL) of the mean chemical concentrations. 95% UCL of the mean concentrations were calculated using EPA ProUCL Version 4.1 software (EPA, 2010).

- Literature-based BCFs and BAFs based on, or modeled from, central tendency estimates (e.g., mean, median, midpoint) will be used in place of maximum or high-end (e.g., 90th percentile) estimates. An assumed BCF/BAF of 1.0 will still used for those chemicals lacking a literature-based BAF/BCF. The refined BCFs and BAFs for those chemicals carried into Step 3a of the BERA (if available) are presented in Table 32. It should be noted that the soil-omnivore BAF for zinc is 0.51 and was the only chemical that had a refined BAF.

- Central tendency estimates (e.g., mean, median, midpoint) for body weight and food ingestion rate will be used to develop exposure estimates for upper trophic level receptors rather than the minimum body weights and maximum food ingestion rates used in the SLERA. The use of central tendency estimates is more relevant, because they represent the characteristics of a greater proportion of the individuals in the population. The evaluation of food web exposures will still assume an AUF of 1.0. Less conservative exposure parameters are presented in Table 30.

- In addition to the NOAEL-based HQs used in the SLERA, consideration also will be given to food web exposure HQs based on Low Observable Adverse Effect Levels (LOAELs) and Maximum Acceptable Toxicant Concentrations (MATCs). The MATC was derived by taking the geometric mean of the NOAEL and LOAEL. Calculations with NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide

realistic HQs since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced).

- Consideration will be given to background data by statistically comparing site concentrations to background concentrations in accordance with Navy guidance (Naval Facilities Engineering Service Center (NFESC), 2002, 2003, and 2004). The process that will be used to statistically evaluate data is depicted on Figure 5-2 as presented in the CMS Work Plan (Baker, 2008). As evidenced by the figure, statistical comparisons will include descriptive summaries of each data set (maximum, minimum, and mean concentrations), statistical tests on the mean/median of the distributions (i.e., student's t-test, Wilcoxin rank sum test, Gehan test, and Satterthwaite's t-test), and statistical tests on the right tail of the distributions (i.e., quantile test and/or slippage test). The significance level for rejecting the null hypotheses that data sets were sampled from the same population) will be set at 0.05 for all statistical tests (NFESC, 2002, 2003, and 2004). For a given medium, the background data to be used in the statistical evaluation will be the background data set presented and discussed within the *Revised Final Summary Report for Environmental Background Concentrations of Inorganic Compounds* (Baker, 2008).

- As exposure does not necessarily equate to risk, consideration will be given to site-specific factors that can affect the bioavailability of chemicals.

- Chemicals not identified as ecological COPCs because maximum detected concentrations (or maximum reporting limits in the case of nondetected chemicals) are less than medium-specific screening values will not be evaluated in Step 3a of the BERA, since a conclusion of no unacceptable risk was made from the conservative SLERA.

7.10.1 Refined Risk Evaluation.

Chemicals identified as COPCs in Step 2 of the SLERA were evaluated further in Step 3a of the BERA. HQs were calculated using the 95% UCL for the chemicals identified in the screening-level evaluation as COPCs.

Chemicals can further be eliminated based on frequency of detection (FOD) and the background statistical analysis comparison to site concentrations. Eliminating chemicals based on FOD is an acceptable approach in ERAs (EPA, 2001) and allows for the elimination of chemicals from further consideration if the FOD is less than 5% when 20 or more samples are collected. No chemicals were eliminated based on FOD since those chemicals containing 20 or more samples had FODs greater than 5%. Further discussions regarding the background analysis is present in the sections that follow.

7.10.1.1 Step 3a Risk Evaluation for Surface Soil.

For surface soil, HQs were calculated using the 95% UCL for all chemicals identified in the screening-level evaluation as COPCs. The statistical background comparison shown in Table 33 indicates that chromium, cobalt, and vanadium concentrations in SWMU 73 surface soil are not elevated above background levels. Therefore, further evaluation of these chemicals in surface soil is not recommended.

Refined Hazard Quotients for Terrestrial Community Receptors at SWMU 73

Terrestrial community receptors include terrestrial plants and terrestrial invertebrates which were evaluated considering the following assessment endpoint.

> Assessment Endpoint: Survival, growth, and reproduction of terrestrial community receptors.

The potential for chemicals to cause adverse health effects to terrestrial communities was estimated by using the HQ method: comparing 95% UCL COPC concentrations in soil to a COPC-specific toxicity benchmark. The 95% UCL HQs that exceeded the target level of 1 are presented in Table 31 and are discussed below. The refined HQs indicate that chlordane, endosulfan sulfate, endrin aldehyde, heptachlor, kepone, methoxychlor, p,p'-DDD, p,p'-DDE, p,p'-DDT, copper, thallium, zinc, and mercury may have the potential to cause adverse health effects to terrestrial plant and invertebrate populations and are discussed below.

Kepone (detected in 9 of 33 samples), heptachlor (detected in 5 of 33 samples), endosulfan sulfate (detected in 2 of 24 samples), endrin aldehyde (detected in 2 of 24 samples), and methoxychlor (detected in 2 of 24 samples) had maximum concentrations that were based on a non-detected values (43,000 µg/kg, 480 µg/kg, 980 µg/kg, 980 µg/kg, and 4,800 µg/kg respectively) and were considerably higher than the other detected and non-detected surface soil concentrations (kepone range of 2.8J-66J µg/kg, heptachlor range of 0.36J -16.0J µg/kg, endosulfan sulfate range of 0.51J -1.7J µg/kg, endrin aldehyde range of 1.6J-9.2ND µg/kg, and methoxychlor range of 8.5ND+J-89ND+J µg/kg). In addition, no detected concentrations exceeded the screening-level benchmark for kepone (100 µg/kg), heptachlor (100 µg/kg), endosulfan sulfate (100 µg/kg), endrin aldehyde (100 µg/kg), and methoxychlor (100 µg/kg). Therefore, the HQs for kepone (HQ=96.32), heptachlor (HQ=1.13), heptachlor epoxide (HQ=1.09), endosulfan sulfate (HQ=2.22), endrin aldehyde (HQ=2.22), and methoxychlor (HQ=10.87) were likely overestimated due to the high non-detected values. Based on the information above, further evaluation of these chemicals is not recommended.

Chlordane (HQ=22.43) was detected at concentrations that exceeded the benchmark of 100 µg/kg in 2 out of 9 samples (73SB01; 480 µg/kg and 73SB24; 130 µg/kg). Out of the two samples that exceeded the benchmark, the sample with the highest concentration (480 µg/kg) was sampled from the gravel substrate at the scrap metal yard. The second sample (73SB24; 130 µg/kg) only slightly exceeded the benchmark. It should also be noted that chlordane had a high

non-detected value (9,800 µg/kg) that was considerably higher than other surface soil concentrations. This likely overestimates the HQ for terrestrial community receptors. Based on the information above, further evaluation of chlordane in surface soil is not recommended.

Although p,p'-DDD (HQ=2.31), p,p'-DDE (HQ=6.11), and p,p'-DDT (HQ=42.60) were retained for further evaluation, it should be noted that p,p'-DDD, p,p'-DDE, and p,p'-DDT had two considerably high detections (i.e., DDD: 5,500 µg/kg and 810J µg/kg; DDE: 9,600 µg/kg and 4,700 µg/kg; DDT: 77,000 µg/kg and 5,300 µg/kg) in close proximity to each other within the gravel substrate at the scrap metal yard at sampling locations 73SB02 and 19E-03. The range of concentrations identified in surrounding areas are considerably lower (DDD: 1.4J-13.0 µg/kg, DDE: 1.3J-360 µg/kg, and DDT: 1.0J-160J µg/kg). The concentration ranges specified for the samples surrounding locations 73SB02 and 19E-03 for p,p'-DDD, p,p'-DDE, and p,p'-DDT in surface soil did not exceed the screening-level value of 401 µg/kg; therefore, the HQ is likely overestimated for the terrestrial community receptors. Further evaluation for p,p'-DDD, p,p'-DDE, and p,p'-DDT in surface soil is not recommended.

HQs exceeded the target level of 1 for copper (HQ= 2.90), thallium (HQ= 1.45), zinc (HQ= 3.09), and mercury (HQ= 12.40). It should be noted that the benchmarks for copper and zinc were based on plant data. Although copper and zinc had HQs that slightly exceeded the target level, the site is fully vegetated, specifically where the highest detections were recorded (19E-SS07; 290 mg/kg and 73SB245; 360 mg/kg). In the most frequently applied and appropriate benchmark guidance (Efroymson et al., 1997a), there is a disclaimer that is fully applicable to the SWMU 73, and it states that "if chemical concentrations reported in field soils that support vigorous and diverse plant communities exceed one or more of the benchmarks presented in this report or if a benchmark is exceeded by background soil concentrations, it is generally safe to assume that the benchmark is a poor measure of risk to the plant community at that site." Copper and zinc were detected above the screening level (70 mg/kg and 50 mg/kg) at various sampling locations. However, the HQs for these two chemicals were only slightly above the target level (HQ=2.90 and HQ= 3.09), and vegetation exists even at the highest detected concentration. Therefore, further evaluation for copper and zinc in surface soil is not recommended.

Mercury had a HQ that exceeded the target level (HQ= 12.40). It should be noted that the benchmark (.10 mg/kg) was based on earthworm data (Efroymson et al., 1997b) and even though the target level was exceeded, a HQ>1 does not guarantee that adverse health effects are actually occurring at SWMU 73. HQs are not a measure of risk (i.e., they are not probabilities of toxicological effects occurring in the population), and exceedances of soil invertebrate benchmarks do not demonstrate that soil invertebrates are impacted. The benchmarks were developed from work with species that likely do not occur at SWMU 73, and in the development of the benchmarks, commercially available worms that had no prior chemical exposures were used. A less conservative soil benchmark (.30 mg/kg) based on plants (Efroymson et al., 1997a) was also exceeded at several locations resulting in a HQ=4.0, an HQ slightly above the target level. However, as indicated in the previous paragraph, "if chemical concentrations reported in field soils that support vigorous and diverse plant communities exceed one or more of the

benchmarks presented in the Efroymson et al., 1997a report or if a benchmark is exceeded by background soil concentrations, it is generally safe to assume that the benchmark is a poor measure of risk to the plant community at that site." Some of the highest mercury detections recorded (4.4, 4.3, and 3.6 mg/kg) were sampled from a fully vegetated sites (73SB245, 73SB24, and 73SB15 respectively). As such, further evaluation of mercury in surface soil is not recommended.

Although thallium had a HQ that exceeded the target level (HQ= 1.45), it should be noted that 91% of the samples collected (i.e., 33 out of 36 samples) were considered non-detected values. Only one sample (2J mg/kg) exceeded the benchmark of 1 mg/kg. In addition, the HQ was only slightly above the target level. Therefore, further evaluation of thallium in surface soil is not recommended.

Further evaluation is not recommended for three PCBs (Aroclor 1248, Aroclor 1254, and Aroclor 1260), five VOCs (2-butanone, acetone, bromomethane, carbon disulfide, and methyl iodide), and one metal (sulfide) since no soil screening values are available for the evaluation of terrestrial community receptors.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial community receptors exposed to surface soil at SWMU 73; therefore, additional evaluation is not recommended.

Refined Hazard Quotients for Wildlife Populations at SWMU 73

Wildlife receptors evaluated at SWMU 73 include the following feeding guilds, with their representative species shown in parentheses: terrestrial avian carnivore (i.e., red-tailed hawk), terrestrial avian omnivore (i.e., American robin), and terrestrial avian herbivore (i.e., mourning dove). These receptors were evaluated considering the following assessment endpoint.

Assessment Endpoint: Development and reproduction success of wildlife populations.

The potential for chemicals to cause adverse health effects to herbivorous, omnivorous, and carnivorous birds was estimated by using the HQ method: comparing the wildlife average daily COPC intake from oral ingestion to an oral toxicity reference value (TRV). The 95% UCL, NOAEL-based HQs that exceeded the target level are presented in Table 34.

Red-tailed hawk

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that p,p'-DDD, p,p'-DDE, p,p'-DDT, and Aroclor 1254 may have the potential to cause adverse health effects to red-tailed hawks. However, refined HQs using the MATC-based HQ (i.e., a more realistic HQ) indicate that Aroclor 1254 does not have the potential to cause adverse health effects to red-tailed hawks (i.e., HQ<1).

HQs for p,p'-DDD (HQ=3.14), p,p'-DDE (HQ=13.27), and p,p'-DDT (HQ=73.54) exceeded the target level. It should be noted that p,p'-DDD, p,p'-DDE, and p,p'-DDT had two considerably high detections (i.e., DDD: 5,500 µg/kg and 810J µg/kg; DDE: 9,600 µg/kg and 4,700 µg/kg; DDT: 77,000 µg/kg and 5,300 µg/kg) in close proximity to each other within the gravel substrate at the scrap metal yard at sampling locations 73SB02 and 19E-03. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the range of concentrations identified in surrounding areas are considerably lower (DDD: 1.4J-13.0 µg/kg, DDE: 1.3J-360 µg/kg, and DDT: 1.0J-160J µg/kg) and 2) hawks have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their extensive home range (272 acres). When the AUF was adjusted to reflect the hawks home range, p,p'-DDT is the only chemical with a HQ>1 (HQ=2.21) . However, the MATC-based HQ would eliminate p,p'-DDT from further evaluation since the HQ<1. Therefore, further evaluation of p,p'-DDD, p,p'-DDE, and p,p'-DDT with regard to the red-tailed hawk is not recommended.

Although chlordane, endrin aldehyde, kepone, zinc, and mercury were identified as ecological COPCs in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQs<1 based on 95% UCL soil concentrations). Additionally, no further evaluation is recommended for two PCBs (Aroclor 1248, Aroclor 1260, four VOCs (2-butanone, bromomethane, carbon disulfide, and methyl iodide), and one metal (sulfide) since no wildlife TRVs are available for the evaluation of terrestrial avian carnivores.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial avian carnivores at SWMU 73; therefore, additional evaluation is not recommended.

American robin

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that p,p'-DDD, p,p'-DDE, p,p'-DDT, endrin aldehyde, copper, zinc, and mercury may have the potential to cause adverse health effects to wildlife populations. However, HQ estimates using the MATC-based HQ (i.e., a more realistic HQ) indicate that p,p'-DDD, p,p'-DDE, endrin aldehyde, copper, and zinc had HQs<1 and further evaluation of those chemicals is not recommended.

The HQ for p,p'-DDT (HQ=19.5) exceeded the target level. It should be noted that p,p'- DDT had two considerably high detections (77,000 µg/kg and 5,300 µg/kg) in close proximity to each other on the scrap metal yard at sampling locations 73SB02 and 19E-03. The HQ is likely overestimated for the robin since the range of concentrations identified in surrounding areas with favorable habitat are considerably lower (1.0J-160J µg/kg). Robins tend to inhabit areas with preferable habitat and feed in preferable areas throughout their home range and the scrap metal yard contains a gravel substrate with concrete existing on much of the pad.

The NOAEL based HQ for mercury (HQ=2.9) exceeded the target level and the MATC-based HQ did as well (HQ=1.6) but to a much lesser extent. It should be noted that the HQ exceeded

the target level only slightly. It was concluded in the previous section (Refined Hazard Quotients for Terrestrial Community Receptors at SWMU 73) that it was unlikely that mercury would cause adverse health effects to terrestrial community receptors, the robin's food source, therefore, additional evaluation is not recommended.

Although Aroclor 1254, was identified as an ecological COPCs in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQ<1 based on 95% UCL soil concentrations). Additionally, no further evaluation is recommended for two PCBs (Aroclor 1248, Aroclor 1260, four VOCs (2-butanone, bromomethane, carbon disulfide, and methyl iodide), and one metal (sulfide) since no wildlife TRVs are available for the evaluation of terrestrial avian omnivores.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial avian omnivores at SWMU 73; therefore, additional evaluation is not recommended.

Mourning Dove

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that p,p'-DDD, p,p'-DDT, endrin aldehyde, and mercury may have the potential to cause adverse health effects to wildlife populations. However, HQ estimates using the MATC-based HQ (i.e., a more realistic HQ) indicate that p,p'-DDD and endrin aldehyde had HQs<1 and further evaluation of those chemicals is not recommended.

The HQ for p,p'-DDT (HQ=48.07) exceeded the target level of 1. It should be noted that p,p'-DDT had two considerably high detections (DDT: 77,000 µg/kg and 5,300 µg/kg) in close proximity to each other within the gravel substrate at the scrap metal yard at sampling locations 73SB02 and 19E-03. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the range of concentrations identified in surrounding areas are considerably lower (DDT: 1.0J-160J µg/kg) and 2) mourning doves have a tendency to inhabit areas with preferable habitat and to feed in preferable areas throughout their extensive home range. The scrap metal yard would not be considered preferable habitat since it contains a gravel substrate with concrete existing on much of the pad. The refined ecological risk assessment also assumes an AUF=1, indicating that the dove spends 100% of its time on SWMU 73. Adjusting the AUF to represent a more realistic home range for the mourning dove (i.e., 637 acres) would result in a HQ<1. Therefore, further evaluation of p,p'-DDT with regard to terrestrial avian herbivores is not recommended.

Mercury had a NOAEL-based HQ that slightly exceeded the target level of 1 (HQ=2.12). The refined ecological risk assessment assumes an AUF=1, indicating that the dove spends 100% of its time on SWMU 73. Although various concentrations were located on the scrap metal yard and in surrounding forested areas, the mourning dove has a large home range (i.e., 637 acres) that was not represented in this assessment. Adjusting the AUF to represent a more realistic home range would result in a HQ<1. Therefore, the HQ is likely overestimated and further evaluation of mercury is not recommended for the dove.

Although p,p'-DDE and zinc were identified as ecological COPCs in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQs<1 based on 95% UCL soil concentrations). Additionally, no further evaluation is recommended for two PCBs (Aroclor 1248, Aroclor 1260, four VOCs (2-butanone, bromomethane, carbon disulfide, and methyl iodide), and one metal (sulfide) since no wildlife TRVs are available for the evaluation of mourning doves.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial avian herbivores at SWMU 73; therefore, additional evaluation is not recommended.

7.10.1.2 Step 3a Risk Evaluation for SubSurface Soil.

For subsurface soil, HQs were recalculated using average concentrations (where applicable) since 95% UCLs could not be calculated due to limited data. Average concentrations were calculated for the following chemicals identified in the screening-level evaluation as COPCs: chromium, cobalt, copper, selenium, vanadium, zinc, and mercury. Since average concentrations could not be calculated for endrin, chlordane, p,p'-DDD, p,p'-DDE, and p,p'-DDT, HQs were based on maximum concentrations. The statistical background comparison shown in Table 33 indicates that chromium and vanadium concentrations in SWMU 73 subsurface soil are not elevated above background levels. Therefore, further evaluation of these chemicals in subsurface soil is not recommended.

Refined Hazard Quotients for Terrestrial Community Receptors at SWMU 73

Terrestrial community receptors include terrestrial plants and terrestrial invertebrates which were evaluated considering the following assessment endpoint.

Assessment Endpoint: Survival, growth, and reproduction of terrestrial community receptors.

The potential for chemicals to cause adverse health effects to terrestrial communities was estimated by using the HQ method: comparing average COPC concentrations (when available) in soil to a COPC-specific toxicity benchmark. The HQs > 1 are presented in Table 32. HQs based on the average concentrations indicate that the following chemicals had HQs that exceeded the target level of 1: cobalt (HQ=4.29), copper (HQ=3.57), selenium (HQ=1.03), and zinc (HQ=5.16).

Although cobalt, copper, selenium, and zinc had HQs that exceeded the target level, it should be noted that the benchmarks for these chemicals were based on plant data. The sampling sites are fully vegetated or either located on the gravel scrap metal yard (zinc only), specifically where the highest detection was recorded (cobalt: 55mg/kg at 73SB14, copper: 460 mg/kg at 73SB27, selenium: 1.1 mg/kg at 73SB27, and zinc: 600 mg/kg at 73SB02). In the most frequently applied and appropriate benchmark guidance (Efroymson et al., 1997a), there is a disclaimer that is fully

applicable to the SWMU 73, and it states that "if chemical concentrations reported in field soils that support vigorous and diverse plant communities exceed one or more of the benchmarks presented in this report or if a benchmark is exceeded by background soil concentrations, it is generally safe to assume that the benchmark is a poor measure of risk to the plant community at that site." Cobalt, copper, selenium, and zinc were detected above the screening level (13 mg/kg, 70 mg/kg, 1.0 mg/kg, and 50 mg/kg) at various sampling locations; however, vegetation exists even at the highest detected concentration location for most of the chemicals. Although the highest sampled concentration for zinc was located on the scrap metal yard, vegetation exists even though the substrate consists of gravel. Therefore, further evaluation of cobalt, copper, selenium, and zinc in subsurface soil is not recommended.

HQs based on the maximum concentration (since a 95% UCL was unavailable due to small sample sizes) indicate that the following chemicals had HQs >1: p,p'-DDD (HQ=22), p,p'-DDE (HQ=62), and p,p'-DDT (HQ= 280). These chemicals had considerably high detected concentrations (1,100 µg/kg, 3,100 µg/kg, and 14,000 µg/kg respectively) and were collected from the scrap metal yard (73SB02), an area that consists of gravel substrate and concrete. Only a single sample was collected for p,p'-DDD, p,p'-DDE, and p,p'-DDT in subsurface soil representing the maximum (conservative) concentration; therefore, the refined HQ is likely overestimated for the terrestrial community receptors. Further evaluation of p,p'-DDD, p,p'-DDE, and p,p'-DDT in subsurface soil is not recommended.

The HQ for endrin (HQ=2.7) and chlordane (HQ=9.0) were based on the maximum concentrations since an average concentration could not be calculated. Both chemicals had considerably high detected concentrations (1,100 µg/kg and 900 µg/kg) collected from the scrap metal yard that exceeded their screening-level benchmarks of 401 µg/kg and 100 µg/kg. The HQ is likely overestimated for the terrestrial community receptors since: 1) endrin was not detected in surface soil, and 2) the results were based on a single sample located on the scrap metal yard that consists of gravel substrate and concrete.

No further evaluation is recommended for six VOCs (2-butanone, allyl chloride, bromomethane, carbon disulfide, chloromethane, and methyl iodide), and three metals (molybdenum, sulfide, and tin) since no soil screening values are available for the evaluation of terrestrial community receptors.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial community receptors exposed to subsurface soil at SWMU 73; therefore, additional evaluation is not recommended.

Refined Hazard Quotients for Wildlife Populations at SWMU 73

Wildlife receptors evaluated at SWMU 73 include the following feeding guilds, with their representative species shown in parentheses: terrestrial avian carnivore (i.e., red-tailed hawk), terrestrial avian omnivore (i.e., American robin), and terrestrial avian herbivore (i.e., mourning dove). These receptors were evaluated considering the following assessment endpoint.

Assessment Endpoint: Development and reproduction success of wildlife populations.

The potential for chemicals to cause adverse health effects to herbivorous, omnivorous, and carnivorous birds was estimated by using the HQ method: comparing the wildlife average daily COPC intake from oral ingestion to an oral TRV. The average concentration (or maximum concentration when the average concentration was not available) NOAEL-based HQs that exceeded a HQ=1 are presented in Table 35.

Red-tailed hawk

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that endrin, p,p'-DDD, p,p'-DDE, p,p'-DDT, and copper may have the potential to cause adverse health effects to wildlife populations.

The HQs for p,p'-DDD (HQ=5.2), p,p'-DDE (HQ=8.48), and p,p'-DDT (HQ=61.47) were based on the maximum concentration since an average concentration could not be calculated and they all exceeded the target level of 1. It should be noted that p,p'-DDD, p,p'-DDE, and p,p'-DDT had a considerably high detection (i.e., DDD: 1,100J µg/kg; DDE: 3,100J µg/kg; DDT: 14,000J µg/kg) within the gravel substrate at the scrap metal yard at sampling location 73SB02. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the results were based on a single sample, and 2) hawks have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their extensive home range (272 acres). When the AUF was adjusted to reflect the hawks home range, p,p'-DDT is the only chemical with a HQ>1 (HQ=1.84) . However, the MATC-based HQ would eliminate p,p'-DDT from further evaluation since the HQ<1. Therefore, further evaluation of p,p'-DDD, p,p'-DDE, and p,p'-DDT with regard to the red-tailed hawk is not recommended.

The HQ for endrin (HQ=24.15) was based on the maximum concentration since an average concentration could not be calculated. Endrin had a considerably high detected concentration (1,100 µg/kg) collected from the scrap metal yard. The HQ is likely overestimated for the terrestrial avian receptor since: 1) endrin was not detected in surface soil, 2) the results were based on a single sample, and 3) hawks have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their extensive home range (272 acres). When the AUF was adjusted to reflect the hawks home range, the NOAEL based HQ<1. Therefore, further evaluation of endrin with regard to the red-tailed hawk is not recommended.

The HQ for copper (HQ=5.89) was based on the average concentration. The HQ is likely overestimated for the terrestrial avian receptor since: hawks have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their extensive home range (272 acres). When the AUF was adjusted to reflect the hawks home range, the NOAEL based HQ<1. Therefore, further evaluation of copper with regard to the red-tailed hawk is not recommended.

Although mercury was identified as an ecological COPC in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQs<1). No further evaluation is recommended for six VOCs

(2-butanone, allyl chloride, bromomethane, carbon disulfide, chloromethane, and methyl iodide), and one metal (sulfide) since no TRVs are available for the evaluation of terrestrial carnivorous birds

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial carnivorous birds at SWMU 73; therefore, additional evaluation is not recommended.

American robin

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that endrin, p,p'-DDD, p,p'-DDE, p,p'-DDT, copper, molybdenum, and zinc may have the potential to cause adverse health effects to wildlife populations. However, HQ estimates using the MATC-based HQ (i.e., a more realistic HQ) indicate that copper, molybdenum, and zinc had HQs<1 and further evaluation of those chemicals in subsurface soil is not recommended.

The HQs for p,p'-DDD (HQ=1.2), p,p'-DDE (HQ=3.8), and p,p'-DDT (HQ=16.0) were based on the maximum concentrations since an average concentration could not be calculated, and they all exceeded the target level. It should be noted that p,p'-DDD, p,p'-DDE, and p,p'-DDT had a considerably high detection (i.e., DDD: 1,100J µg/kg; DDE: 3,100J µg/kg; DDT: 14,000J µg/kg) within the gravel substrate at the scrap metal yard at sampling location 73SB02. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the results were based on a single sample collected from the scrap metal yard, and 2) robins have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their home range. Additionally, the MATC-based HQ would eliminate p,p'-DDD from further evaluation since the HQ<1 and the HQs for p,p'-DDE and p,p'-DDT would be slightly above the target level (HQ=1.2 and 5.0). Therefore, further evaluation of p,p'-DDD, p,p'-DDE, and p,p'-DDT with regard to the robin is not recommended.

The HQ for endrin (HQ=6.2) was based on the maximum concentration since an average concentration could not be calculated. Endrin had a considerably high detected concentration (1,100 µg/kg) collected from the scrap metal yard. The HQ is likely overestimated for the terrestrial avian receptor since: 1) endrin was not detected in surface soil, 2) the results were based on a single sample collected from the scrap metal yard, and 3) robins have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their home range. Additionally, the MATC-based HQ would for endrin would be slightly above the target level (HQ=1.9). Therefore, further evaluation of endrin with regard to the robin is not recommended.

Although mercury was identified as an ecological COPCs in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQs<1). No further evaluation is recommended for six VOCs (2-butanone, allyl chloride, bromomethane, carbon disulfide, chloromethane, and methyl iodide), and one metal (sulfide) since no TRVs are available for the evaluation of terrestrial omnivorous birds

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial omnivorous birds at SWMU 73; therefore additional evaluation is not recommended.

Mourning Dove

The refined HQs using NOAEL-based HQs (i.e., a more conservative HQ) indicate that endrin, p,p'-DDD, p,p'-DDT, copper, and molybdenum may have the potential to cause adverse health effects to wildlife populations. However, HQ estimates using the MATC-based HQ (i.e., a more realistic HQ) indicate that copper had a HQs<1 and further evaluation of this chemical in subsurface soil is not recommended.

The HQs for p,p'-DDD (HQ=3.0) and p,p'-DDT (HQ=39.3) were based on the maximum concentrations since an average concentration could not be calculated and they all exceeded the target level of 1. It should be noted that p,p'-DDD and p,p'-DDT had a considerably high detections (i.e., DDD: 1,100J and DDT: 14,000J µg/kg) within the gravel substrate at the scrap metal yard at sampling location 73SB02. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the results were based on a single sample collected from the scrap metal yard, and 2) doves have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their home range. The refined ecological risk assessment assumes an AUF=1, indicating that the dove spends 100% of its time on SWMU 73. Adjusting the AUF to represent a more realistic home range for the mourning dove (i.e., 637 acres) would result in a HQ<1. Therefore, further evaluation of p,p'-DDD and p,p'-DDT with regard to the dove is not recommended.

The HQ for endrin (HQ=15.4) was based on the maximum concentration since an average concentration could not be calculated. Endrin had a considerably high detected concentration (1,100 µg/kg) collected from the scrap metal yard. The HQ is likely overestimated for the terrestrial avian receptor since: 1) endrin was not detected in surface soil, 2) the results were based on a single sample collected from the scrap metal yard, and 3) doves have a tendency to inhabit areas with preferable habitat and to feed in favorable areas throughout their home range. The refined ecological risk assessment assumes an AUF=1, indicating that the dove spends 100% of its time on SWMU 73. Adjusting the AUF to represent a more realistic home range for the mourning dove (i.e., 637 acres) would result in a HQ<1. Therefore, further evaluation of endrin with regard to the dove is not recommended.

The HQ for molybdenum (HQ=3.2) was based on the maximum concentration since an average concentration could not be calculated. Molybdenum had a single detected concentration (82 mg/kg) collected from the forested area. The HQ is likely overestimated for the terrestrial avian receptor since: 1) the results were based on a single sample, 2) The MATC value had a HQ=1, and 3) doves have an extensive home range (i.e., 637 acres). The refined ecological risk assessment assumes an AUF=1, indicating that the dove spends 100% of its time on SWMU 73. Adjusting the AUF to represent a more realistic home range for the mourning dove would result

in a HQ<1. Therefore, further evaluation of molbdenum with regard to the dove is not recommended.

Although zinc and mercury were identified as an ecological COPCs in Step 2 of the SLERA, no additional evaluation is recommended (i.e., HQs<1). No further evaluation is recommended for six VOCs (2-butanone, allyl chloride, bromomethane, carbon disulfide, chloromethane, and methyl iodide), and one metal (sulfide) since no TRVs are available for the evaluation of mourning doves.

In summary, it is unlikely that any of the chemicals discussed above would cause adverse health effects to terrestrial herbivorous birds at SWMU 73; therefore additional evaluation is not recommended.

7.10.1.3 Step 3a Risk Evaluation for Groundwater.

HQs were recalculated using average concentrations (where applicable) since 95% UCLs could not be calculated due to limited data. Average concentrations were calculated for the following chemicals identified in the screening-level evaluation as COPCs: cadmium, copper, and silver. Since average concentrations could not be calculated for p,p'-DDD, and p,p'-DDT, HQs were based on maximum concentrations. The statistical background comparison shown in Table 33 indicates that cobalt, nickel, and zinc concentrations in SWMU 73 groundwater are not elevated above background levels. Therefore, further evaluation of these chemicals in groundwater is not recommended.

The remaining chemicals were further evaluated by comparing maximum and average (when available) chemical concentrations to chronic saltwater screening values since SWMU 73 is located upgradient of open marine habitat and represents a possible discharge point for groundwater to Puerca Bay.

Maximum HQs exceeded the target level for p,p'-DDD (HQ=3.3) and p,p'-DDT (HQ=100). It should be noted that a small sample size (n=3) existed for these two chemicals. The HQ for p,p'-DDD was based on three samples collected in May 2004 in which a single non-detected value (0.1 µg/l) and two J- values (0.08J µg/l and 0.04J) exceeded the screening-level benchmark of 0.03 µg/l at sites 19E-00, 19E-01, and 19E-02 respectively. The HQ for p,p'-DDT was based on three samples collected in May 2004 in which two non-detected values (0.1 µg/l and 0.1 µg/l) and a single detected value (0.08 µg/l) exceeded the screening-level benchmark of 0.001 µg/l at sites 19E-00, 19E-01, and 19E-02 respectively. The HQ is likely overestimated for these chemicals since: 1) the sample size is relatively small, 2) the maximum value is based on a non-detected value, and 3) the only data that exists for these chemicals is from May 2004. No further evaluation of these chemicals in groundwater is recommended.

Average HQs exceeded the target level of 1 for copper (HQ=17.3) and silver (HQ=13.2) but did not exceed the target level for cadmium (HQ=0.8). Chemical concentrations were compared at monitoring well 1 (MW01), monitoring well 2 (MW02), and monitoring well 3 (MW03). Note

that MW01 is located on the scrap metal yard, is downgradient from MW02 and MW03, and is the closest monitoring well to Puerca Bay. Copper was detected well above the screening benchmark of 3.73 mg/l at MW02 (57.6 mg/l, 61 mg/l and 67 mg/l) and MW03 (120 mg/l and 140 mg/l) and the concentrations were considerably higher than those sampled from MW01, which had a non-detected concentration (5 mg/l) as well as a concentration (3 mg/l) that did not exceed the screening benchmark. The concentrations for silver were similar in that the concentrations at MW02 (5.9 mg/l, 5.2 mg/l, and 3.5 mg/l) and MW03 (3.7 mg/l) exceeded the screening benchmark of 0.2 mg/l and were considerably higher than the concentrations at MW01, which were both non-detected concentrations (2 mg/l and 1.0 mg/l). Since metals readily adsorb to soil, copper and silver may simply not be moving with the groundwater flow. The elevated chemical concentrations at MW02 and MW03 do not appear to be influencing the chemical concentrations in the down gradient well (i.e., MW01). Therefore, it is unlikely that unacceptable chemical concentrations will enter the surface water at Puerca Bay. No further evaluation of these chemicals in groundwater is recommended.

In summary, the chemical concentrations entering Puerca Bay are unknown; however, the available sampling data suggests that elevated concentrations are not likely discharging into Puerca Bay. Many factors may affect the fate and transport of contaminants in groundwater as it travels through the subsurface including dilution, adsorbtion to soil particles, and degredation. In addition, further dilution of chemical concentrations would also occur once entering the surface water at Puerca Bay. Considering all of these factors, the decision was made not to conduct any further quantitative evaluation of groundwater.

7.10.2 Uncertainties Associated with Step 3a of the Baseline Ecological Risk Assessment.

Uncertainties associated with Step 3a of the BERA are presented below and many of the uncertainties summarized in the SLERA (Table 29) are also applicable.

7.10.2.1 Identification of Ecological COPCs

Chemicals lacking screening-level values were not retained for further evaluation nor were chemicals that were considered background due to the background statistical analysis.

7.10.2.2 Exposure Parameters

An AUF of 1 was assumed for the ecological receptors. For receptors that have a home range which is larger than the site, the use of an AUF of 1 assumes the receptor spends all of its time foraging at the site and causes the HQs to be overestimates of potential for risk.

7.10.3 Step 3a Decision Points.

Possible decision points based on the results of Step 3a include:

- **No further action is warranted.** This decision is appropriate if Step 3a of the BERA indicates that there is no reasonable potential for unacceptable ecological risk within acceptable uncertainty.

- **Evaluate the need for corrective measures.** According to the Final CMS Work Plan (Baker, 2008) this decision is appropriate if Step 3a of the BERA indicates that there is a reasonable likelihood for unacceptable ecological risks within acceptable uncertainty. Whether or not corrective measures are taken will depend upon a number of risk management factors such as the results of any human health risk assessments and the potential impact of the remedial action itself on the habitats and biota present on the site.

Recommendations for each media and food web exposure pathway are presented in the following sections.

7.10.3.1 Surface Soil.

Based on the refined media-specific risk evaluation presented in Section 7.10.1.1, no chemicals were recommended for further evaluation.

7.10.3.2 Subsurface Soil.

Based on the refined media-specific risk evaluation presented in Section 7.10.1.2, no chemicals were recommended for further evaluation.

7.10.3.3 Groundwater.

Based on the refined media-specific risk evaluation and discussion presented in Section 7.10.1.3, no chemicals were recommended for further evaluation.

7.10.3.4 Terrestrial Food Web Exposures: Surface Soil.

Based on the refined media-specific risk evaluation presented in Section 7.10.1.1, no chemicals were recommended for further evaluation.

7.10.3.5 Terrestrial Food Web Exposures: Subsurface Soil.

Based on the refined media-specific risk evaluation presented in Section 7.10.1.2, no chemicals were recommended for further evaluation.

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8.0 HUMAN HEALTH RISK ASSESSMENT AND DEVELOPMENT OF CAOS.

8.1 Background.

This section details the human health risk assessment (HHRA) conducted for SWMU 73. This baseline HHRA was conducted in accordance with the Risk Assessment Guidance for Superfund (RAGS), Part A, Human Health Evaluation Manual (EPA, 1989), and the available updates including RAGS Part E (EPA, 2004) and Part F (EPA, 2009a). In accordance with this guidance and general EPA policy, the HHRA evaluates the most likely routes of exposure for current and future site receptors. It should be noted that the future residential receptors were included as a baseline only as the future use of the site is known to be industrial. Also note that this approach represents a significant deviation from the previously approved work plan for this site.

8.2 Exposure Setting.

A complete description of the site is provided in Section 2.2. Chapter 3 details the physical characteristics of the study area. SWMU 73 is currently an industrial area and has been used as a scrap metal storage yard in the past. Future use is not expected to change given the history and current use of the site. In addition, a detailed development plan exists that will be initiated at the completion of this study. The conceptual site model (CSM) diagram shown in Figure 9 depicts the potential exposures possible at this site. The initial release at the site was due to surficial storage of scrap metal and other miscellaneous waste. Substances associated with this disposal practice may have been deposited on the soil surface and subsequently migrated to subsurface soil as well as shallow groundwater. The human receptors that could potentially come into contact with any substances on the site are industrial workers, construction workers, and possibly trespassers. As previously mentioned, future residential receptors were included in this evaluation as well, but only for informational purposes. For each of these receptors, exposure to surface soil is possible where substances could be taken in through incidental ingestion, dermal contact, and inhalation of either particulates or volatiles in air. For the construction worker, extensive contact with subsurface soil could also occur leading to possible intake by these same three mechanisms. In addition, dermal contact with shallow groundwater is possible during intrusive construction activities. Finally, groundwater ingestion by future residents was included in the CSM as well, though it should be noted that the shallow groundwater at the site is not considered potable and drinking water is already supplied via pipeline from a public source.

8.3 Selection of Chemicals of Potential Concern.

The consolidated dataset used in this HHRA is presented in Tables 1 through 11. COPCs selected from this dataset were identified in accordance with EPA guidance (EPA, 1989 and 2002a). The specific steps in this process are described in the following sections.

8.3.1 Data Reduction.

The raw data were first reduced by removing all substances that were not detected in greater than 5% of samples in a given medium. For the inorganics data, a statistical background analysis was then conducted in accordance with the Navy Guidance for Environmental Background Analysis. Methods used for comparison of site to background followed the Navy Guidance for Environmental Background Analysis (Figure 2 flowchart). Arithmetic summaries, distribution tests, and lognormal data summaries used datasets with ½ the reported values for non-detects. For Frequency of Detection (FOD) Category A (0 detects) and Category B (1 detect) most summary statistics were not calculated, per the guidance. Also per the guidance, descriptive statistics were provided for FOD Category C datasets (≤ 50%, with more than 1 detect) with truncated (detects only) datasets, but only full datasets were used for statistical comparison. ProUCL version 4.00.05 was used for all distribution tests. Determination of the data distribution for both normality and log-normality were made using a Shapiro-Wilk test. With over 50% non-detects, evaluation to determine distributions will result in a high level of uncertainty. Distribution could not be determined for all datasets, given their small sample size. To determine appropriate statistical testing, the Figure 2 flowchart was used with the following conditions:

- It was assumed that there was one and only one detection limit for each set of data.
- Both locations had to have the same distribution for a t-test to be conducted. If both locations had normal distributions, then a t-test was used for comparison. If either did not have a normal distribution, but both had a lognormal distribution, then a t-test on the log transformed data was used. If both did not share a common distribution, then either a Wilcoxon Rank Sum or Gehan test was performed, according to the flowchart.
- In determining if any site values were greater than the largest background non-detect value, only the detected values in the site data were used.
- In determining which right-tail test(s) to perform, only detected values were used when determining if there were at least 10 samples in the dataset.

To conduct statistical testing, ProUCL version 4.00.05 was used for t-tests, Wilcoxon Rank Sum tests, and Quantile testing. Tests of proportions, Gehan tests, and slippage tests were performed by hand, following the methods described in the EPA's guidance G-9S "Data Quality Assessment: Statistical Methods for Practitioners" and using extended critical value tables from the Navy in their Handbook of Statistical Analysis of Environmental Background Data (1999). Statistical significance was defined as $p<.05$ for all tests.

The flowchart indicated some cases where a two sample proportion test was the desired comparative method. However, due to the small sample sizes, this test would not be valid since the data violate the "success/failure condition" assumption for comparing two proportions. Inorganics that were found to be statistically within background levels were excluded from the analysis. The inorganic substances screened out in this step include barium, beryllium,

chromium, cobalt, sulfide and vanadium in surface soil, arsenic, beryllium, chromium, lead, nickel, tin, and vanadium in subsurface soil, and barium, cadmium, cobalt, nickel and zinc in groundwater. The full statistical analysis can be found in Appendix E.

8.3.2 Screening of Sampling Data.

The next step in the data evaluation process was to compare the maximum detections of each substance to the Residential EPA Regional Screening Levels (RSLs) (EPA, 2011a). For this screening, any RSL that was based on noncarcinogenic effects was reduced by a factor of 10 to account for possible additive effects. Groundwater was also compared to MCLs where available. Any substance whose maximum detection was equal to or less than the RSL or MCL was eliminated from further consideration in the risk evaluation. The remaining substances were designated substances of potential concern (SOPCs) and retained for evaluation in the risk assessment. These included the following:

- Surface Soil: acenaphthylene, aroclor 1248, aroclor 1254, aroclor 1260, arsenic, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k]fluoranthene, chlordane, chrysene, dibenz[a,h]anthracene, dieldrin, endosulfan sulfate, endrin aldehyde, heptachlor, heptachlor epoxide, indeno[1,2,3-cd]pyrene, kepone, methyl iodide, p,p'-DDD, p,p'-DDE, p,p'-DDT, and phenanthrene.

- Subsurface Soil: acenaphthylene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, chromium, cobalt, dibenze[a,h]anthracene, methyl iodide, p,p'-DDD, p,p'-DDE, and p,p'-DDT.

- Groundwater: arsenic, bis(2-ethylhexyl)phthalate, naphthalene, p,p'-DDD, p,p'-DDE, p,p'-DDT, and phenanthrene.

8.4 Derivation of Exposure Point Concentrations.

For the substances identified as SOPCs, exposure point concentrations (EPCs) were developed in accordance with EPA guidance (EPA, 2002a). This guidance recommends using the ProUCL software (EPA, 2009b). ProUCL has been developed specifically to calculate statistically defensible estimates of the 95% UCL of the mean concentration of a given population. The EPCs recommended by the software were used in each case unless there were insufficient data to perform a statistical analysis. In this case, the maximum detection was used as the EPC. If two values were suggested by the software, the higher was chosen for conservatism. This approach is not suitable for groundwater however, since there are generally too few data and the underlying assumption that they all represent the same population is not necessarily accurate. In this case the maximum detection of each chemical was used as the EPC for conservatism. It should be noted that non-detect results were included in the data set at the detection limit in accordance with the original approved workplan for this site. This assumption adds a degree of

conservatism to the evaluation. The list of EPCs as well as the statistical test used to derive each is detailed in Tables 36 and 37.

8.5 Exposure Assessment.

An exposure pathway describes the theoretical process by which a chemical is transmitted from a source, through an environmental medium, and ultimately comes into contact with an exposed receptor. In general, an exposure pathway must have four elements to be considered complete: a source and mechanism for release, a transport medium, a point for receptors to potentially come in contact with the contaminated medium (exposure point), and an exposure route (e.g., inhalation, ingestion, and dermal absorption) at the point of contact. An exposure pathway must be potentially complete to warrant evaluation in the risk evaluation. For evaluating SWMU 73, the exposure pathways that are potentially complete are shown in Table 38. These are also shown graphically in the CSM diagram (Figure 9).

8.6 Quantification of Exposure.

To quantitatively assess the potential exposures associated with the evaluated pathway, estimates of chemical concentrations at the exposure point are combined with values describing the extent, frequency, and duration of the exposure to provide an estimate of the daily intake of chemicals. Table 39 presents the values used for the various intake parameters. These values are based on EPA recommended values, and the general factors are discussed below. Other chemical-specific parameters are used as well but will not be discussed here.

8.6.1 Body Weight.

The EPA recommends a conservative body weight of 70 kilograms (kg) for adult receptors (EPA, 1989). This represents the mean value for men and women between 19 and 65 years old. For children, a body weight of 15 kg was used for the future resident and 45 kg was used to represent the youth trespasser (EPA, 1997).

8.6.2 Event Frequency.

Event frequency is a measure of the number of exposure events in a given day. For this assessment, the event frequency was set at 1 for all receptors.

8.6.3 Exposure Frequency.

Exposure frequency is a measure of the number of days in a year a receptor will be potentially exposed to the study site. Different values are appropriate for each receptor group. EPA recommends an exposure frequency of 350 days per year for residents and 250 days per year for industrial and construction workers (EPA, 1989). For trespassers, 52 days per year (once per week) was assumed.

8.6.4 Exposure Duration.

Exposure duration refers to the number of years a given receptor will likely be exposed to the study site. Again, different values are appropriate for each receptor. For the future residents, a value of 24 years was used for adults and 6 years for children (for a total of 30 years). For the trespassers, 24 and 11 years were used for adults and youths, respectively. A value of 1 year was used for construction workers, and 25 years was selected for industrial workers. These values all represent conservative upper bound estimates of the time each group would potentially be exposed (EPA, 1989 and 1997).

8.6.5 Averaging Time.

The averaging time for noncarcinogenic effects is the exposure duration expressed in days. For carcinogenic effects, an average lifetime of 70 years is used (25550 days) (EPA, 1989).

8.6.6 Soil Ingestion Rate.

This value represents the amount of soil a given receptor is likely to incidentally ingest each day. It is receptor specific with 100 mg/day and 200 mg/day being the recommended values for adult and child residents, respectively. For construction workers, a value of 330 mg/day is recommended and 100 mg/day was used for industrial workers and trespassers (EPA, 2002b).

8.6.7 Skin Surface Area.

The skin surface area refers to the typical amount of skin that will be exposed and available for direct soil contact and subsequent dermal absorption. The values used for adult residents and trespassers are the same at 5700 cm^2. For child residents, 2800 cm^2 was used, and for youth trespassers, a value of 3,200 cm^2 was selected (EPA, 2002b). For construction workers and industrial workers 3300 cm^2 is the recommended value (EPA, 2002b).

8.6.8 Particulate Emission Factor

The Particulate Emission Factor (or PEF) is used to estimate a ratio between a particulate's concentration in soil to the concentration of dust particles in the air. A default value of 1.36 x 10^9 m^3/kg was used for particle emissions (EPA 2002b). To account for the potential inhalation of volatile organics, a Volatilization Factor (VF) was used which is chemical-specific and may be calculated as shown in Section 8.7.

8.7 <u>Intake Equations.</u>

These exposure parameters are then used in the following equations to develop estimates of average daily intake for each receptor through the various exposure pathways. Equations (1) and (2) calculate ingestion of chemicals in soil and dermal absorption of chemicals in soil, respectively. In addition, a simplified version of Equation (1) was used to calculate intake

through ingestion of groundwater in which the CS term becomes CW (concentration in water) and the CF and FI terms are deleted.

(1)

$$Intake\ (mg/kg-day) = \frac{CS * IR * CF * FI * EF * ED}{BW * AT}$$

Where:

CS = Contaminant concentration in soil (mg/kg)
IR = Ingestion rate (mg/day)
CF = Conversion factor (10^{-6} kg/mg)
FI = Fraction ingested from contaminated source (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body Weight (kg)
AT = Averaging Time (days)

(2)

$$DAD = (DA_{event} * EF * ED * EV * SA)/(BW * AT)$$

Where:

DAD = Dermal absorbed dose (mg/kg-day)
DA_{event} = Absorbed dose per event (mg/cm^2-event)
SA = Skin surface area available for contact (cm^2)
EV = Event frequency (events/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Equation (3) is used to calculate the DA_{event} term for soil contact:

(3)

$$DA_{event} = C_{soil} * CF * AF * ABS_d$$

Where:

DA_{event} = Absorbed dose per event (mg/cm^2-event)
C_{soil} = Chemical concentration in soil (mg/kg)
CF = Conversion factor (10^{-6} kg/mg)
AF = Adherence factor of soil to skin (mg/cm^2-event)
ABS_d = Dermal absorption fraction – chemical specific (unitless)

Finally, the following series of equations (i.e., Equation (4), (5), and (6)) is used to estimate the dermal absorbed dose from direct contact with groundwater:

(4)

$$DAD = (DA_{event} * EV * ED * EF * SA)/(BW * AT)$$

Where:

DAD = Dermally absorbed dose (mg/kg-day)
DA_{event} = Absorbed dose per event (mg/cm^2-event)
SA = Skin surface area available for contact (cm^2)
EV = Event frequency (events/day)
ED = Exposure duration (years)
EF = Exposure frequency (days/year)
BW = Body weight (kg)
AT = Averaging time (days)

In this case, Equations (5) and (6) are used to calculate the DA_{event} term for organic compounds in water:

(5)

$$\text{If } t_{event} \leq t^*, \text{ then } DA_{event} = 2FA * K_p * C_w \sqrt{\frac{6\tau_{event} * t_{event}}{\pi}}$$

(6)

If $t_{event} > t^*$, then $DA_{event} = FA * K_p * C_w \left[\frac{t_{event}}{1+B} + 2\tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$

Where:

C_w = Concentration in water (mg/cm^3)
DA_{event} = Absorbed dose per event (mg/cm^2-event)
FA = Fraction absorbed (dimensionless)
K_p = Dermal permeability coefficient (cm/hr)
t_{event} = Event duration (hr/event)
τ_{event} = Lag time per event (hr/event)
t* = Time to reach steady state (hr)
B = Ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (dimensionless)

The following equations provide the derivations of the variables listed above that have not yet been defined, beginning with the K_p value. For many compounds, K_p values are provided in the dermal risk assessment guidance (EPA, 2004). For those that are not listed, the value can be approximated using Equation (7).

(7)

$$\log K_p = -2.80 + 0.66\, logK_{ow} - 0.0056\, MW$$

Where:

K_p = Dermal permeability coefficient of compound in water (cm/hr)
K_{ow} = Octanol/water partition coefficient (dimensionless)
MW = Molecular weight (g/mole)

The B parameter can then be derived using these parameters as shown in Equation (8).

(8)

$$B \cong K_p \frac{\sqrt{MW}}{2.6}$$

Where:

B = Ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (dimensionless)

K_p = Dermal permeability coefficient of compound in water (cm/hr)

MW = Molecular weight (g/mole)

Next the D_{sc} parameter can be derived as shown in Equation (9).

(9)

$$\frac{D_{sc}}{l_{sc}} = 10^{(-2.80-0.0056\,MW)}$$

Where:

D_{sc} = Effective diffusion coefficient for chemical transfer through the stratum corneum (cm^2/hr)

l_{sc} = Apparent thickness of stratum corneum (cm) = 10^{-3} cm

MW = Molecular weight (g/mole)

The l_{sc} and D_{sc} terms are then used in deriving the τ_{event} parameter using equation (10).

(10)

$$\tau_{event} = \frac{l_{sc}^2}{6\,D_{sc}} = 0.105\ x\ 10^{(0.0056\,MW)}$$

Where:

τ_{event} = Lag time per event (hr/event)

D_{sc} = Effective diffusion coefficient for chemical transfer through the stratum corneum (cm^2/hr)

l_{sc} = Apparent thickness of stratum corneum (cm) = 10^{-3} cm

MW = Molecular weight (g/mole)

Finally, the t* parameter is calculated using the B value derived in equation (8) above. Two different equations are provided dependent upon the value of B (11) and (12).

(11)

If $B \leq 0.6$, then $t^* = 2.4\ \tau_{event}$

(12)

If B > 0.6, then $t^* = 6\tau_{event}(b - \sqrt{b^2 - c^2})$

(13)

For, $b = \frac{2(1+B)^2}{\pi} - c$

(14)

and, $c = \frac{1+3B+3B^2}{3(1+B)}$

Where:

B = Ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (ve) (dimensionless)

τ_{event} = Lag time per event (hr/event)

b,c = Correlation coefficients

t* = Time to reach steady-state (hr)

To evaluate noncancer health risks due to inhalation, Equation 15 was used. This equation does not solve for an intake value per se, but rather uses measured contaminant concentrations in soil and directly calculates a hazard quotient.

(15)

$$HQ = \frac{EPC * EF * ED}{RfC * PEF * AT}$$

Where:

EPC = Exposure Point Concentration in the soil (mg/kg)

EF = Exposure frequency (days / yr)

ED = Exposure duration (years)

RfC = Reference concentration used for a specific contaminant (mg/m^3)

PEF = Particulate emission factor (m^3/kg)

AT = Averaging Time (days)

To evaluate cancer health risks due to inhalation, Equation 16 was used. This equation uses very similar parameters as Equation 15 and it directly calculates a cancer risk for a specific contaminant in soil due to inhalation.

$$Risk = \frac{EPC * EF * ED * 1{,}000 * URF}{PEF * AT} \quad \textbf{(16)}$$

Where:

URF = Inhalation unit risk factor for a particular contaminant $(\mu g/m^3)^{-1}$

When volatile organic substances needed to be considered, a Volatilization Factor (VF) had to be substituted for the PEF. Substance-specific VF values were calculated via Equation 17.

$$VF = \frac{\frac{Q}{C_{vol}} * \sqrt{\pi * D_A * T} * 10^{-4}}{2 * \rho_b * D_A} \quad \textbf{(17)}$$

Where:

Q/C_{vol} = Inverse of the mean concentration at the center of a 0.5 acre square source (g/m^2-s per kg/m^3)

D_A = The apparent diffusivity of the compound (cm^2/s)

T = Exposure interval (s) (9.5E8 was used as the default)

ρ_b = Dry soil bulk density (g/cm^3)

Q/C_{vol} was calculated using Equation 18 below, taken from Appendix D of the Supplemental Soil Screening Guidance (EPA, 2002b).

$$\frac{Q}{C_{vol}} = A * e^{\frac{(\ln A_{site} - B)^2}{C}} \quad \textbf{(18)}$$

Where:

A, B, and C are constants taken from Appendix D of the SSG. Parameters from Zone 9 (Miami, FL) were determined to be the most applicable to the Camp Moscrip site.

A_{site} = area of the site in acres (9 acres used)

And lastly, the apparent diffusivity (D_A) used in Equation 17 is calculated using Equation 19.

$$D_A = \frac{\theta_a^{\frac{10}{3}} * D_i * H' + \theta_w^{\frac{10}{3}} * D_w}{n^2(\rho_b * K_d + \theta_w + \theta_a * H')} \quad \textbf{(19)}$$

Where:

θ_A = Air-filled soil porosity (unitless) (0.284)
D_i = Chemical diffusivity in air (cm^2/s)
H' = Dimensionless Henry's law constant
θ_w = Water-filled soil porosity (unitless) (0.15)
n = total soil porosity (unitless) (0.434)
ρ_b = Dry soil bulk density (g/cm^3) (1.5)
K_d = Soil-Water Partition coefficient (cm^3/g)

8.8 Toxicity Assessment.

The foundation of the HHRA process is the relationship between the amount of a substance a receptor is exposed to (the dose) and the potential for adverse health effects resulting from this exposure. This established dose-response relationship provides the ability to quantitatively evaluate the potential health impacts that may result from a given exposure scenario. The evaluation is based on toxicity data published primarily by the EPA for use in risk assessment. For the assessment of human health risks from exposure to chemicals, there are two basic toxicity values that are of principal importance. They are:

Reference doses (RfDs) for oral exposure – These represent the acceptable chronic daily intake for exposure to a specific chemical. RfDs are intended to be protective of sensitive subpopulations. Reference doses are expressed in terms of mg/kg-day.

Cancer Slope Factors (CSFs) for oral exposure – The slope factor is the cancer risk (proportion affected) per unit of dose. The slope factor is expressed on the basis of chemical weight [$(mg/kg\text{-}day)^{-1}$].

The EPA has developed the following hierarchy of sources for toxicity values:

- Tier 1 – Integrated Risk Information System (IRIS) (EPA, 2011b)
- Tier 2 – EPA Provisional Peer Reviewed Toxicity Values (PPRTVs) (EPA, 2011c)
- Tier 3 – Other toxicity values (including non-EPA sources)

Accordingly, this hierarchy was followed in gathering toxicity reference values for use in this risk assessment. The values used for each substance are listed in Table 40 along with its source.

EPA recommends two different approaches for evaluating noncarcinogenic and carcinogenic health effects. The two approaches reflect the fundamental difference in the proposed mechanism of toxic action. In assessing the potential for noncarcinogenic health effects, EPA assumes that there is a toxicologic threshold below which no adverse health effects occur. These toxicological thresholds are represented by RfDs for oral exposures and reference concentrations (RfCs) for inhalation exposures. No values have been developed for dermal exposures so the oral RfD is used to evaluate this route of exposure. The RfD represents an average daily intake expressed in units of milligrams per kilogram-day (mg/kg-day).

For carcinogens, the threshold response level is believed to be inappropriate. CSFs are developed with the idea that cancer risk is linearly related to dose. Therefore, even though most of the cancer data obtained from laboratory animal studies are for relatively high doses, it is assumed that these doses can be extrapolated down to the extremely small doses that would be expected from environmental exposures. This nonthreshold theory assumes that even a single molecule of a carcinogen may cause changes in a single cell that could result in the cell dividing in an uncontrolled manner and eventually lead to cancer. It should be pointed out that this method leads to a plausible upper limit of cancer risk but does not necessarily give a realistic prediction of the true risk.

The carcinogenic potency of a substance depends, in part, on its route of entry into the body. Therefore CSFs are classified, like RfDs, according to the route of administration (i.e., inhalation, ingestion). Ideally, route-specific CSFs should be used to evaluate the carcinogenic risk posed by each carcinogen through each exposure route of concern. However, only a limited number of CSFs have been developed and may exist for only one route of exposure. The oral slope factor is presented as the risk per mg/kg-day. For inhalation, a unit risk factor is provided that is a quantitative estimate in terms of risk per micrograms per meter cubed ($\mu g/m^3$) of air breathed for adults. Dermal CSFs have not been derived for any chemicals so the oral value was used instead. The EPA has developed a classification system which indicates the likelihood that a particular chemical is a human carcinogen based on a weight-of-evidence (WOE) judgment using human and animal evidence. This classification system is described below:

A – Human carcinogen.
B1 – Probable human carcinogen – limited evidence of human carcinogenicity.
B2 – Probable human carcinogen – sufficient animal evidence and inadequate human data.
C - Possible human carcinogen – limited evidence in animals and no human data.
D - Not classified as to carcinogenicity.
E - No evidence for carcinogenicity.

8.9 Risk Characterization Process.

The risk characterization presents a separate evaluation of noncarcinogenic and carcinogenic effects. The EPA methodology distinguishes between the two because organisms typically respond differently following exposure to carcinogens as opposed to noncarcinogens.

8.9.1 Noncarcinogenic Effects.

Risk characterization for noncarcinogenic effects involves calculating an HQ, which represents the ratio of the chronic daily intake for a specific chemical to the toxicological reference value (i.e., RfD) for that chemical. The individual HQs are summed over all chemicals to obtain an overall hazard index (HI) for the site. An HI of less than or equal to 1.0 indicates that the occurrence of adverse noncarcinogenic health effects as a result of the evaluated chemical exposure is unlikely.

8.9.2 Carcinogenic Effects.

Cancer risk is expressed as a probability (e.g., 1E-6 or 1 in 1,000,000), which indicates the risk of additional incidences of cancer above the normal background cancer rate in an exposed population. Risk estimates represent the additional probability that individuals in a population will develop cancer over a lifetime as a result of exposure to a particular carcinogen. The probabilities are derived by multiplying the estimated daily intake by the chemical-specific CSFs. As with the HI, cancer risk levels are calculated for each substance and then an overall site risk is derived by adding all of these together. The EPA generally suggests that carcinogenic risk below 1E-6 is considered de minimus risk, risk between 1E-6 and 1E-4 (1 in 10,000) is within the range considered safe, and risk exceeding 1E-4 is considered unacceptable.

8.9.3 Risk Characterization.

For each receptor, risk was quantified for all compounds detected at the site for intake through the various exposure pathways. The individual compound values were then combined over all pathways to calculate the cumulative risk. This represents the total risk for the site. Noncancer hazard and cancer risk were calculated using the equations below:
Noncancer Hazard:

$$Hazard\ Quotient = \frac{Intake}{RfD} \tag{15}$$

Where:
Intake = Average daily intake (mg/kg-day)
RfD = Chemical-specific reference dose (mg/kg-day)

Cancer Risk: **(16)**

$$\text{Risk} = \text{Intake} * \text{CSF}$$

Where:
Intake = Average daily intake (mg/kg-day)
CSF = Cancer slope factor $(\text{mg/kg-day})^{-1}$

8.9.3.1 Noncancer Results.

As an estimate of the noncancer hazard associated with SWMU 73 for each receptor, the individual chemical HQs are summed to provide an overall HI. Again, an HI of greater than 1.0 indicates that the levels of substances detected may be of potential concern. The calculated HIs are shown in Table 41. The complete results of the risk assessment can be found in Appendix F. As the tables indicate, the noncancer HI falls below the 1.0 level that would indicate a level of concern for industrial workers, youth trespassers and adult trespassers. The HIs for the future child resident (10.9), future adult resident (3.7) and the construction worker (1.4) do exceed 1.0. However, several mitigating factors should be considered when evaluating the validity of this finding. The HI for both residential receptors is due in large part to ingestion of arsenic in groundwater. However, as stated previously, the groundwater is not currently being consumed nor would it be in the future and so the significance of this finding is questionable. In addition, a significant portion of the elevated HQ for soil exposure for both residential receptors as well as the construction worker is due to the calculated EPC for aroclor 1254, kepone, and DDT. In each of these instances the exposure point concentration is misleading as they are all biased high. For aroclor 1254 and kepone, this is due to the inclusion of non-detect results with elevated detection limits that are much higher than the rest of the data set. For DDT, this is a result of including a single detection that is several orders of magnitude higher than the other reported detections. Removing these outliers from the dataset and recalculating EPCs results in the surface soil contact HQs being reduced to 0.7, 0.08, and 0.2 for the child resident, adult resident, and construction worker respectively.

8.9.3.2 Carcinogenic Risk Results.

As an initial estimate of the carcinogenic risk associated with SWMU 73, the individual chemical cancer risks were added together to derive the overall site cancer risk for each receptor. Table 41 lists the calculated cancer risk levels for each receptor. The complete results of the risk assessment can be found in Appendix F. While all of the calculated cancer risk levels were above the 1E-6 level, only the future child (4.7E-4) and adult resident (5.9E-4) exceeded 1E-4. However, as with the HI, both of these elevated results are due in large part to arsenic ingestion in groundwater and exposure to kepone in surface soil. The same recalculated EPC for kepone results in a surface soil contact cancer risk of 3.7E-5 for children and1.8E-5 for adults.

8.10 Vapor Intrusion Modeling.

The final exposure pathway that was considered in this evaluation is vapor intrusion into buildings as a result of volatile or semivolatile substances in the subsurface. This pathway was evaluated according to the tiered process prescribed in the EPA Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (EPA, 2002c). The Tier 1 Primary Screen consists of determining whether or not any potential exists at the site for vapor intrusion. Since chemicals of sufficient volatility and toxicity are potentially present at this site, and inhabited buildings are planned for the site, the screening moved on to Tier 2 – secondary screening. Since indoor air and/or soil gas data are not currently available for this site, this step in the screening process relied on the groundwater data. Question Q4(d) requires screening site groundwater data against generic target media-specific concentrations presented in Table 2(a) in the guidance. The available data for SWMU 73 were all below the generic screening levels. However, with no soil gas data available the evaluation was moved to Tier 3 – Site Specific Assessment. Groundwater can be rather shallow under portions of the site and the soil tends to be silty, both of which can contribute to migration of vapors to indoor air in buildings. To quantitatively evaluate this pathway, the screening level Johnson and Ettinger model was used (EPA, 2002d). This model has been in use since 1991 and has been updated to spreadsheet format and endorsed by the EPA. The screening-level model takes into account basic information regarding the construction of the buildings on site, as well as the soil type, depth to groundwater, and soil temperature. In addition, it uses the same exposure parameters as the other risk equations to calculate risk to indoor receptors from vapor intrusion. The model contains chemical properties for substances that are considered a potential concern from a vapor intrusion standpoint, so any substance detected in subsurface soil that was available in the model was included in this evaluation. These included benzo(b)fluoranthene, endosulfan, and 4,4'-DDE. Upon running the evaluation, benzo(b)fluoranthene and endosulfan were classified 'NOC" (Not Of Concern) by the model due to their being solid at the modeled temperature. The screening level calculated for 4,4'-DDE was 46 mg/kg which is considerably higher than the site EPC of 3.4 mg/kg. Therefore, vapor intrusion to indoor air of buildings should not be a concern at this site. The model output results can be found in Appendix G.

8.11 Uncertainty.

The process of evaluating risk uses principles drawn from many scientific disciplines, including chemistry, toxicology, physics, mathematics, and statistics. Since the data sets used in the calculations are incomplete, many assumptions are required. Therefore, calculated numerical risk values contain inherent uncertainties. As a result of the uncertainties described below, this risk evaluation should not be construed as presenting an absolute frequency of expected health affects in the populations modeled. Rather, it is an estimate intended to indicate the potential for occurrence of adverse health impacts under the exposure conditions evaluated.

8.11.1 Exposure Assessment.

There is a level of uncertainty in the assumptions made regarding the specific intake parameters. Values are chosen for variables such as body weight and inhalation rate that are meant to be conservative. For most receptors, this will result in an overestimation of risk. However, an individual could exceed the values used and would therefore represent a higher potential risk than was estimated in the assessment.

8.11.2 Study Design.

There is also uncertainty due to the design of the sampling strategy. Sample locations were chosen to provide a picture of the aerial distribution of substances on site. However, it is possible that smaller areas of higher concentrations were missed during sampling. This could produce an estimate of the site mean concentration that is higher or lower than the true mean. In addition, since the sampling was initially intended to delineate the extent of any contamination on the site, it was somewhat focused and biased. As a result, it is not necessarily ideal as a basis for the risk assessment.

8.11.3 Toxicity Assessment.

The derivation of toxicity values is a source of uncertainty. Most of the data on health effects comes from animal studies. EPA collects and evaluates all known studies for each chemical and uses the most sensitive animal study available and the adverse effect that occurs at the lowest dose to derive, by the application of uncertainty and modifying factors, the RfD for noncarcinogens. Humans are assumed to be even more sensitive than the most sensitive animal. The health effect in humans may not be the same so human data are sought to corroborate the animal data. The same data evaluation process takes place for carcinogens, except the data are extrapolated to humans by using the 95% UCL of the mean slope from the primary study used to derive the CSF.

8.11.4 Risk Characterization.

A final source of uncertainty in the risk estimates is the assumption that chemical risks are additive. In actuality, multiple chemicals may act antagonistically or synergistically with regard to the adverse health effects produced.

8.12 <u>Summary of Risk Assessment.</u>

Field sampling of surface soil, subsurface soil, and groundwater was conducted over several sampling events for SWMU 73. The data collected during these events was used as the basis for a risk assessment evaluating the potential risk and hazard to several potential current and future receptors. The quantitative assessment indicated that the site HIs for future adult and child residents (3.7 and 10.9 respectively), as well as construction workers (1.4) exceeded the safe level of 1.0. However, further evaluation shows that these findings are artificially elevated. The HIs for all three receptors are due in large part to EPCs that are elevated due to one or more

outliers being included in the dataset. Recalculating the EPCs with the outliers removed, results in soil contact HQs of 0.7, 0.08, and 0.8 for children, adults, and construction workers respectively. The results of the carcinogenic evaluation are similar. While all of the calculated cancer risk levels were above the 1E-6 level, only the future child and adult resident exceeded 1E-4. However, as with the HI, both of these elevated results are due almost entirely to arsenic ingestion in groundwater and exposure to kepone in surface soil. As discussed previously, public drinking water is already provided to the site and the shallow groundwater sampled is not a viable potable source. Using the adjusted EPC for kepone reduces the surface soil contact risk estimates to 3.7E-5, 1.8E-5, and 1.6E-6 for children, adults, and construction workers respectively.

8.13 References.

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9.0 SUMMARY OF ECOLOGICAL AND HUMAN HEALTH RISK ASSESSMENT.

Sections 7.0 and 8.0 discuss the ecological and human health risk assessment process for SWMU 73. Media areas evaluated during the risk assessment included surface soil (defined as soils from 0-1 foot in depth), subsurface soils (defined as soils from 1-3 feet in depth), and groundwater. Risk-based CAOs were developed using the same exposure parameters as the risk assessment in order to represent the potentially exposed populations as closely as possible while still providing a degree of conservatism.

9.1 Ecological.

A screening-level ERA was conducted using sampling data for surface soil, subsurface soil, and groundwater at SWMU 73. Various chemicals were retained as COPCs and further evaluated in a more refined Step 3a of the ERA. Although some chemicals exceeded the target level of 1, they were not recommended for further evaluation based on discussions presented in Section 7.10.1.1. Chemicals in groundwater were not recommended for further evaluation based on discussions presented in Section 7.10.1.3.

9.2 Human Health.

The quantitative assessment indicated that the site HIs for future adult and child residents (3.7 and 10.9 respectively) as well as construction workers (1.4) exceeded the safe level of 1.0. However, further evaluation shows that these findings are artificially elevated. The HI exceedences for all three receptors are due in large part to EPCs that are elevated due to one or more outliers being included in the dataset. Recalculating the EPCs with the outliers removed results in soil contact HQs of 0.7, 0.08, and 0.8 for children, adults, and construction workers, respectively. The results of the carcinogenic evaluation are similar. While all of the calculated cancer risk levels were above the 1E-6 level, only the future child and adult resident exceeded 1E-4. However, as with the HI, both of these elevated results are due almost entirely to arsenic ingestion in groundwater and exposure to kepone in surface soil. Public drinking water is already provided to the site and the shallow groundwater sampled during the investigation is not a viable potable source. Using the adjusted EPC for kepone reduces the surface soil contact risk estimates to 3.7E-5, 1.8E-5, and 1.6E-6 for children, adults, and construction workers respectively.

10.0 RECOMMENDED ACTION.

No further action is recommended at SWMU 73 based on the findings of the ecological and human health evaluation.

TABLES

Table 1. 2004 ECP Surface Soil Chemical Data at SWMU 73.

Site ID **Sample ID**	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	2x Average Detected Background (NAPR)	**19E-01** **19E-SS01**	**19E-02** **19E-SS02**	**19E-03** **19E-SS03**	**19E-SS04** **19E-SS04**	**19E-SS05** **19E-SS05**	**19E-SS06** **19E-SS06**	**19E-SS07** **19E-SS07**	**19E-SS08** **19E-SS08**	**19E-SS09** **19E-SS09**
Sample Date					06-May-04	06-May-04	06-May-04	13-May-04	13-May-04	13-May-04	13-May-04	13-May-04	13-May-04
Sample Depth					0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
Volatile Organic Compounds (µg/Kg)													
Carbon tetrachloride	610	3,000	0.17	N/A	*2.6J*	*2.9J*	*ND (5.6)*	*ND (7.9)*	*ND (6.8)*	*ND (5.8)*	*ND (6)*	*ND (6.5)*	*ND (6.3)*
Chlorobenzene	290,000	1,400,000	62	N/A	ND (4.8)	ND (5.6)	ND (5.6)	ND (7.9)	ND (6.8)	1.8J	ND (6)	ND (6.5)	ND (6.3)
Tetrachloroethene	5,500	2,600	0.049	N/A	*ND (4.8)*	*ND (5.6)*	*ND (5.6)*	*ND (7.9)*	*ND (6.8)*	*5.7J*	*ND (6)*	*ND (6.5)*	*ND (6.3)*
Xylene	630,000	2,700,000	200	N/A	ND (9.7)	ND (11)	3.8J	ND (16)	ND (14)	ND (12)	ND (12)	ND (13)	ND (12)
Semi-Volatile Organic Compounds (ug/Kg)													
Acenaphthylene	N/A	N/A	N/A	N/A	ND (360)	ND (380)	ND (420)	ND (540)	ND (490)	71J	ND (440)	ND (450)	ND (440)
Anthracene	17,000,000	170,000,000	360,000	N/A	ND (360)	ND (380)	ND (420)	ND (540)	ND (490)	48J	ND (440)	ND (450)	ND (440)
Benz(a)anthracene	150	2,100	10	N/A	*ND (360)*	*ND (380)*	*ND (420)*	*ND (540)*	*ND 490)*	*220J*	*ND (440)*	*ND (450)*	*ND (440)*
Benzo(a)pyrene	15	210	3.5	N/A	*ND (360)*	*ND (380)*	*ND (420)*	*ND (540)*	*ND (490)*	***270J***	*ND (440)*	*ND (450)*	*ND (440)*
Benzo(b)fluoranthene	150	2,100	35	N/A	*ND (360)*	*ND (380)*	*ND (420)*	*ND (540)*	*ND (490)*	*320J*	*ND (440)*	*ND (450)*	*ND (440)*
Benzo(g,h,i)perylene	N/A	N/A	N/A	N/A	49J	ND (380)	32J	ND (540)	ND (490)	230J	ND (440)	ND (450)	ND (440)
Benzo(k)fluoranthene	1,500	21,000	350	N/A	26J	*ND (380)*	*ND (420)*	*ND (540)*	*ND (490)*	*350J*	*ND (440)*	*ND (450)*	*ND (440*
Butylbenzylphthalate	260,000	910,000	510	N/A	52J	ND (380)	ND (420)	320J	ND (490)	ND (400)	ND (440)	ND (450)	ND (440)
Chrysene	15,000	210,000	1,100	N/A	ND (360)	ND (380)	ND (420)	ND (540)	ND (490)	320J	ND (440)	ND (450)	ND (440)
Fluoranthene	2,300,000	22,000,000	160,000	N/A	34J	ND (380)	41J	ND (540)	ND (490)	200J	ND (440)	56J	ND (440)
Indeno(1,2,3-cd) pyrene	150	2,100	120	N/A	43J	*ND (380)*	*ND (420)*	*ND (540)*	*ND (490)*	*190J*	*ND (440)*	*ND (450)*	*ND (440)*
Pyrene	1,700,000	17,000,000	120,000	N/A	39J	18J	43J	ND (540)	ND (490)	230J	ND (440)	54J	ND (440)
Pesticides/PCBs (µg/Kg)													
Dieldrin	30	110	0.17	N/A	***7.7***	*1.9J*	*ND (840)*	*ND (5.4)*	*6.7*	*ND (4)*	*ND (4.4)*	*ND (4.5)*	*ND (4.4)*
Heptachlor	110	380	1.2	N/A	*3.7P*	*ND (3.9)*	*ND (430)*	*ND (2.8)*	*ND (2.5)*	*ND (2)*	*ND (2.3)*	*ND (2.3)*	*ND (2.3)*
4,4'-DDT	1,700	7,000	67	N/A	ND (7.2)	10	***5,300***	7.1	ND (4.9)	4.9	ND (4.4)	ND (4.5)	3.7J
4,4'-DDE	1,400	5,100	47	N/A	7.6	*66*	***4,700***	22	8.8	4.3	ND (4.4)	ND (4.5)	1J
4,4'-DDD	2,000	7,200	66	N/A	ND (7.2)	1.4J	*810J*	ND (5.4)	ND (4.9)	ND (4)	ND (4.4)	ND (4.5)	ND (4.4)
Kepone	49	170	0.24	N/A	*ND (370)*	*ND (390)*	*ND (43,000)*	*ND (280)*	*ND (250)*	*26J*	*ND (230)*	*ND (230)*	*ND (230)*
Aroclor-1248	220	740	5.2	N/A	*140*	*ND (75)*	*ND (8,400)*	*ND (54)*	*ND (49)*	*ND (40)*	*ND (44)*	*ND (45)*	*ND (44)*
Aroclor-1254	220	740	8.8	N/A	*ND (72)*	*40J*	*ND (8,400)*	*ND (54)*	*ND (49)*	*ND (40)*	*ND (44)*	*ND (45)*	*ND (44)*
Aroclor-1260	220	740	24	N/A	*120*	15J	*ND (8,400)*	*ND (54)*	*73*	*ND (40)*	*ND (44)*	*ND (45)*	*ND (44)*
Organophospahte Pesticides (µg/Kg)													
No detections	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chlorinated Herbicides (µg/Kg)													
No detections	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 1 (contd.). 2004 ECP Surface Soil Chemical Data at SWMU 73.

Site ID	Nov 2010 EPA Regional Screen Level Residential	Nov 2010 EPA Regional Screen Level Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	2x Average Detected Background (NAPR)	**19E-01**	**19E-02**	**19E-03**	**19E-SS04**	**19E-SS05**	**19E-SS06**	**19E-SS07**	**19E-SS08**	**19E-SS09**
Sample ID					**19E-SS01**	**19E-SS02**	**19E-SS03**	**19E-SS04**	**19E-SS05**	**19E-SS06**	**19E-SS07**	**19E-SS08**	**19E-SS09**
Sample Date					06-May-04	06-May-04	06-May-04	13-May-04	13-May-04	13-May-04	13-May-04	13-May-04	13-May-04
Sample Depth					0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'	0-1'
Metals (mg/Kg)													
Arsenic	0.39	1.6	0.0013	2.65	***2.3***	***1.8***	*1B*	*ND (1.5)*	*ND (1.4)*	***3.8***	*ND (1.2)*	***4.6***	***1.5***
Barium	15,000	190,000	300	199	83	82	130	67	89	46	53	120	140
Beryllium	160	2000	58	0.590	0.32B	0.22B	0.2B	0.28B	0.23B	0.16B	0.57	0.35B	0.36B
Cadmium	70	800	1.4	1.02	4.2	0.28B	1	ND (0.77)	0.87	0.35B	*ND (3)*	ND (0.65)	ND (0.62)
Chromium	0.29	5.6	0.0083	49.8	*27*	*19*	***25***	***28***	***24***	*22*	*22*	***24***	***34***
Cobalt	23	300	0.49	46.2	*16*	*16*	*13*	*22*	*26*	*10*	*7.7*	*19*	*27*
Copper	3,100	41,000	51	168	*120*	*110*	*110*	*170*	*250*	*210*	*290*	*170*	*180*
Cyanide	1,600	20,000	7.4	N/A	ND (0.53)	ND (0.56)	ND (0.63)	ND 0.8)	ND (0.72)	ND (0.6)	ND (0.65)	0.36B	0.37B
Lead	400	800	14 (MCL-based)	22.0	*73*	9.3	*56*	*26*	*67*	*58*	4.6	13	*21*
Nickel	1,500	20,000	48	20.7	*44E*	17E	*21E*	15	16	11	6.4	12	14
Silver	390	5,100	1.6	N/A	0.14B	ND (1)	ND (1.1)	ND (1.5)	ND (1.4)	ND (1.1)	ND (1.2)	ND (1.3)	ND (1.2)
Sulfide	N/A	N/A	N/A	N/A	ND (27)	ND (28)	ND (32)	ND (41)	ND (37)	ND (30)	ND (34)	34B	ND (33)
Tin	47,000	610,000	5500	3.76	2.7B	2.8B	2.6B	*4B*	*4.3B*	2.9B	2.8B	*4.1B*	*4B*
Vanadium	390	5,200	180	259	**100**	**110**	**85**	**130**	**130**	**65**	***270***	**160**	**150**
Zinc	23,000	310,000	680	115	*240*	72	*160*	*210E*	*220E*	*120E*	71E	*160E*	*120E*
Mercury	5.6	34	0.03	0.109	*0.033*	*0.055*	*0.25S*	*0.3S*	*0.29S*	*2.1*	*0.022B*	*0.038*	*0.092S*

N/A Not Applicable.
J Constituent estimated value below the analytical method detection limit.
ND Constituent not detected at the identified analytical method detection limit.
Italicized numbers indicate that constituent detetion limit exceeds one or more screening levels.
P The GC or HPLC confirmation critera were exceeded. The relative percent difference is greater than 40% between the two GC columns or HPLC detectors.
Bold text indicates the constituent was detected at the identified value above the original analytical method detection limit.
B Blank sample associated with environmental sample was identified with contamination.
E Reported value is an estimate because of the presence of matrix interference.
S Result determined by Method of Standard Addition.

Table 2. 2004 ECP Subsurface Soil Chemical Data at SWMU 73.

Site ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	2x Average Detected Background NAPR*	**19E-01**	**19E-02**	**19E-03**
Sample ID					**19E-SB01-02**	**19E-SB02-03**	**19E-SB03-03**
Sample Date					06-May-04	06-May-04	06-May-04
Sample Depth					3'-5'	5'-7'	5'-7'
Volatile Organic Compounds (µg/Kg)							
Carbon tetrachloride	610	3,000	0.17	N/A	*ND (5.1)*	*1.1J*	*ND (5.2)*
Semi-Volatile Organic Compounds(µg/Kg)							
No detections	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pesticides and PCBs (µg/Kg)							
4-4'-DDD	2,000	72,000	66	N/A	ND (7.4)	ND (7.4)	19J
4-4'-DDE	1,400	5,100	47	N/A	ND (7.4)	9	*120*
4-4'-DDT	1,700	7,000	67	N/A	ND (7.4)	1.2JP	*230*
Organophosphate Pesticides (µg/Kg)							
No detections	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chlorinated Herbicides (µg/Kg)							
No detections	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Metals (mg/Kg)							
Barium	15,000	190,000	300	207	73	97	110
Beryllium	160	2,000	58	0.596	0.15B	0.14B	0.18B
Cadmium	70	800	1.4	0.54	*0.61*	0.15B	ND (0.51)
Chromium	230	1,400	0.0083	47.9	***37***	*21*	***28***
Cobalt	23	300	0.049	26.9	*23*	*23*	*20*
Copper	3,100	41,000	51	120	*130*	*130*	*120*
Lead	400	800	14 (MCL-based)	6.2	1.1	1.6	5.7
Nickel	1,500	20,000	48	24.7	14E	18E	17E
Silver	390	5,100	1.6	N/A	0.13B	ND (1)	0.12B
Sulfide	N/A	N/A	N/A	N/A	28B	ND (28)	ND (27)
Tin	47,000	610,000	5,500	3.47	1.6B	3B	2.8B
Vanadium	390	5,200	180	256	**110**	**140**	**100**
Zinc	23,000	310,000	680	88	*200*	81	85
Mercury	5.6	34	0.03	0.067	*0.0048B*	*0.014B*	*0.0055B*

* Lowest of two values calculated for subsurface soil background in fine sand/silt or clay.
N/A Not Applicable.
ND Constituent not detected at the identified analytical method detection limit.
B Blank sample associated with environmental sample was identified with contamination.
Italicized numbers indicate that constituent detetion limit exceeds one or more screening levels.
Bold text indicates the constituent was detected at the identified value above the original analytical method detection limit.
J Constituent estimated value below the analytical method detection limit.
P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two GC columns or HPLC detectors.
E The reported value is estimated because of the presence of matrix interference.

Table 3. 2004 ECP Groundwater Chemical Data at SWMU 73.

Site ID **Sample ID** **Sample Date**	Nov 2010 EPA RSL Tap Water[1]	Federal Drinking Water[2] MCL	PR Water Quality Standards	**19E-01** **19E-GW01** 10-May-04	**19E-02** **19E-GW02** 10-May-04	**19E-03** **19E-GW03** 10-May-04
Volatile Organic Constituents (µg/L)						
Ethyl benzene	1.5	700	700	ND (1)	0.61J	ND (1)
Toluene	2,300	1,000	1,000	1	1.2	ND (1)
Carbon disulfide	1,000	N/A	N/A	1.3	1.6	ND (1)
Semi-Volatile Organic Constituents (µg/L)						
Cresol, m&p	3,700	N/A	N/A	ND (10)	1.8J	ND (10)
Pesticides/PCBs (µg/L)						
4,4'-DDD	0.28	N/A	N/A	ND (0.1)	0.088J	0.04J
4,4'-DDE	0.20	N/A	N/A	ND (0.1)	0.015J	0.11
4,4'-DDT	0.20	N/A	0.001	ND (0.1)	ND (0.1)	0.088J
Organophosphate Pesticides (µg/L)						
No detections	N/A	N/A	N/A	N/A	N/A	N/A
Chlorinated Herbicides (µg/L)						
No detections	N/A	N/A	N/A	N/A	N/A	N/A
Dissolved Metals (mg/L)						
Barium	7.3	2	N/A	0.015	0.01B	0.021
Cobalt	0.011	N/A	N/A	ND (0.01)	0.002B	0.002B
Nickel	0.730	N/A	N/A	0.003B	ND (0.04)	ND (0.04)
Vanadium	0.180	N/A	N/A	**0.026**	**0.014**	0.003B
Total Cyanide and Sulfide (mg/L)						
No detections	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB01-00**	**73SB01A-00**	**73SB02-00**	**73SB03-00**	**73SB04-00**
Sample Date						31-Mar-08	31-Mar-08	31-Mar-08	31-Mar-08	31-Mar-08
Volatile Organic Compounds (µg/Kg)										
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	11 J-p	5 J-p	ND (11) J-p	5 J-p	5 J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	ND (9) J-p	ND (9) J-p	**ND (11) J-p**	ND (10) J-p	**ND (11) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	62 J-p	66 J-p	31 J-p	72 J-p	45 J-p
Allyl chloride	680	3,400	0.21	N/A	N/A	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**
Benzene	1,100	5,400	0.21	101	N/A	**0.8 J-p**	**ND (5) J-p**	**2 J-p**	**ND (5) J-p**	**3 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**	**4 J-p**	**ND (5) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	5 J-p	ND (5) J-p	5 J-p	4 J-p	5 J-p
Chloromethane	120,000	500,000	49	N/A	N/A	ND (5) J-p	ND (5) J-p	ND (5) J-p	ND (5) J-p	ND (5) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	ND (5) J-p	ND (5) J-p	ND (5) J-p	ND (5) J-p	ND (5) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**	**ND (5) J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	ND (5) J-p	ND (5) J-p	ND (5) J-p	ND (5) J-p	2 J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)										
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	0.92 J	1.2 J	ND (1.8)	1.4 J	1.4 J
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	1.4 J	2	0.83 J	2	1.2 J
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	1.6 J	ND (1.8)	ND (1.8)	8	ND (1.9)
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	0.63 J	0.59 J	16	0.69 J	1.5 J
Anthracene	17,000,000	170,000,000	360,000	1,200	N/A	1.6 J	1.3 J	41	21	1.7 J
Benz[a]anthracene	150	2,100	10	1,200	N/A	**15**	**10**	**150**	**77**	8.3
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**18 Jm**	**12 Jm**	**160 Jm**	**64 Jm**	**16 Jm**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	30	26	**360**	**96**	24
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	15	8.2	66	23	7.7
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	14	9	200	45	11
Chrysene	15,000	210,000	1,100	1,200	N/A	16 Jm	12 Jm	220 Jm	74 Jm	12 Jm
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	3.7	2.2	**19**	8.7	2.1
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	20 Jm	14 Jm	250 Jm/ 39 J	170 Jm	21 Jm
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	ND (1.7)	ND (1.8)	1.3 J	6.7	0.83 J
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	12 Jm	7.3 Jm	69 Jm	25 Jm	7.4 Jm
Naphthalene	3,600	18,000	0.47	1,200	N/A	**3.2**	**5.3**	**2.4**	**5.9**	**2**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	8	7.1	10	100	17
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	15	10	270 / 48 J	97	16
Semi-Volatile Organics Compounds (µg/Kg)										
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (170)	ND (180)	ND (180)	ND (170)	ND (190)
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	83 J	ND (180)	ND (180)	ND (170)	ND (190)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	280 J	400	**1,200**	890	260 J

Table 4 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB01-00**	**73SB01A-00**	**73SB02-00**	**73SB03-00**	**73SB04-00**
Sample Date						31-Mar-08	31-Mar-08	31-Mar-08	31-Mar-08	31-Mar-08
Pesticides and PCBs (µg/Kg)										
Aroclor 1254	220	740	8.8	N/A	N/A	**ND (18.3)**	**ND (17.9)**	**ND (3930)**	**ND (176)**	**ND (18.4)**
Aroclor 1260	220	740	24	N/A	N/A	22.5	**33.1 J+s**	**ND (3930)**	**312**	20.7
Chlordane	1,600	6,500	13	100	N/A	**390 Jq**	**480**	**ND (9800)**	**ND (18)**	**ND (92)**
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	0.48 J	0.81 Jq	**ND (480)**	ND (0.86)	ND (4.5)
Dieldrin	30	110	0.17	401	N/A	**ND (1.8)**	**0.52 Jq**	**ND (980)**	**0.73 Jq**	**ND (9.2)**
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	ND (1.8)	1.7 J	**ND (980)**	ND (1.8)	ND (9.2)
Endosulfan II	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	**ND (980)**	ND 1.8)	ND (9.2)
Endrin	18,000	180,000	440	401	N/A	ND (1.8)	ND (1.8)	**ND (980)**	ND (1.8)	ND (9.2)
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	**ND (980)**	ND (1.8)	ND (9.2)
Gamma BHC (hexachlorobenzene)	300	1,100	0.53	201	N/A	**ND (0.89)**	**ND (0.88)**	**ND (480)**	**ND (0.86)**	**ND (4.5)**
Heptachlor	110	380	1.2	100	N/A	0.36 Jl	ND (0.88) Jl	**ND (480) Jl**	ND (0.86) Jl	**ND (4.5) Jl**
Heptachlor epoxide	53	190	0.15	100	N/A	**2.3 Jq**	**3 Jq**	**ND (480)**	**ND (0.86)**	**ND (4.5)**
Kepone (chlordecone)	49	170	0.24	100	N/A	**25**	**ND (7.4)**	**ND (4000)**	**14**	**ND (38)**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (8.9) Jc	ND (8.8) Jc	**ND (4800)**	ND (8.6) Jc	ND (45) Jc
p,p'-DDD	2,000	7,200	66	401	N/A	ND (1.8)	ND (6.3)	**5,500**	2.2 Jq	13
p,p'-DDE	1,400	5,100	47	401	N/A	**75**	**150**	**9,600**	7.2	**360**
p,p'-DDT	1,700	7,000	67	401	N/A	**71 Jc**	**160 Jc**	**77,000**	34 Jc	**120 Jc**
Metals (mg/Kg)										
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**2.3 Jd**	**3.3 Jd**	**2.8 Jd**	**4.9 Jd**	**ND (2)**
Barium	15,000	190,000	300	330	199	77 Jd	90 Jd	120 Jd	58 Jd	59 Jd
Cadmium	70	800	1.4	32	1.02	0.68 J-m	**1.8 J-m**	**19 J-m**	**3.1 J-m**	ND (0.5) J-m
Chromium	230	1,400	0.0083	0.4	49.8	**24**	**34**	**27**	**27**	**19**
Cobalt	23	300	0.49	13	46.2	**13**	**16**	**12**	**13**	**13**
Copper	3,100	41,000	51	70	168	**82**	**120**	**110**	**160**	**83**
Lead	400	800	14 (MCL-based)	120	22	**64 J-m**	**73 J-m**	**110 J-m**	**110 J-m**	**30 J-m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	**38**	**63**	**21**	**39**	**28**
Selenium	390	5,100	0.95	1	1.48	Rm	Rm	Rm	Rm	Rm
Silver	390	5,100	1.6	560	N/A	ND (1)	ND (1)	ND (0.99)	ND (0.99)	ND (1)
Thallium	N/A	N/A	N/A	1	N/A	**ND (2) Jm**	**ND (2) Jm**	**ND (2) Jm**	**ND (2) Jm**	**ND (2) Jm**
Vanadium	390	5,200	180	2	259	**77**	**92**	**82**	**69**	**83**
Zinc	23,000	310,000	680	50	115	**300**	**90**	**65**	**270**	**88**
Mercury	5.6	34	0.03	0.1	0.109	0.020	**0.069**	**0.103**	**0.059**	**0.123**

Table 4 (contd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB05-00**	**73SB06-00**	**73SB07-00**	**73SB08-00**
Sample Date						31-Mar-08	31-Mar-08	1-Apr-08	1-Apr-08
Volatile Organic Compounds (µg/Kg)									
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	6 J-p	6 J-p	5 J-p	12 J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	ND (10) J-p	**ND (11) J-p**	**ND (12) J-p**	**ND (11) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	37 J-p	50 J-p	67 J-p	160 J-p
Allyl chloride	680	3,400	0.21	N/A	N/A	**ND (5) J-p**	**ND (5) J-p**	**ND (6) J-p**	**ND (6) J-p**
Benzene	1,100	5,400	0.21	101	N/A	**0.7 J-p**	**1 J-p**	**ND (6) J-p**	**2 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**ND (5) J-p**	**ND (5) J-p**	**ND (6) J-p**	**ND (6) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	6 J-p	3 J-p	ND (6) J-p	5 J-p
Chloromethane	120,000	500,000	49	N/A	N/A	ND (5) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	ND (5) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**ND (5) J-p**	**ND (5) J-p**	**3 J-p**	**ND (6) J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	ND (5) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)									
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	ND (1.8)	ND (1.7)	ND (1.7)	ND (1.7)
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	0.92 J	0.90 J	ND (1.7)	ND (1.7)
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	ND (1.8)	ND (1.7)	ND (1.7)	1.3 J
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	ND (1.8)	ND (1.7)	2.1	20
Anthracene	17,000,000	170,000,000	360,000	1,200	N/A	0.64 J	0.6 J	3.9	27
Benz[a]anthracene	150	2,100	10	1,200	N/A	9.3	5	8.4	**56**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**15 Jm**	**9 Jm**	**7.8 Jm**	**71 Jm**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	30	21	24	**180**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	8.1	12	7.8	54
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	13	6.9	11	79
Chrysene	15,000	210,000	1,100	1,200	N/A	14 Jm	7.7 Jm	19 Jm	100 Jm
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	2.4	2.4	2.0	**15**
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	7.6 Jm	7 Jm	41 Jm	140 Jm
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	ND (1.8)	ND (1.7)	ND (1.7)	1.4 J
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	8.1 Jm	8.9 Jm	6.8 Jm	51 Jm
Naphthalene	3,600	18,000	0.47	1,200	N/A	**3.9**	**2**	**ND (1.7)**	**1.3 J**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	4.7	4	8.1	20
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	6.9	7.1	26	100
Semi-Volatile Organics Compounds (µg/Kg)									
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (180)	ND (170)	ND (170)	ND (170)
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	ND (180)	ND (170)	ND (170)	ND (170)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	330 J	830	400	120 J

Table 4 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB05-00**	**73SB06-00**	**73SB07-00**	**73SB08-00**
Sample Date						31-Mar-08	31-Mar-08	1-Apr-08	1-Apr-08
Pesticides and PCBs (µg/Kg)									
Aroclor 1254	220	740	8.8	N/A	N/A	**ND (89.3)**	**103**	**ND (17.5)**	**48**
Aroclor 1260	220	740	24	N/A	N/A	**345**	**59.4**	ND (17.5)	**27.3**
Chlordane	1,600	6,500	13	100	N/A	**ND (180)**	**ND (180)**	**ND (17)**	**ND (18)**
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	ND (4.5)	ND (8.7)	ND (0.85)	ND (0.86)
Dieldrin	30	110	0.17	401	N/A	**13 J**	**9.1 J**	**ND (1.7)**	**3.3**
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	ND (18)	ND (18)	ND (1.7)	ND (1.8)
Endosulfan II	N/A	N/A	N/A	100	N/A	ND (18)	ND (18)	ND (1.7)	ND (1.8)
Endrin	18,000	180,000	440	401	N/A	ND 18)	ND (18)	ND (1.7)	1 J
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (18)	ND (18)	ND (1.7)	ND (1.8)
Gamma BHC (hexachlorobenzene)	300	1,100	0.53	201	N/A	**ND (8.7)**	**ND (8.9)**	**ND (0.85)**	**ND (0.86)**
Heptachlor	110	380	1.2	100	N/A	**ND (8.7) Jl**	**ND (8.9) Jl**	**ND (0.85) Jl**	0.37 Jlq
Heptachlor epoxide	53	190	0.15	100	N/A	**ND (8.7)**	**2.8 J**	**ND (0.85)**	**0.79 Jq**
Kepone (chlordecone)	49	170	0.24	100	N/A	**66 J**	**ND (75)**	**ND (7.2)**	**11 Jq**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (87) Jc	ND (89) Jc	ND (8.5) Jc	ND (8.6) Jc
p,p'-DDD	2,000	7,200	66	401	N/A	ND (18)	ND (18)	ND (1.7)	ND (1.8)
p,p'-DDE	1,400	5,100	47	401	N/A	36	29	6	5.7
p,p'-DDT	1,700	7,000	67	401	N/A	ND (18) Jc	27 Jq	2.8 Jc	ND (1.8) Jc
Metals (mg/Kg)									
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**3.5 Jd**	**3.5 Jd**	**4.2 Jd**	**4J d**
Barium	15,000	190,000	300	330	199	65 Jd	86 Jd	44 Jd	66 Jd
Cadmium	70	800	1.4	32	1.02	0.63 J-m	**5.3 J-m**	ND (0.5) Jm	0.7 J-m
Chromium	230	1,400	0.0083	0.4	49.8	**22**	**27**	**75**	**18**
Cobalt	23	300	0.49	13	46.2	**15**	**15**	**15**	**14**
Copper	3,100	41,000	51	70	168	**76**	**280**	**65**	**89**
Lead	400	800	14 (MCL-based)	120	22	**60 J-m**	**200 J-m**	7.3 J-m	**43 J-m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	**37**	**48**	12	11
Selenium	390	5,100	0.95	1	1.48	Rm	Rm	Rm	Rm
Silver	390	5,100	1.6	560	N/A	ND (1)	ND (1)	ND (1)	ND (1)
Thallium	N/A	N/A	N/A	1	N/A	**ND (2) Jm**	**ND (1) Jm**	**ND (2) Jm**	**ND (2) Jm**
Vanadium	390	5,200	180	2	259	**100**	**90**	**110**	**86**
Zinc	23,000	310,000	680	50	115	**140**	**500**	**77**	**200**
Mercury	5.6	34	0.03	0.1	0.109	0.029	**0.399**	0.015	**0.184**

Table 4 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB09-00**	**73SB10-00**	**73SB11-00**	**73SB12-00**
Sample Date						1-Apr-08	1-Apr-08	1-Apr-08	1-Apr-08
Volatile Organic Compounds (µg/Kg)									
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	41 J-p	ND (9) J-p	7 J-p	5 J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	6 J-p	ND (9) J-p	**ND (12) J-p**	**ND (11) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	140 J-p	ND (19) J-p	76 J-p	75 J-p
Allyl chloride	680	3,400	0.21	N/A	N/A	**ND (6) J-p**	**ND (5) J-p**	**ND (6) J-p**	**ND (5) J-p**
Benzene	1,100	5,400	0.21	N/A	N/A	**1 J-p**	**ND (5) J-p**	**ND (6) J-p**	**0.9 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**4 J-p**	**ND (5) J-p**	**ND (6) J-p**	**ND (5) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	2 J-p
Chloromethane	120,000	500,000	49	N/A	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	ND (5) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	22 J-p	ND (5) J-p	ND (6) J-p	ND (5) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**ND (6) J-p**	**3 J-p**	**ND (6) J-p**	**6 J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	2 J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)									
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	**14**	ND (1.7)	ND (1.8)	ND (1.7)
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	24	ND (1.7)	0.74 J	0.84 J
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	1.2 J	ND (1.7)	ND (1.8)	ND (1.7)
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	ND (1.8)	1.6 J	12	0.65 J
Anthracene	17,000,000	170,000,000	360,000	1,200	N/A	5.3	2.1	8.3	0.99 J
Benz[a]anthracene	150	2,100	10	1,200	N/A	**24**	5.1	**17**	8.2
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**20 Jm**	**5.5 Jm**	**25 Jm**	**9.7 Jm**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	32	15	**52**	21
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	13	4.6	22	8.7
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	15	7.1	17	8.8
Chrysene	15,000	210,000	1,100	1,200	N/A	24 Jm	9.2 Jm	28 Jm	13 Jm
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	4.0	1.2 J	5.3	2.0
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	47 Jm	11 Jm	31 Jm	11 Jm
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	ND (1.8)	ND (1.7)	0.79 J	ND (1.7)
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	12 Jm	4.4 Jm	19 Jm	7.4 Jm
Naphthalene	3,600	18,000	0.47	1,200	N/A	**6.8**	**ND (1.7)**	**1.1 J**	**1.6 J**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	42	1.5 J	4.7	4.3
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	31	8.1	25	7.4
Semi-Volatile Organics Compounds (ug/Kg)									
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (180)	ND (170)	ND (180)	ND (170)
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	ND (180)	ND (170)	ND (180)	ND (170)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	540	480	190 J	570

Table 4 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-03 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB09-00**	**73SB10-00**	**73SB11-00**	**73SB12-00**
Sample Date						1-Apr-08	1-Apr-08	1-Apr-08	1-Apr-08
Pesticides and PCBs (µg/Kg)									
Aroclor 1254	220	740	8.8	N/A	N/A	**96.2**	**146**	**ND (17.9)**	**ND (17.5)**
Aroclor 1260	220	740	24	N/A	N/A	**71.4**	**53.8 J+s**	ND (17.9)	10.6 J
Chlordane	1,600	6,500	13	100	N/A	**ND (18)**	**94 J**	**ND (18)**	**ND (18)**
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	ND (0.89)	ND (0.87)	ND (0.88)	ND (0.85)
Dieldrin	30	110	0.17	401	N/A	**4.5**	**6.7**	**ND (1.8)**	**ND (1.8)**
Endusulfan sulfate	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)
Endusulfan II	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)
Endrin	18,000	180,000	440	401	N/A	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)
Gamma BHC (hexachlorobenzene)	300	1,100	0.53	201	N/A	**ND (0.89)**	**ND (0.87)**	**ND (0.88)**	**ND (0.85)**
Heptachlor	110	380	1.2	100	N/A	ND (0.89) Jl	**16 Jl**	ND (0.88) Jl	ND (0.85) Jl
Heptachlor epoxide	53	190	0.15	100	N/A	**1.7**	**6.2**	**ND (0.88)**	**ND (0.85)**
Kepone (chlordecone)	49	170	0.24	100	N/A	**11 Jq**	**18 Jq**	**ND (7.4)**	**ND (7.2)**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (8.9) Jc	ND (8.7) Jc	ND (8.8) Jc	ND (8.5) Jc
p,p'-DDD	2,000	7,200	66	401	N/A	ND (2.9)	ND (7.6)	3.9	ND (1.8)
p,p'-DDE	1,400	5,100	47	401	N/A	10	25	8	1.3 Jq
p,p'-DDT	1,700	7,000	67	401	N/A	37 Jc	38 Jc	53 Jc	2 Jc
Metals (mg/Kg)									
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**ND (2)**	**2 Jd**	**ND (2) Jd**	**3.6 Jd**
Barium	15,000	190,000	300	330	199	83 Jd	99 J-d	28 Jd	29 Jd
Cadmium	70	800	1.4	32	1.02	ND (0.5) Jm	**1.2 J-m**	ND (0.5) Jm	ND (0.5) Jm
Chromium	230	1,400	0.0083	0.4	49.8	**16**	**18**	**26**	**17**
Cobalt	23	300	0.49	13	46.2	**15**	**10**	**22**	**6.4**
Copper	3,100	41,000	51	70	168	**76**	**74**	**84**	46
Lead	400	800	14 (MCL-based)	120	22	**29 J-m**	**94 J-m**	3.1 J-m	**21 J-m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	**36**	20	15	5.1
Selenium	390	5,100	0.95	1	1.48	Rm	Rm	Rm	Rm
Silver	390	5,100	1.6	560	N/A	ND (1)	ND (0.99)	ND (1)	ND (1)
Thallium	N/A	N/A	N/A	1	N/A	**ND (2) Jm**	**ND(2) Jm**	**ND (2) Jm**	**ND (2) Jm**
Vanadium	390	5,200	180	2	259	**93**	**71**	**170**	**40**
Zinc	23,000	310,000	680	50	115	**82**	**280**	**87**	**120**
Mercury	5.6	34	0.003	0.1	0.109	0.020	**0.080**	ND (0.012)	**0.145**

[1]-Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2]-Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).
N/A Not Applicable.
J The reported result is an estimate; associated QC results are outside the specified range. J- indicates that result has a negative bias.
p Results are flagged due to preservation or post-digestion spike failures.
ND Constituent not detected. Number in parentheses is the analytical method detection limit.
Bold text indicates that constituent detection or detection limit exceeds one or more screening levels.
m Result is flagged due to matrix spike recoveries outside the specified window.
Multi-value blocks represent detections of the low level PAH result followed by the SVOC result for constituents where the analytes are evaluated by both analyses.
NAn Sample not analyzed for this parameter.
q Result is flagged due to a quantitation anomaly
l Result is flagged due to LCS anomalies.
c Result is flagged due to continuing calibration anomalies related to drift or response
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified.

Data Validation for Table 4:

Metals:

Antimony and selenium data were flagged Rm and were not useable due to matrix spike recoveries less than 30%.

Most of the arsenic results and all of the barium results were flagged "Jd"due to duplicate relative percent differences greater than the acceptance limit.

Cadmium results were flagged "J-m" or UJm" due to MS recoveries less than the lower QC limit.

Lead results were flagged "J-m" due to MS recoveries outside QC criteria.

Thallium results were flagged "UJm" due to MS recoveries less than the lower QC limit.

The laboratory, Microbac, did not include results for tin.

Due to its elevated concentration in some samples, zinc and beryllium may have been analyzed either by methods SW-6010 or SW-6020 due to matrix interferences. Beryllium was not detected in any of the surface soil samples.

MS/MS duplicates (MSDs) were not reported for antimony, silver, or zinc in the Microbac report. No MS was reported for selenium in this report. QC from an alternate batch of samples was employed.

Various results may display elevated reporting limits due to dilutions resulting from matrix interference or concentrations of analytes exceeding the linear range of the calibration curve. Reporting limits have been adjusted for dilution in the data tables. Many samples were received at temperatures greater than the preservation requirement of 4°C +/- 2°C. Although the metals samples were not flagged due to this observation, the anomaly should be considered should a result very close to a threshold value be encountered. In that case, the data should be used conservatively and an exceedence should be noted.

Pesticides:

LCS recoveries less than the QC limit resulted in UJ flags for aldrin, alpha-BHC, beta-BHC, and heptachlor in a broad portion of soil samples.

Various analytes were flagged as estimated due to the result being reported from beyond the linear range of the calibration curve (flagged q), due to large differences in the results between two columns (flagged q), or due to calibration verification anomalies (flagged c). The following convention was used in flagging data due to calibration anomalies: samples were flagged for calibration anomalies only if neither column displayed acceptable performance; it is assumed that the result was reported from that column unless otherwise noted.

Results for kepone may be biased due to florisil clean-up in samples displaying heavy matrix interference, so these data should be used conservatively.

Many matrix spike recovery failures appear to be due to high levels of analyte in the samples relative to the method specified spike amount. In these cases, and in cases where surrogate recoveries are outside acceptance limits due to dilution, no data qualification was performed. Note that retention time updates were applied in the course of various pesticide analytical sequences. There is no discernable negative impact on the data as a result, based on professional judgement. Also, note that a number of analytes present in the calibration or other QC data are not repored in the EDD. This observation applies to all organic analyses excepting PCBs and PAHs.

PCBs:

Aroclor 1260 was flagged “J+s” in samples 73SB10-00 and 73SB01A-00 due to surrogate recoveries greater than the upper QC limit.

Additional QC anomalies of various kinds were observed in the data reports for PCBs but did not require data validation,in accord with the verification protocols. There are no other comments not previously discussed in the PCB narrative above.

VOCs:

Virtually the entire VOC data set is impacted by failure to meet preservation temperature requirements and/or holding time requirements. In accord with the reviewer’s interpretation of the Region 2 guidelines, those samples adversely affected by temperature have been flagged either Jpl or Ujpl and a negative bias is indicated. Those affected by holding time issues have been flagged either Jh or Ujh and a negative bias is also indicated. Thus, these data should be used with conservatism in comparison to threshold values. **no l or h flags were indicated in the VOC data validation report for the Table 4 samples.

Additional QC anomalies of various kinds were observed in the data reports for VOCs but did not require data validation, in accord with the verification protocols. In the VOC and, to a lesser extent, the SVOC fraction, matrix interferences resulted in internal standard area depression. In general terms, the reported area is only slightly less than the lower control limit. However, in contrast to the above, surrogate recoveries were generally nominal. Thus, it is apparent that the internal standards continued to perform their basic function and, therefore, no data flags were applied on this basis. There are no other comments not previously discussed in the VOCs narrative above.

SVOCs:

1,4-phenylenediamine, 2,4-dinitrophenol, 2-naphthylamine, 4-nitroquinoline-1-oxide, isosafrole, methapyrilene, and diallate were flagged “R” in a broad cross section of the data due to LCS, MSS, or ICV recoveries less than half the lower control limit.

UJ or J flags were applied to 1,4-naphthoquinone, methyl methanesulfonate, aramite, and hexachlorocyclopentadiene in a broad cross section of the data.

Additional QC anomalies of various kinds were observed in the data reports for SVOCs but did not require data qualification, in accord with the verification protocols. 3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for analysis. The sum of any positive detects for either of these compounds is reported as 4-methylphenol. There are no other comments not previously discussed in the SVOC narrative above.

PAHs:

A variety of the PAHs were flagged J due to matrix spike recoveries less than the lower control limit. As the soil matrix spike samples were, in most cases, heavily impacted by both elevated concentrations of target analyte and interferences, it is difficult ot accurately asses the direction of bias.

Additional QC anomalies of various kinds were observed in the data reports for PAHs but did not require data qualification, in accord with the verification protocols. There are no other comments not previously discussed in the narrative above.

Table 5. Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB13-00**	**73SB13A-00**	**73SB14-00**	**73SB15-00**	**73SB16-00**
Sample Date						2-Apr-08	2-Apr-08	3-Apr-08	2-Apr-08	2-Apr-08
Volatile Organic Compounds (µg/Kg)										
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	21 J-p	7 J-p	ND (11) J-p	ND (12) J-p	ND (12) J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	**ND (12) J-p**	**ND (11) J-p**	**ND (11) J-p**	**ND (12) J-p**	**ND (12) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	110 J-p	48 J-p	45 J-p	59 J-p	30 J-p
Allyl chloride	680	3,400	0.21	N/A	N/A	**ND (6) J-p**	**ND (5) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**
Benzene	1,100	5,400	0.21	101	N/A	**3 J-p**	**1 J-p**	**ND (6) J-p**	**2 J-p**	**0.9 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**ND (6) J-p**	**ND 5) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Chloromethane	120,000	500,000	500,000	N/A	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	ND (6) J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**ND (6) J-p**	**ND (5) J-p**	**ND (6) b**	**ND (6) J-p**	**ND (6) J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	2 J-p	ND (5) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)										
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	ND (1.7)	ND (1.8)	ND (1.8)	1.4 J	ND (1.8)
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	ND (1.7)	ND (1.8)	ND (1.8)	1.5 J	ND (1.8)
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	ND (1.7)	0.81 J	ND (1.8)	4.3	1.2 J
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	1.9	3.4	13	61 / 83 J	14
Anthracene	17,000,000	170,000,000	1,200	1,200	N/A	1.7	4.4	7.5	62 / 89 J	12
Benz[a]anthracene	150	2,100	10	1,200	N/A	4.1	**12**	**16 / 37 J**	**130 / 220**	**34 / 47 J**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**6.6**	**16**	**28 / 41 J**	**190 / 250**	**53 / 59 J**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	14 Jm	33 Jm	**51 / 60 Jm**	**230 Jm/ 450**	**110 Jm/ 99 J**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	4.8	9.6	13	81 / 190	41 / 46 J
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	4.8	10	20	200 / 160 J	37 / 41 J
Chrysene	15,000	210,000	1,100	1,200	N/A	6.1	10	24 / 43 J	190 / 310	49 / 59 J
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	1.2 Jm	2.6 Jm	3.9 Jm	**25 Jm/ 47 J**	**11 Jm**
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	4.5 Jm	20 Jm	17 Jm	190 Jm/ 230	39 Jm/ 45 J
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	ND (1.7)	ND (1.8)	0.78 J	5.7	1.1 J
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	4.1	9	12	83 / **160 J**	35 / 38 J
Naphthalene	3,600	18,000	0.47	1,200	N/A	**ND (1.7)**	**ND (1.8)**	**0.83 J**	**2.1**	**ND (1.8)**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	0.78 Jm	6.3 Jm	2.9	46 Jm/ 60 J	9.7 Jm
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	4.3	15	22 / 46 J	160 / 340	34 / 65 J
Semi-Volatile Organics Compounds (µg/Kg)										
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (170)	ND (180)	ND (180)	ND (180)	ND (180)
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	ND (170)	ND (180)	ND (180)	**890**	ND (180)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	1,000	850	**1,900**	**1,600**	**2,800**

Table 5 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB13-00**	**73SB13A-00**	**73SB14-00**	**73SB15-00**	**73SB16-00**
Sample Date						2-Apr-08	2-Apr-08	3-Apr-08	2-Apr-08	2-Apr-08
Pesticides and PCBs (µg/Kg)										
Aroclor 1254	220	740	8.8	N/A	N/A	**12.1 J**	**ND (18)**	**ND (19.1)**	**ND (18)**	**ND (18.1)**
Aroclor 1260	220	740	24	N/A	N/A	ND (18)	ND (18)	ND (19.1)	11.5 J	ND (18.1)
Chlordane	1,600	6,500	13	100	N/A	**ND (18)**	**ND (18)**	**21**	**ND (41)**	**ND (18)**
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	ND (0.88) Jb	ND (0.88) Jb	ND (0.93)	ND (1.8)	ND (0.88) Jb
Dieldrin	30	110	0.17	401	N/A	**ND (1.8)**	**ND (1.8)**	**ND (1.9)**	**ND (3.6)**	**ND (1.8)**
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (3.6)	ND (1.8)
Endosulfan II	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (3.6)	ND (1.8)
Endrin	18,000	180,000	440	401	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (3.6)	ND (1.8)
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (3.6)	ND (1.8)
Gamma BHC	300	1,100	0.53	201	N/A	**ND (0.88)**	**ND (0.88)**	**ND (0.93)**	**0.59 Jq**	**ND (0.88)**
Heptachlor	110	380	1.2	100	N/A	ND (0.88)	ND (0.88)	ND (0.93) Jm	**ND (1.8)**	ND (0.88)
Heptachlor expoxide	53	190	0.15	100	N/A	**ND (0.88)**	**ND (0.88)**	**ND (0.93)**	**ND (1.8)**	**ND (0.88)**
Kepone (chlordecone)	49	170	0.24	100	N/A	**ND (7.4)**	**ND (7.4)**	**2.8 Jq**	**ND (15)**	**ND (7.5)**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (8.8)	ND (8.8)	ND (9.3) Jc	11 Jq	ND (8.8)
p,p'-DDD	2,000	7,200	66	401	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (3.6)	ND (1.8)
p,p'-DDE	1,400	5,100	47	401	N/A	ND (1.8)	0.45 J	0.71J	3.9 Jq	0.61 J
p,p'-DDT	1,700	7,000	67	401	N/A	1.1 J	0.64 J	0.69 Jc	3.6	0.72 J
Metals (mg/Kg)										
Antimony	31	410	0.66	78	3.17	**ND (1.2) J—mb**	Rm	Rm	**ND (1.3) J—mb**	**ND (1.1) J—mb**
Arsenic	0.39	1.6	0.0013	18	2.65	**7.3**	**7.7**	**9**	**11**	**11**
Barium	15,000	190,000	300	330	199	87	75	180	80	69
Cadmium	70	800	1.4	32	1.02	0.17	0.22	0.68	0.92	0.49
Chromium	230	1,400	0.0083	0.4	49.8	**26J+p**	**24 J+p**	**140 J+p**	**29 J+p**	**28 J+p**
Cobalt	23	300	0.49	13	46.2	**38J+p**	**33 J+p**	**42 J+p**	**17 J+p**	**17 J+p**
Copper	3,100	41,000	51	70	168	**190**	**200**	**190**	**250**	**170**
Lead	400	800	14 (MCL based)	120	22	9.2 J+m	8.5 J+m	**46 J+m**	**110 J+m**	**90 J+m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	16	16	17	14	18
Selenium	390	5,100	0.95	1	1.48	**ND (0.99)**	**ND (0.99)**	**ND (1)**	**ND (0.99)**	**ND (1)**
Silver	390	5,100	1.6	560	N/A	0.38	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
Thallium	5.1	66	N/A	1	N/A	0.51	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.4)
Vanadium	390	5,200	180	2	259	**170 J+l**	**160 J+l**	**170 J+l**	**110 J+l**	**100 J+l**
Zinc	23,000	310,000	680	50	115	**72**	**72**	**87**	**180**	**88**
Mercury	5.6	34	0.03	0.1	0.109	**0.153**	**0.092**	**0.368**	**3.62**	**0.539**

Table 5 (contd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB17-00**	**73SB18-00**	**73SB18A-00**	**73SB19-00**	**73SB20-00**
Sample Date						2-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Volatile Organic Compounds (µg/Kg)										
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	ND (12) J-p	ND (11) J-p	ND (12) J-p	ND (10) J-p	ND (12) J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	**ND (12) J-p**	**ND (11) J-p**	**ND (12) J-p**	ND (10) J-p	**ND (12) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	67 J-p	24 J-p	26 J-p	75 J-p	19 J-p
Allyl chloride	680	3,400	0.21	N/A	N/A	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (5) J-p**	**ND (6) J-p**
Benzene	1,100	5,400	0.21	101	N/A	**2 J-p**	**1 J-p**	**1 J-p**	**ND (5) J-p**	**1 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**	**4 J-p**	**ND (6) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	4 J-p	ND (6) J-p	ND (6) J-p	ND (5) J-p	ND (6) J-p
Chloromethane	120,000	500,000	500,000	N/A	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (5) J-p	ND (6) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (5) J-p	ND (6) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (5) J-p**	**ND (6) J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (5) J-p	ND (6) J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)										
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	ND (1.7)	11	1.1 J	ND (1.8)	6.5
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	ND (1.7)	19	1.2 J	ND (1.8)	10 / 86 J
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	ND (1.7)	1.5 J	1.8 J	ND (1.8)	ND (1.8)
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	1.6 J	110 / 160 J	130 / 180 J	8.2	13
Anthracene	17,000,000	170,000,000	1,200	1,200	N/A	1.1 J	100 / 130 J	120 / 160 J	7.8	11
Benz[a]anthracene	150	2,100	10	1,200	N/A	2.8	**330 / 600**	**440 / 590**	**17**	**22**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**4.1**	**400 / 600**	**510 / 610**	**28**	**36**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	7.3 Jm	**750/ 930 Jm**	**960/1,000 Jm**	**64 Jm/ 46 J**	**79 Jm**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	2.8	210 / 370	230 / 400	15	20
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	3.8	**400 / 370**	**500 / 370**	22	29
Chrysene	15,000	210,000	1,100	1,200	N/A	3.7	490 / 800	650 / 810	27 Jm	37 Jm
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	0.78 Jm	**73 / 99 J**	**73 / 110 J**	4.2	5.5
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	2.5 Jm	180 / 270	210/ 240	24 Jm	28 Jm
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	ND (1.7)	4.6	6.3	ND (1.8)	0.77 J
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	2.6	**200 / 330**	**230 / 370**	16	20
Naphthalene	3,600	18,000	0.47	1,200	N/A	**ND (1.7)**	**73**	**2.8**	**ND (1.8)**	**42 / 320**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	ND (1.7)	13 / 54 J	11	4.4 Jm	5.4 Jm
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	2.9 Jm	170 / 480	220 / 440	20 Jm	25 Jm
Semi-Volatile Organics Compounds (µg/Kg)										
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (170)	ND (190)	ND (190)	ND (180)	140J
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	ND (170)	130 J	ND (190)	ND (180)	ND (180)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	**1,900**	**1,900**	**2,800**	**2,900**	**2,400**

Table 5 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB17-00**	**73SB18-00**	**73SB18A-00**	**73SB19-00**	**73SB20-00**
Sample Date						2-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Pesticides and PCBs (µg/Kg)										
Aroclor 1254	220	740	8.8	N/A	N/A	**ND (17.9)**	**ND (19.5)**	**ND (20.4)**	**ND (18.8)**	**ND (18.1)**
Aroclor 1260	220	740	24	N/A	N/A	ND (17.9)	10.1 J	12.7 J+	ND (18.8)	ND (18.1)
Chlordane	1,600	6,500	13	100	N/A	**ND (18)**	**100 Js**	**93 J+s**	**ND (19)**	12 J
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	ND (0.87) Jb	ND (0.95)	ND (0.99)	ND (0.92) Jb	ND (0.88) Jb
Dieldrin	30	110	0.17	401	N/A	**ND (1.8)**	**ND (2)**	**ND (2)**	**ND (1.9)**	**ND (1.8)**
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (2)	ND (2.0)	0.51 Jq	ND (1.8)
Endosulfan II	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (2)	ND (2)	ND (1.9)	ND (1.8)
Endrin	18,000	180,000	440	401	N/A	ND (1.8)	ND (2)	ND (2)	ND (1.9)	ND (1.8)
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (1.8)	1.6 Js	1.2 J+s	ND (1.9)	ND (1.8)
Gamma BHC	300	1,100	0.53	201	N/A	**ND (0.87)**	**ND (0.95)**	**ND (0.99)**	**ND (0.92)**	**ND (0.88)**
Heptachlor	110	380	1.2	100	N/A	ND (0.87)	0.28 Jsm	0.23 J+sm	ND (0.92)	ND (0.88)
Heptachlor expoxide	53	190	0.15	100	N/A	**ND (0.87)**	**ND (0.95)**	**1.3 J+s**	**ND (0.92)**	**ND (0.88)**
Kepone (chlordecone)	49	170	0.24	100	N/A	**ND (7.4)**	**17 Jsq**	**14 J+sq**	**ND (7.7)**	**ND (7.4)**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (8.7)	ND (9.5)Jc	ND (9.9) J+c	3.2 J	ND (8.8)
p,p'-DDD	2,000	7,200	66	401	N/A	ND (1.8)	ND (2)	ND (2)	ND (1.9)	ND (1.8)
p,p'-DDE	1,400	5,100	47	401	N/A	ND (1.8)	6.6 Js	6.3 J+s	ND (1.9)	0.49 Jq
p,p'-DDT	1,700	7,000	67	401	N/A	ND (1.8)	6.4 Js	6 J+sc	0.98 Jq	1 J
Metals (mg/Kg)										
Antimony	31	410	0.66	78	3.17	Rm	**ND (1.6) J—mb**	**ND (2.7) J—mb**	**ND (1.4) J—mb**	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**9**	**11**	**11**	**6.6**	**10**
Barium	15,000	190,000	300	330	199	82	62	60	91	70
Cadmium	70	800	1.4	32	1.02	0.19	**1.1**	0.78	0.17	0.36
Chromium	230	1,400	0.0083	0.4	49.8	**30 J+p**	**110 J+p**	**110 J+p**	**170 J+p**	**22 J+p**
Cobalt	23	300	0.49	13	46.2	**27 J+p**	**15 J+p**	**15 J+p**	**25J+p**	**20 J+p**
Copper	3,100	41,000	51	70	168	**130**	**140**	**130**	**110**	**250**
Lead	400	800	14 (MCL based)	120	22	11 J+m	**170 J+m**	**370 J+m**	12 J+m	**20 J+m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	16	14	14	18	15
Selenium	390	5,100	0.95	1	1.48	**ND (0.99)**	**ND (0.98)**	**ND (0.98)**	**ND (0.99)**	**ND (0.98)**
Silver	390	5,100	1.6	560	N/A	ND (0.2)	ND (0.64) b	ND (0.2)	ND (0.2)	ND (0.2)
Thallium	5.1	66	N/A	1	N/A	ND (0.4)	ND (0.39)	ND (0.39)	ND (0.4)	ND (0.39)
Vanadium	390	5,200	180	2	259	**150 J+l**	**97 J+l**	**100 J+l**	**150 J+l**	**140 J+l**
Zinc	23,000	310,000	680	50	115	**72**	**140**	**120**	**85**	**80**
Mercury	5.6	34	0.03	0.1	0.109	**0.14**	**1.65**	**1.41**	**0.215**	**2.69**

Table 5 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB21-00**	**73SB22-00**	**73SB23-00**	**73SB24-00**
Sample Date						3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Volatile Organic Compounds (µg/Kg)									
2-Butanone {MEK}	28,000,000	200,000,000	1,500	N/A	N/A	ND (13) J-p	ND (12) J-p	12 J-p	ND (12) J-p
2-Hexanone	210,000	1,400,000	11	N/A	N/A	**ND (13) J-p**	**ND (12) J-p**	**ND (11) J-p**	**ND (12) J-p**
Acetone	61,000,000	630,000,000	4,500	N/A	N/A	41 J-p	44 J-p	140 J-p	67 J-p
Allyl Chloride	680	3,400	0.21	N/A	N/A	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**
Benzene	1,100	5,400	0.21	101	N/A	**1 J-p**	**0.9 J-p**	**ND (6) J-p**	**2 J-p**
Bromomethane	7,300	32,000	2.2	N/A	N/A	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**	**ND (6) J-p**
Carbon disulfide	820,000	3,700,000	310	N/A	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Chloromethane	120,000	500,000	500,000	N/A	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Methyl iodide	N/A	N/A	N/A	N/A	N/A	ND (6) J-p	ND (6) J-p	11 J-p	ND (6) J-p
Methylene chloride	11,000	53,000	1.2	1,004	N/A	**3 J-p**	**ND (6) J-p**	**4 J-p**	**ND (6) J-p**
Toluene	5,000,000	45,000,000	1,600	13,001	N/A	ND (6) J-p	ND (6) J-p	ND (6) J-p	ND (6) J-p
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)									
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	ND (1.8)	ND (1.7)	ND (1.9)	7.9 J
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	0.78 J	ND (1.7)	ND (1.9)	7.6 J
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	0.99 J	ND (1.7)	1.6 J	63
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	29	0.97 J	12	320 / 720
Anthracene	17,000,000	170,000,000	1,200	1,200	N/A	21	0.46 J	15	320 / 820
Benz[a]anthracene	150	2,100	10	1,200	N/A	**48**	0.81 J	**30 / 65 J**	**1,800 / 4,000**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**74**	1.2 J	**48 / 60 J**	**1,800 / 3,400**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	**130 Jm/ 45 J**	2.2 Jm	**97 Jm/ 93 J**	**3,100 Jm/ 4,800**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	40	0.84 J	46 / 52 J	1,000 / **1,800**
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	51	0.77 J	40	**1,200 / 1,900**
Chrysene	15,000	210,000	1,100	1,200	N/A	66 Jm	1.1 Jm	43 Jm / 71 J	**1,800 Jm/ 4,200**
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	**12**	ND (1.7)	9.6	**350 / 560**
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	49 Jm	0.94 Jm	48 J m/ 98 J	**1,500 Jm/ 1,900**
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	2	ND (1.7)	1.2 J	41 / 37 J
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	38	0.73 J	27 / 41 J	**950 / 1,700**
Naphthalene	3,600	18,000	0.47	1,200	N/A	**1.2 J**	**ND (1.7)**	**ND (1.9)**	**14 J**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	12 Jm	ND (1.7) Jm	13 Jm/ 44 J	450 Jm / 85 J
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	44 Jm	0.91 Jm	38 Jm/ 120 J	**1,400 Jm/ 3,100**
SemiVolatile Organic Compounds (µg/Kg)									
Acetophenone	7,800,000	100,000,000	1,100	N/A	N/A	ND (180)	ND (170)	ND (190)	ND (180)
Butylbenzylphthalate	260,000	910,000	510	6,010	N/A	ND (180)	ND (170)	ND (190)	ND (180)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	N/A	720	**1,200**	**2,900**	**2,800**

Table 5 (cont'd). Chemical Results of Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (March-April 2008).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB21-00**	**73SB22-00**	**73SB23-00**	**73SB24-00**
Sample Date						3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Pesticides and PCBs (µg/Kg)									
Aroclor 1254	220	740	8.8	N/A	N/A	**ND (18)**	**ND (17.9)**	**ND (18.9)**	**ND (18)**
Aroclor 1260	220	740	24	N/A	N/A	ND (18)	ND (17.9)	16 J	13.2 J+s
Chlordane	1,600	6,500	13	100	N/A	**18 J**	**ND (18)**	**ND (19)**	**130**
Delta BHC (cyclohexane)	7,000,000	29,000,000	13,000	201	N/A	ND (0.88) Jb	ND (0.87) Jb	ND (0.92) Jb	ND (4.4) Jb
Dieldrin	30	110	0.17	401	N/A	**ND (1.8)**	**ND (1.8)**	**ND (1.9)**	**ND (9)**
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (9.0)
Endosulfan II	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (9)
Endrin	18,000	180,000	440	401	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (9)
Endrin aldehyde	N/A	N/A	N/A	100	N/A	ND (1.8)	ND (1.8)	ND (1.9)	3.3 Jq
Gamma BHC	300	1,100	0.53	201	N/A	**ND (0.88)**	**ND (0.87)**	**ND (0.92)**	**ND (4.4)**
Heptachlor	110	380	1.2	100	N/A	ND (0.88)	ND (0.87)	ND (0.92)	ND (4.4)
Heptachlor epoxide	53	190	0.15	100	N/A	**ND (0.88)**	**ND (0.87)**	**ND (0.92)**	**ND (4.4)**
Kepone (chlordecone)	49	170	0.24	100	N/A	**ND (7.4)**	**ND (7.4)**	**ND (7.8)**	**ND (37)**
Methoxychlor	310,000	3,100,000	9,900	100	N/A	ND (8.8)	ND (8.7)	ND (9.2)	ND (44)
p,p'-DDD	2,000	7,200	66	401	N/A	ND (1.8)	ND (1.8)	ND (1.9)	ND (9)
p,p'-DDE	1,400	5,100	47	401	N/A	0.47 J	ND (1.8)	1.4 J	6.7 J
p,p'-DDT	1,700	7,000	67	401	N/A	0.92 J	0.61J	1.4 J	6.6 J
Metals (mg/Kg)									
Antimony	31	410	0.66	78	3.17	Rm	Rm	**ND (2) J—mb**	**ND (1.5) J—mb**
Arsenic	0.39	1.6	0.0013	18	2.65	**11**	**12**	**8.4**	**10**
Barium	15,000	190,000	300	330	199	66	23	120	73
Cadmium	70	800	1.4	32	1.02	0.47	0.3	0.8	0.96
Chromium	230	1,400	0.0083	0.4	49.8	**21 J+p**	**0.8J+p2**	**170 J+p**	**27 J+p**
Cobalt	23	300	0.49	13	46.2	**20 J+p**	**4.9J+p2**	**93 J+p**	**18 J+p**
Copper	3,100	41,000	51	70	168	**110**	31	**200**	**240**
Lead	400	800	14 (MCL based)	120	22	**23J+m**	1.5 J+m	**88 J+m**	**110 J+m**
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	14	7.9	17	15
Selenium	390	5,100	0.95	1	1.48	**ND (1)**	**ND (1)**	**ND (0.99)**	**ND (0.98)**
Silver	390	5,100	1.6	560	N/A	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
Thallium	5.1	66	N/A	1	N/A	ND (0.4)	ND (0.4)	ND (0.4)	ND (0.39)
Vanadium	390	5,200	180	2	259	**110J+l**	**34 J+l**	**170 J+l**	**110 J+l**
Zinc	23,000	310,000	680	50	115	**86**	25	**220**	**180**
Mercury	5.6	34	0.03	0.1	0.109	**0.899**	0.021	**2.45**	**4.31**

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.

[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).

N/A Not Applicable.

J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.

p Result is flagged due to preservation or handling problems (organic analysis), or result is flagged due to post-digestion spike failure (inorganic analysis).

Bold text indicates that constituent detection or detection limit exceeds one or more screening levels.

ND Constituent not detected. Number in parentheses is the analytical method detection limit.

m Result is flagged due to matrix spike recoveries outside of the specified window.

b Result is flagged due to method blank contamination; reported value is raised to the reporting limit for values between MDL and RL: and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
NAn Sample not analyzed for this parameter.
Multi-value blocks represent detections of the low level PAH result followed by the SVOC result for constituents where the analytes are evaluated by both analyses.
R Result is rejected or unuseable either quantitatively or qualitatively; a data gap is indicated.
l Result is flagged due to LCS anomalies.
q Result is flagged due to a quantitation anomaly.
c Result is flagged due to continuing calibration anomalies related to drift or response.
s Result is flagged due to surrogate recovery (organic) or serial dilution (inorganic) failures.

Data Validation for Table 5:

Metals:

Antimony data are flagged either UJ--, mb, or Rm. The data flagged UJ—are samples that originally displayed a positive result but which the validator modified to non-detects based on method blank contamination. All of the antimony data are also impacted by MS recoveries less than 30% resulting in R qualifiers for the samples that originally displayed a non-detect result. Based on professional judgement, the reviewer suggests that all antimony data be treated as though R flagged and not used.

Beryllium results were qualified Rm due to poor MS recoveries. Chromium and cobalt results were qualified J+p due to PDS recovery greater than the upper QC limit. Lead data were broadly impacted by MS recoveries outside QC criteria and were flagged J+m. Vanadium samples were flagged J+l.

Samples analyzed by the contract laboratory, Microbac, did not include results for tin.

Due to elevated concentration in some samples and/or matrix interferences, zinc and beryllium may have been analyzed either by methods SW-6010 or SW-6020.

Various results may display elevated reporting limits due to dilutions resulting from matrix interference or concentrations of analyte exceeding thel linear range of the calibration curve. Reporting limits have been adjusted for dilution in the data tables.

Many samples were received at temperatures greater than the preservation requirement of 4°C +/- 2°C. The data user is advised to consider this anomaly should a result very close to a threshold value be encountered. In that case the data should be used conservatively and an exceedence should be noted.

Pesticides:

LCS recoveries less than the QC limit resulted in UJ flags for aldrin, beta-BHC, and some alpha-BHC and heptachlor results. Likewise, in a portion of the data various analytes were flagged as estimates due to the result being reported from beyond the linear range of the calibration curve or due to large differences (>40%) in the results between two columns (flagged q), or due to calibration verification anomalies (flagged c). Please note the following convention used in flagging data due to calibration anomalies: samples were flagged for calibration anomalies only if neither column displayed acceptable calibration results. As long as at least one column displayed acceptable performance, it is assumed that the result was reported from the column unless otherwise noted.

Positive results for sample 73SB18A-00 were flagged J+ due to surrogate recoveries greater than the upper QC limit.

Some delta-BHC results were qualified b for method blank contamination.

Sample 73SB18-00 does not appear to be present in the EDD as an original sample, although it does appear as an MS/MSD pair.

Results for kepone may be biased due to florisil clean-up in samples displaying heavy matrix interference. These data should be used conservatively.

Many matrix spike recovery failures appear to be due to high levels of analyte in the samples relative to the method specified spike amount. In these cases, and in cases where surrogate recoveries are outside acceptance limits due to dilution, no data qualification was performed.

Retention time updates were applied in the course of various pesticide sequences. There is no discernable negative impact on the data as a result, based on professional judgement.

A number of analytes are present in the calibration or other QC data that are not reported in the EDD.

PCBs:

For sample 73SB24-00, a J+s flag was applied to Arochlor 1260 due to surrogate recoveries greater than the upper QC limit.

Additional QC anomalies of various kinds were observed in the data reports for PCBs that did not require data validation in accord with the verification protocols. There are no other comments not previously discussed in the PCB narrative above.

VOCs:

Virtually the entire VOC data set is impacted by failure to meet preservation temperature requirements and/or holding time requirements. In accord with the reviewer's interpretation of the Region 2 guidelines, those samples adversely affected by temperature have been flagged either Jp or UJp and a negative bias is indicated. Those affected by holding time issues have been flagged either Jh or UJh and a negative bias is also indicated. Thus these data should be used with conservatism in comparison to threshold values.

In the VOC fraction, matrix interferences resulted in internal standard are depression. In general terms, the reported area is only slightly less than the lower control limit. However, in contrast to the above, surrogate recoveries were generally nominal. Thus, it is apparent that the internal standards continued to perform their basic function and therefore no data flags were applied on this basis.

SVOCs:

The compounds 1,4-phenylenediamine, 2,4-dinitrophenol, 2-naphthylamine, 4-nitroquinone-1-oxide, isosafrole, hexachlorocyclopentadiene, and methapyrilene, were flagged R in a broad cross section of the data due to either LCS, MS, or ICV recoveries less than half the lower control limit.

UJ or J flags were applied to diallate, 1,4-naphthoquinone, methyl methanesulfonate, and aramite in a broad cross section of the data.

3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for the analysis. The sum of any positive detects for either of these compounds is reported as 4-methylphenol.

PAHs:

A variety of the PAHs were flagged J due to matrix spike recoveries less than the lower control limit. As the soil matrix spike samples were, in most cases, heavily impacted by both elevated concentrations of the target analyte and interferences, it is difficult to accurately assess the direction of the bias.

Table 6. Metals Results for Surface Soil Samples from 0-1' Depth at the 19E-SS07 Location (March-April 2008) (in mg/Kg).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB25-00**	**73SB26-00**	**73SB27-00**	**73SB27A-00**	**73SB28-00**
Sample Date						3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**5.7**	**5.9**	**6.3**	**6.1**	**7.3**
Barium	15,000	190,000	300	330	199	67	**230**	72	78	**350**
Cadmium	70	800	1.4	32	1.02	ND (0.1)	ND (0.098)	ND (0.099)	ND (0.097)	0.2
Chromium	230	1,400	0.0083	0.4	49.8	**41J+p**	**33J+p**	**35J+p**	**37J+p**	**26J+p**
Cobalt	23	300	0.49	13	46.2	**8.3J+p**	**15J+p**	**15J+p**	**13J+p**	**69J+p**
Copper	3,100	41,000	51	70	168	**250**	**240**	**200**	**210**	**270**
Lead	400	800	14 (MCL based)	120	22	3.5J+m	2.8J+m	6.9J+m	7.6J+m	7.6J+m
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	7.9	18	10	12	18
Selenium	390	5,100	0.95	1	1.48	**ND (1)**	**ND (0.98)**	**1.8**	**1.6**	**1.2**
Silver	390	5,100	1.6	560	N/A	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.19)	ND (0.25) b
Thallium	5.1	66	N/A	1	N/A	ND (0.4)	ND (0.39)	ND (0.4)	ND (0.39)	0.48
Vanadium	390	5,200	180	2	259	**280J+l**	**220J+l**	**300J+l**	**300J+l**	**240J+l**
Zinc	23,000	310,000	680	50	115	**65**	**130**	**65**	**71b**	**160**
Mercury	5.6	34	0.03	0.1	0.109	0.02	0.018	**0.062**	**0.035**	**0.042**

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB29-00**	**73SB30-00**	**73SB31-00**	**73SB32-00**
Sample Date						3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**6.5**	**6**	**7**	**6.2**
Barium	15,000	190,000	300	330	199	87	**430**	56	**410**
Cadmium	70	800	1.4	32	1.02	ND (0.097)	ND (0.098)	0.29	0.12
Chromium	230	1,400	0.0083	0.4	49.8	**29J+p**	**23J+p**	**44J+p**	**30J+p**
Cobalt	23	300	0.49	13	46.2	**18J+p**	**9.4J+p**	**18J+p**	**63J+p**
Copper	3,100	41,000	51	70	168	**200**	**200**	**170**	**210**
Lead	400	800	14 (MCL based)	120	22	7.3J+m	3.5J+m	**15J+m**	5.6J+m
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	11	7.3	13	16
Selenium	390	5,100	0.95	1	1.48	**1.2**	**1.4**	**ND (1)**	**ND (0.99)**
Silver	390	5,100	1.6	560	N/A	ND (0.19)	ND (0.2)	ND (0.2)	ND (0.2)
Thallium	5.1	66	N/A	1	N/A	ND (0.39)	ND (0.39)	ND (0.4)	ND (0.4)
Vanadium	390	5,200	180	2	259	**230J+l**	**220J+l**	**220J+l**	**250J+l**
Zinc	23,000	310,000	680	50	115	**75**	**63**	**110**	**140**
Mercury	5.6	34	0.03	0.1	0.109	**0.040**	0.018	**0.044**	0.029

Table 6 (contd). Metals Results for Surface Soil Samples from 0-1' Depth at the 19E-SS07 Location (March-April 2008) (in mg/Kg).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB33-00**	**73SB34-00**	**73SB35-00**	**73SB36-00**
Sample Date						3-Apr-08	3-Apr-08	3-Apr-08	3-Apr-08
Antimony	31	410	0.66	78	3.17	Rm	Rm	Rm	Rm
Arsenic	0.39	1.6	0.0013	18	2.65	**6.8**	**5.9**	**8**	**5.6**
Barium	15,000	190,000	300	330	199	130	**250**	170	140
Cadmium	70	800	1.4	32	1.02	ND (0.099)	ND (0.096)	0.37	ND (0.099)
Chromium	230	1,400	0.0083	0.4	49.8	**34J+p**	**40J+p**	**180J+p**	**24J+p**
Cobalt	23	300	0.49	13	46.2	**17J+p**	**8.6J+p**	**65J+p**	**290J+p**
Copper	3,100	41,000	51	70	168	**230**	**240**	**160**	**200**
Lead	400	800	14 (MCL based)	120	22	4.2J+m	5.4J+m	**23J+m**	1.5J+m
Molybdenum	390	5,100	3.7	N/A	N/A	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	9.1	14	20	**25**
Selenium	390	5,100	0.95	1	1.48	**1.1**	**1**	**ND (0.98)**	**ND (0.99)**
Silver	390	5,100	1.6	560	N/A	ND (0.2)	ND (0.19)	ND (0.2)	ND (0.2)
Thallium	5.1	66	N/A	1	N/A	ND (0.4)	ND (0.39)	ND (0.39)	ND (0.4)
Vanadium	390	5,200	180	2	259	**300J+l**	**330J+l**	**270J+l**	**130J+l**
Zinc	23,000	310,000	680	50	115	**75**	**70**	**130**	**310**
Mercury	5.6	34	0.03	0.1	0.109	0.020	**0.038**	**0.084**	ND (0.015)

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).
N/A Not Applicable.
R Result is rejected or unuseable either quantitatively or qualitatively; a data gap is indicated.
m Result is flagged due to matrix spike recoveries outside of the specified window.
ND Constituent not detected. Number in parentheses is the analytical method detection limit.
NAn Sample not analyzed for this parameter.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.
p Result is flagged due to preservation or handling problems (organic analysis), or result is flagged due to post-digestion spike failure (inorganic analysis).
Bold text indicate that constituent detection or detection limit exceeds one or more screening levels.
l Result is flagged due to LCS anomalies.
b Result is flagged due to field, ambient, or trip blank contamination; reported value is raised to the reporting limit for values between MDL and RL: and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.

Data Validation for Table 6:

Metals:

All of the antimony and beryllium data were flagged Rm and were not useable due to matrix spike recoveries less than 30%.

All of the chromium and cobalt results were flagged J+p due to PDS recovery greater than the upper QC limit.

Lead results were flagged "J+m" due to matrix spike recoveries outside of QC criteria.

The laboratory, Microbac, did not include results for tin.

The vanadium results were flagged J+l due to LCS anomalies.

Due to its elevated concentration in some samples, zinc and beryllium may have been analyzed either by methods SW-6010 or SW-6020 due to matrix interferences.

Various results may display elevated reporting limits due to dilutions resulting from matrix interference or concentrations of analytes exceeding the linear range of the calibration curve. Reporting limits have been adjusted for dilution in the data tables. Many samples were received at temperatures greater than the preservation requirement of 4°C +/- 2°C. Although the metals samples were not flagged due to this observation, the anomaly should be considered should a result very close to a threshold value be encountered. In that case, the data should be used conservatively and an exceedence should be noted.

Table 7. Metals Results for Follow-Up Surface Soil Samples from 0-1' Depth at the 19E-03 Location (January 2009) (in mg/Kg).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB091-00**	**73SB092-00**	**73SB101-00**	**73SB102-00**	**73SB121-00**	**73SB122-00**
Sample Date						14 Jan 09	14 Jan 09	14 Jan 09	14 Jan 09	14 Jan 09	14 Jan 09
Chromium	230	1400	0.0083	0.4	49.8	NAn	NAn	NAn	NAn	NAn	NAn
Cobalt	23	300	0.49	13	46.2	NAn	NAn	NAn	NAn	NAn	NAn
Copper	3,100	41,000	51	70	168	NAn	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	**39J+mD**	**40J+mD**	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	NAn	NAn	NAn	NAn	NAn	NAn
Zinc	23,000	310,000	680	50	115	NAn	NAn	**230D**	**120D**	47D	37D
Mercury	5.6	34	0.03	0.1	0.109	NAn	NAn	NAn	NAn	ND (0.026)D	ND (0.027)D

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).
Nan Sample not analyzed for this parameter.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.
m Result is flagged due to matrix spike recoveries outside of the specified window.
D Sample was diluted during analysis, elevating reporting limit.
Bold text indicate that constituent detection or detection limit exceeds one or more screening levels.
ND Constituent not detected. Number in parentheses is the analytical method detection limit.

Data Validation for Table 7:

Metals:

The initial calibration verification was biased high for multiple analytes. However, the initial calibration verification was reanalyzed with acceptable results. No flags were applied, based on professional judgement.

Extensive dilution was performed on all metals samples, elevating reporting limits.

Matrix spike results were greater than the upper control limits for nickel. Associated results were flagged J+m.

One of the replicates for mercury failed to inject properly. The laboratory reported the result from the other two replicates. This is not an accepted practice; however, as it is difficult to predict the bias associated with this approach no data flags were applied. In addition, multiple mercury CCVs are identified in the raw data to be out of control; however, this appears to result from incorrectly programming the control limits in the method file. No flags were applied.

Table 8. Chemical Results of Follow-Up Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (January 2009).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB211-00**	**73SB212-00**	**73SB231-00**	**73SB232-00**
Sample Date						15 Jan 09	15 Jan 09	15 Jan 09	15 Jan 09
Metals (µg/Kg)									
Chromium	230	1,400	0.0083	0.4	49.8	NAn	NAn	**28D**	**23D**
Cobalt	23	300	0.49	13	46.2	NAn	NAn	**19J+mD**	**22J+mD**
Copper	3,100	41,000	51	70	168	NAn	NAn	NAn	NAn
Nickel	1.500	20,000	48	30	20.7	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	NAn	NAn	NAn	NAn
Zinc	23,000	310,000	680	50	115	NAn	NAn	**72D**	**96D**
Mercury	5.6	34	0.03	0.1	0.109	**0.20D**	**0.21D**	**0.16D**	**0.15D**

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB232A-00**	**73SB241-00**	**73SB242-00**	**73SB243-00**
Sample Date						15 Jan 09	15 Jan 09	15 Jan 09	15 Jan 09
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)									
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	NAn	ND (1.8)	1.5J	3.7
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	NAn	ND (1.8)	2.4	4.9
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	NAn	ND (1.8)	1.6J	18
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	NAn	14	140	47
Anthracene	17,000,000	170,000,000	1,200	1,200	N/A	NAn	10	77	66
Benz[a]anthracene	150	2,100	10	1,200	N/A	NAn	**37**	**140**	**270**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	NAn	**50**	**220**	**190**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	NAn	**100**	**320**	**340**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	NAn	25	150	78
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	NAn	35	160	240
Chrysene	15,000	210,000	1,100	1,200	N/A	NAn	50	180	380
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	NAn	8.8	**45**	**29**
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	NAn	47Jd	65Jd	780Jd
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	NAn	0.89J	8.8	10
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	NAn	25	**120**	83
Naphthalene	3,600	18,000	0.47	1,200	N/A	NAn	**0.93J**	**3.6**	**6.2**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	NAn	5.8	7.6	210
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	NAn	51J+m	110J+m	630J+m
Metals (µg/kg)									
Chromium	230	1,400	0.0083	0.4	49.8	**22D**	NAn	NAn	NAn
Cobalt	23	300	0.49	13	46.2	**23J+mD**	NAn	NAn	NAn
Copper	3,100	41,000	51	70	168	NAn	16J+mBD	32J+mBD	34J+mBD
Nickel	1,500	20,000	48	30	20.7	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	NAn	NAn	NAn	NAn
Zinc	23,000	310,000	680	50	115	**100D**	14D	21D	43D
Mercury	5.6	34	0.003	0.1	0.109	**0.16D**	**0.36D**	**0.29D**	**1.9D**

Table 8 (contd). Chemical Results of Follow-Up Surface Soil Samples from 0-1' Depth at the 19E-SS06 Location (January 2009).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB244-00**	**73SB245-00**	**73SB246-00**	**73SB246A-00**
Sample Date						15 Jan 09	15 Jan 09	15 Jan 09	15 Jan 09
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)									
1-Methylnaphthalene	22,000	99,000	12	1,200	N/A	1.4J	4.2	3.7	6.6
2-Methylnaphthalene	310,000	4,100,000	750	1,200	N/A	1.8J	5.3	4.2	8.4
Acenaphthene	3,400,000	33,000,000	22,000	20,000	N/A	7.8	27	20	16
Acenaphthylene	N/A	N/A	N/A	1,200	N/A	95	190	150	110
Anthracene	17,000,000	170,000,000	1,200	1,200	N/A	110	210	160	99
Benz[a]anthracene	150	2,100	10	1,200	N/A	**280**	**910**	**350**	**340**
Benzo[a]pyrene	15	210	3.5	1,200	N/A	**340**	**930**	**380**	**370**
Benzo[b]fluoranthene	150	2,100	35	1,200	N/A	**600**	**1,900**	**660**	**440**
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	N/A	190	650	190	210
Benzo[k]fluoranthene	1,500	21,000	350	1,200	N/A	310	**950**	290	**370**
Chrysene	15,000	210,000	1,100	1,200	N/A	340	**1,300**	400	400
Dibenz[a,h]anthracene	15	210	11	1,200	N/A	**59**	**170**	**61**	**73**
Fluoranthene	2,300,000	22,000,000	160,000	1,200	N/A	340Jd	**1,300Jd**	450Jd	360Jd
Fluorene	2,300,000	22,000,000	27,000	30,000	N/A	6	26	15	12
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	N/A	**180**	**570**	**180**	**210**
Naphthalene	3,600	18,000	0.47	1,200	N/A	**3.3**	**8.7**	**4.6**	**5.4**
Phenanthrene	N/A	N/A	N/A	1,200	N/A	67	190	160	130
Pyrene	1,700,000	17,000,000	120,000	1,200	N/A	320J+m	**1,300J+m**	460J+m	470J+m
Metals (µg/kg)									
Chromium	230	1,400	0.0083	0.4	49.8	NAn	NAn	NAn	NAn
Cobalt	23	300	0.49	13	46.2	NAn	NAn	NAn	NAn
Copper	3,100	41,000	51	70	168	31J+mBD	**220J+mBD**	**160J+mBD**	**150J+mBD**
Nickel	1,500	20,000	48	30	20.7	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	NAn	NAn	NAn	NAn
Zinc	23,000	310,000	680	50	115	39D	**360D**	**170D**	**150D**
Mercury	5.6	34	0.03	0.1	0.109	**3.1D**	**4.4D**	**1.2D**	**1.1D**

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).

N/A Not Applicable.
NAn Sample not analyzed for this parameter.
D Sample was diluted during analysis, elevating reporting limit.
Bold text indicates that constituent detection or detection limit exceeds one or more screening levels.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.
m Result is flagged due to matrix spike recoveries outside of the specified window.
ND Constituent not detected. Number in parentheses is the analytical method detection limit.
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified.
b Result is flagged due to method blank contamination; reported value is raised to the reporting limit for values between MDL and RL: and a positive bias is indicated.

Data Verification for Table 8:

Metals:

The initial calibration verification was biased high for multiple analytes. However, the initial calibration verification was reanalyzed with acceptable results. No flags were applied, based on professional judgement.

Extensive dilution was performed on all metals samples, elevating reporting limits.

Copper results are flagged J+m due to matrix spike results greater than the upper control limit. The method blank for copper displayed a positive result at 0.106 mg/Kg. All sample results were much greater than 5x the amount in the blank.

One of the replicates for mercury failed to inject properly. The laboratory reported the result from the other two replicates. This is not an accepted practice; however, as it is difficult to predict the bias associated with this approach no data flags were applied. In addition, multiple mercury CCVs are identified in the raw data to be out of control; however, this appears to result from incorrectly programming the control limits in the method file. No flags were applied.

LLPAHs:

The recovery of pyrene was greater than the upper control limit in the matrix spike. The duplicate relative percent differences for pyrene and fluoranthene were greater than the control lmit. Pyrene was flagged J+m and fluoranthene was flagged Jd in the associated samples.

Matrix QC should not be applied to field QC samples and the abnormally severe indication of matrix effect in these spikes is difficult to understand. Preservation temperatures were slightly lower than the specification; however, based on professional judgement no flags were applied.

Table 9. Metals Results for Follow-Up Surface Soil Samples from 0-1' Depth at the 19E-SS07 Location (January 2009) (in ug/Kg).

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB 331-00**	**73SB 332-00**	**73SB 341-00**	**73SB 342-00**	**73SB 351-00**
Sample Date						14 Jan 09	14 Jan 09	14 Jan 09	14 Jan 09	15 Jan 09
Chromium	230	1,400	0.0083	0.4	49.8	NAn	NAn	NAn	NAn	**28D**
Cobalt	23	300	0.49	13	46.2	NAn	NAn	NAn	NAn	**24J+mD**
Copper	3,100	41,000	51	70	168	**250J+mbD**	**160J+mbD**	**200J+mbD**	**210J+mbD**	NAn
Nickel	1,500	20,000	48	30	20.7	NAn	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	**240JlmD**	**300JlmD**	**240JlmD**	**230JlmD**	NAn
Zinc	23,000	310,000	680	50	115	NAn	NAn	NAn	NAn	**200D**
Mercury	5.6	34	0.03	0.1	0.109	NAn	NAn	NAn	NAn	NAn

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Table 5-1 Screen[1] Soil	Up Limit of Means[2] (x+2s) NAPR	**73SB 352-00**	**73SB 361-00**	**73SB 362-00**	**73SB 362A-00**
Sample Date						15 Jan 09	15 Jan 09	15 Jan 09	15 Jan 09
Chromium	230	1,400	0.0083	0.4	49.8	**27D**	**25D**	**12D**	**12D**
Cobalt	23	300	0.49	13	46.2	**30J+mD**	**30J+mD**	**53J+mD**	**49J+mD**
Copper	3,100	41,000	51	70	168	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	20.7	NAn	NAn	NAn	NAn
Vanadium	390	5,200	180	2	259	NAn	NAn	NAn	NAn
Zinc	23,000	310,000	680	50	115	**210D**	**150D**	**110D**	**100D**
Mercury	5.6	34	0.03	0.1	0.109	NAn	NAn	NAn	NAn

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).
NAn Sample not analyzed for this parameter.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.
m Result is flagged due to matrix spike recoveries outside of the specified window.
b Result is flagged due to method blank contamination; reported value is raised to the reporting limit for values between MDL and RL: and a positive bias is indicated.
D Sample was diluted during analysis, elevating reporting limit.
Bold text indicates that constituent detection or detection limit exceeds one or more screening levels.
l Result is flagged due to LCS anomalies.

Data validation for Table 9:

The initial calibration verification was biased high for multiple analytes. However, the initial calibration verification was reanalyzed with acceptable results. No flags were applied, based on professional judgement. Extensive dilution was performed on all metals samples, elevating reporting limits.

Copper results are flagged J+m due to matrix spike results greater than the upper control limit. The method blank for copper displayed a positive result at 0.106 mg/Kg. All sample results were much greater than 5x the amount in the blank. Vanadium recovered greater than the upper QC limit in the LCS but lower than the lower QC limit in the matrix spike. Associated results were flagged Jlm.

Table 10. Chemical Results for Subsurface Soil Samples.

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	**73SB02-01** (silt) (MW01)	**73SB02-04** (silt) (MW01)	**73SB14-01**	**73SB14-04**
Sample Date					7-Apr-08	7-Apr-08	7-Apr-08	7-Apr-08
Sample Depth					1'-3'	7'-9'	1'-3'	7'-9'
Volatile Organic Compounds (µg/Kg)								
2-Butanone (MEK)	28,000,000	200,000,000	1,500	N/A	5 J-h	ND (9) J-h	ND (10) J-h	5 J-h
2-Hexanone	210,000	1,400,000	11	N/A	ND (10) J-h	ND (9) J-h	ND (10) J-h	**ND (12) J-h**
Acetone	61,000,000	630,000,000	4,500	N/A	36 J-h	12 J-h	37 J-h	120 J-h
Allyl chloride	680	3,400	0.21	N/A	**ND (5) J-h**	**1 J-h**	**ND (5) J-h**	**ND (6) J-h**
Benzene	1,100	5,400	0.21	101	**2 J-h**	**ND (5) J-h**	**ND (5) J-h**	**ND (6) J-h**
Bromomethane	7,300	32,000	2.2	N/A	**ND (5) J-h**	**ND (5) J-h**	**ND (5) J-h**	**4 J-h**
Carbon disulfide	820,000	3,700,000	310	N/A	2 J-h	ND (5) J-h	ND (5) J-h	ND (6) J-h
Chloromethane	120,000	500,000	500,000	N/A	ND (5) J-h	ND (5) J-h	ND (5) J-h	3 J-h
Methyl iodide	N/A	N/A	N/A	N/A	ND (5) J-h	ND (5) J-h	ND (5) J-h	ND (6) J-h
Methylene chloride	11,000	53,000	1.2	1,004	**ND (5) J-h**	**ND (5) J-h**	**ND (5) J-h**	**ND (6) J-h**
Toluene	5,000,000	45,000,000	1,600	13,001	1 J-h	ND (5) J-h	ND (5) J-h	ND (6) J-h
Low Level Polycyclic Aromatic Hydrocarbons (µg/Kg)								
1-Methylnaphthalene	22,000	99,000	12	1,200	ND (1.8)	ND (1.9)	ND (1.8)	ND (2)
2-Methylnaphthalene	310,000	4,100,000	750	1,200	ND (1.8)	ND (1.9)	ND (1.8)	ND (2)
Acenaphthene	3,400,000	33,000,000	22,000	20,000	ND (1.8)	ND (1.9)	ND (1.8)	ND (2)
Acenaphthylene	N/A	N/A	N/A	1,200	1.5 J	ND (1.9)	ND (1.8)	ND (2)
Anthracene	17,000,000	170,000,000	1,200	1,200	1.1 J	ND (1.9)	ND (1.8)	ND (2)
Benz[a]anthracene	150	2,100	10	1,200	5.1 / **82 J**	ND (1.9)	ND (1.8)	ND (2)
Benzo[a]pyrene	15	210	3.5	1,200	**6.4 / 69 J**	ND (1.9)	ND (1.8)	ND (2)
Benzo[b]fluoranthene	150	2,100	35	1,200	12 / **110 Jm**	ND (1.9)	ND (1.8)	ND (2)
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	4.0 / 43 J	ND (1.9)	ND (1.8)	ND (2)
Benzo[k]fluoranthene	1,500	21,000	350	1,200	4.8 / 50 J	ND (1.9)	ND (1.8)	ND (2)
Chrysene	15,000	210,000	1,100	1,200	6.5 / 120 J	ND (1.9)	ND (1.8)	ND (2)
Dibenz[a,h]anthracene	15	210	11	1,200	0.97 J	ND (1.9)	ND (1.8)	ND (2)
Fluoranthene	2,300,000	22,000,000	160,000	1,200	10 / 170 J	ND (1.9)	ND (1.8)	ND (2)
Fluorene	2,300,000	22,000,000	27,000	30,000	ND (1.8)	ND (1.9)	ND (1.8)	ND (2)
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	3.4 / 40 J	ND (1.9)	ND (1.8)	ND (2)
Naphthalene	3,600	18,000	0.47	1,200	**ND (1.8)**	**ND (1.9)**	**ND (1.8)**	**ND (2)**
Phenanthrene	N/A	N/A	N/A	1,200	3.1 / 56 J	ND (1.9)	ND (1.8)	ND (2)
Pyrene	1,700,000	17,000,000	120,000	1,200	9.3 / 180 J	ND (1.9)	ND (1.8)	ND (2)
SemiVolatile Organic Compounds (µg/Kg)								
Acetophenone	7,800,000	100,000,000	1,100	N/A	ND (180)	ND (190)	ND (180)	ND (200)
Butylbenzylphthalate	260,000	910,000	510	6,010	ND (180)	ND (190)	ND (180)	ND (200)
Di(2-ethylhexyl)phthalate (DEHP)	35,000	120,000	1,100	6,010	**1,500**	390	330 J	**1,400**

Table 10 (cont'd). Chemical Results for Subsurface Soil Samples.

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Upper Limit of Means[2]	Upper Limit of Means[2]	**73SB02-01** (silt) (MW01)	**73SB02B-02** (silt) (MW01)	**73SB02B-03** (silt) (MW01)	**73SB02-04** (silt)(MW01)	**73SB14-01** (silt/clay)	**73SB14-04** (silt/clay)
Sample Date					Subsurface	Subsurface	7-Apr-08	14-Jan-09	14-Jan-09	7-Apr-08	7-Apr-08	7-Apr-08
Sample Depth					Soil (silt)	Soil (clay)	1'-3'	3'-5'	5'-7'	7'-9'	1'-3'	7'-9'
Pesticides and PCBs (µg/Kg)												
Aroclor 1254	220	740	8.8	N/A	N/A	N/A	Rm	NAn	NAn	Rm	Rm	Rm
Aroclor 1260	220	740	24	N/A	N/A	N/A	Rm	NAn	NAn	Rm	Rm	Rm
Chlordane	1,600	6,500	13	100	N/A	N/A	**900 Jm**	**220**	9.8J	12 Jm	Rm	Rm
Delta BHC	7,000,000	29,000,000	13,000	201	N/A	N/A	Rm	ND (9.3)	ND (0.94)	Rm	Rm	Rm
Dieldrin	30	110	0.17	401	N/A	N/A	Rm	**ND (19)**	**ND (1.9)**	Rm	Rm	Rm
Endosulfan sulfate	N/A	N/A	N/A	100	N/A	N/A	Rm	ND (19)	ND (1.9)	Rm	Rm	Rm
Endosulfan II	N/A	N/A	N/A	100	N/A	N/A	Rm	NAn	NAn	Rm	Rm	0.51 Jm
Endrin	18,000	180,000	440	401	N/A	N/A	**1,100 Jm**	ND (19)	ND (1.9)	Rm	Rm	Rm
Endrin aldehyde	N/A	N/A	N/A	100	N/A	N/A	Rm	ND (19)	ND (1.9)	Rm	Rm	Rm
Gamma BHC	300	1,100	0.53	201	N/A	N/A	Rm	**ND (9.3)**	**ND (0.94)**	Rm	Rm	Rm
Heptachlor	110	380	1.2	100	N/A	N/A	Rm	**ND (9.3)**	ND (0.94)	Rm	Rm	Rm
Heptachlor epoxide	53	190	0.15	100	N/A	N/A	Rm	**2.7J+c**	**0.33J**	Rm	Rm	Rm
Kepone	49	170	0.24	100	N/A	N/A	Rm	**ND (79)**	ND (7.9)	Rm	Rm	Rm
Methoxychlor	310,000	3100,00	9,900	100	N/A	N/A	Rm	ND (93)	ND (9.4)	Rm	Rm	Rm
p,p'-DDD	2,000	7,200	66	401	N/A	N/A	**1,100 Jm**	4 J+c	ND (1.9)	0.58 Jm	Rm	Rm
p,p'-DDE	1,400	5,100	47	401	N/A	N/A	**3,100 Jm**	**81**	0.96J	4.9 Jm	Rm	ND (2.1) Jmb
p,p'-DDT	1,700	7,000	67	401	N/A	N/A	**14,000 Jm**	**270J+c**	1.9J+c	4.6 Jm	Rm	2.7 Jm
Metals (mg/Kg)												
Antimony	31	410	0.66	78	7.44	N/A	**ND (1) J—mb**	NAn	NAn	Rm	Rm	NAn
Arsenic	0.39	1.6	0.0013	18	6.66	1.59	**0.96 J+i**	NAn	NAn	**ND (0.39)**	**0.74 J+i**	NAn
Barium	15,000	190,000	300	330	207	220	**210**	NAn	NAn	100	180	NAn
Cadmium	70	800	1.4	32	0.57	0.54	**0.75**	NAn	NAn	ND (0.098)	0.15	NAn
Chromium	230	1,400	0.0083	0.4	47.9	114.5	**46 J—m**	NAn	NAn	**18 J—m**	**31 J--m**	NAn
Cobalt	23	300	0.49	13	63.1	26.9	**20 J—m**	NAn	NAn	**24 J—m**	**55 J--m**	NAn
Copper	3,100	41,000	51	70	120	246	**100**	NAn	NAn	**130**	**190**	NAn
Lead	400	800	14 (MCL based)	120	6.2	6.3	**56**	NAn	NAn	1.7	3.1	NAn
Molybdenum	390	5,100	3.7	N/A	N/A	N/A	NAn	NAn	NAn	NAn	NAn	NAn
Nickel	1,500	20,000	48	30	26.5	24.7	13 J+p	NAn	NAn	ND (4.9) J+p	7.7 J+p	NAn
Selenium	390	5,100	0.95	1	1.19	5.94	**ND (1)**	NAn	NAn	**ND (0.98)**	**ND (0.99)**	NAn
Silver	390	5,100	1.6	560	N/A	N/A	ND (0.2)	NAn	NAn	ND (0.2)	ND (0.2)	NAn
Thallium	5.1	66	N/A	1	N/A	0.92	ND (0.4)	NAn	NAn	ND (0.39)	ND (0.39)	NAn
Vanadium	390	5,200	180	2	256	4	**140**	NAn	NAn	**180**	**250**	NAn
Zinc	23,000	310,000	680	50	92	88	**600**	NAn	NAn	**57**	**64**	NAn
Mercury-Lancaster Lab	5.6	34	0.03	0.1	0.067	0.108	**0.15**	NAn	NAn	ND (0.027)	**0.041**	NAn
Mercury	5.6	34	0.03	0.1	0.067	0.108	**0.102**	NAn	NAn	ND (0.013)	**0.031**	NAn

Table 10 (cont'd). Chemical Results for Subsurface Soil Samples.

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Upper Limit of Means[2]	Upper Limit of Means[2]	**73SB27-01** (silt/clay) (MW02)	**73SB27A-01** (silt/clay) (MW02)	**73SB03-05** (clay) (73SB27-MW02)	**73SB03-05D** (clay) (73SB27-MW02)	**73SB27-09** (silt/clay) (MW02)
Sample Date					Subsurface	Subsurface	7-Apr-08	7-Apr-08	02-Feb-11	02-Feb-11	7-Apr-08
Sample Depth					Soil (silt)	Soil (clay)	1'-3'	1'-3'	9'-11'	9'-11'	17'-19'
Metals (mg/Kg)											
Antimony	31	410	0.66	78	7.44	N/A	**ND (1.1) J—mb**	Rm	**ND (2.5) DRm**	**ND (2.4) DRm**	Rm
Arsenic	0.39	1.6	0.0013	18	6.66	1.59	**ND (0.4)**	**ND (0.39)**	**ND (0.50) D**	**ND (0.48) D**	**ND (0.4)**
Barium	15,000	190,000	300	330	207	220	**210**	86	190 DJdm	180 DJdm	110
Beryllium	160	2000	58	40	0.651	0.596	NAn	NAn	0.91 DJc2	1.0 DJc2	NAn
Cadmium	70	800	1.4	32	0.57	0.54	0.16	0.19	ND (0.50) DJi	ND (0.48) DJi	ND (0.099)
Chromium	230	1,400	0.0083	0.4	47.9	114.5	**41 J--m**	**41 J--m**	**7.2 DJdi**	**7.4 DJdi**	**24 J--m**
Cobalt	23	300	0.49	13	63.1	26.9	**21 J--m**	**23 J--m**	**28 DJdi**	**17 DJdi**	**20 J--m**
Copper	3,100	41,000	51	70	120	246	**460**	**420**	**140 DJdi**	**180 DJdi**	**200**
Lead	400	800	14 (MCL based)	120	6.2	6.3	2.4	1.4	0.95 DJd	0.86 DJd	0.74
Molybdenum	390	5,100	3.7	N/A	N/A	N/A	NAn	**82**	NAn	NAn	ND (5.0)
Nickel	1,500	20,000	48	30	26.5	24.7	12 J+p	11 J+p	15 DJldi	13 DJldi	ND (5) J+p
Selenium	390	5,100	0.95	1	1.19	5.94	**1.1**	**ND (0.97)**	**ND (2.5) DJmi**	**ND (2.4) DJmi**	**ND (0.99)**
Silver	390	5,100	1.6	560	N/A	N/A	ND (0.2)	ND (0.19)	ND (0.50) DJic2	ND (0.48) DJic2	ND (0.2)
Tin	47,000	610,000	5,500	N/A	0.475	4	NAn	NAn	ND (1.3) DJm	ND (1.2) DJm	NAn
Thallium	5.1	66	N/A	1	N/A	0.92	ND (0.4)	ND (0.39)	ND (0.50) D	ND (0.48) D	ND (0.4)
Vanadium	390	5,200	180	2	256	4	**300**	**300**	**76 DJdmic2**	**76 DJmic2**	**160**
Zinc	23,000	310,000	680	50	92	88	**110**	**100**	**120 DJdmi**	**110 DJdmi**	**59**
Mercury	5.6	3.4	0.03	0.1	0.067	0.108	ND (0.012)	ND (0.014)	ND (0.032) D	ND (0.029) D	ND (0.013)

Table 10 (cont'd). Chemical Results for Subsurface Soil Samples.

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	**73SB24-01** (silt/clay) (MW03)	**73SB01-05** (clay) (73SB24-MW03)	**73SB01-05D** (clay) (73SB24-MW03)	**73SB24-09** (silt/clay) (MW03)
Sample Date					13-Jan-09	02-Feb-11	02-Feb-11	13-Jan-09
Sample Depth					1'-3'	9'-11'	9'-11'	17'-19'
Low Level PAHs (µg/Kg)								
1-Methylnaphthalene	22,000	99,000	12	1,200	2.0	ND (8.7) D	NC	ND (2.2)
2-Methylnaphthalene	310,000	4,100,000	750	1,200	1.3J	ND (8.7) D	NC	ND (2.2)
Acenaphthene	3,400,000	33,000,000	22,000	20,000	1.6J	ND (8.7) D	NC	ND (2.2)
Acenaphthylene	N/A	N/A	N/A	1,200	0.87J	ND (4.3) D	NC	ND (2.2)
Anthracene	17,000,000	170,000,000	1,200	1,200	4.5	ND (4.3) D	NC	ND (2.2)
Benz[a]anthracene	150	2,100	10	1,200	**25**	ND (8.7) D	NC	ND (2.2)
Benzo[a]pyrene	15	210	3.5	1,200	**19**	ND (8.7) D	NC	ND (2.2)
Benzo[b]fluoranthene	150	2,100	35	1,200	32	ND (8.7) D	NC	ND (2.2)
Benzo[g,h,i]perylene	N/A	N/A	N/A	1,200	8.3	ND (8.7) D	NC	ND (2.2)
Benzo[k]fluoranthene	1,500	12,000	350	1,200	12	ND (8.7) D	NC	ND (2.2)
Chrysene	15,000	210,000	1,100	1,200	25	ND (4.3) D	NC	0.60J
Dibenz[a,h]anthracene	15	210	11	1,200	3.6	ND (8.7) D	NC	ND (2.2)
Fluoranthene	2,300,000	22,000,000	160,000	1,200	43Jd	ND (8.7) D	NC	(2.2)Jd
Fluorene	2,300,000	22,000,000	27,000	30,000	1.1J	ND (8.7) D	NC	ND (2.2)
Indeno[1,2,3-cd]pyrene	150	2,100	120	1,200	8.8	ND (8.7) D	NC	ND (2.2)
Naphthalene	3,600	18,000	0.47	1,200	**1.4J**	ND (8.7) D	NC	ND (2.2)
Phenanthrene	N/A	N/A	N/A	1,200	24	ND (8.7) D	NC	ND (2.2)
Pyrene	1,700,000	17,000,000	120,000	1,200	36J+m	ND (8.7) D	NC	(2.2)J+m
Pesticides (µg/Kg)								
Aldrin	29	100	0.65	401	NAn	ND (0.22)	ND (0.21)	NAn
Alpha BHC	70	270	.062	201	NAn	**ND (0.22)**	**ND (0.21)**	NAn
Beta BHC	270	960	0.22	201	NAn	**ND (1.2)**	**ND (1.2)**	NAn
Gamma BHC – Lindane	520	2,100	0.36	201	NAn	ND (0.22)	ND (0.21)	NAn
Chlordane	1,600	6,500	13	100	NAn	ND (5.2)	ND (5.1)	NAn
Delta BHC	7,000,000	29,000,000	13,000	201	NAn	ND (0.59)	ND (0.57)	NAn
Dieldrin	30	110	0.17	401	NAn	**ND (0.43)**	**ND (0.42)**	NAn
Endosulfan sulfate	N/A	N/A	N/A	100	NAn	ND (0.43)	ND (0.42)	NAn
Endosulfan I	370,000	3,700,000	3,000	100	NAn	ND (0.29)	ND (0.28)	NAn
Endosulfan II	N/A	N/A	N/A	100	NAn	1.0 J	2.2	NAn
Endrin	18,000	180,000	440	401	NAn	ND (0.43)	ND (0.42)	NAn
Endrin aldehyde	N/A	N/A	N/A	100	NAn	ND (0.43)	ND (0.42)	NAn
Hepatchlor	110	380	1.2	100	NAn	ND (0.22)	ND (0.21)	NAn
Heptachlor epoxide	53	190	0.15	100	NAn	**ND (0.22)**	**ND (0.21)**	NAn
Kepone	49	170	170	100	NAn	ND (3.0)	ND (2.9)	NAn
Methoxychlor	310,000	3,100,000	9,900	100	NAn	ND (2.2)	ND (2.1)	NAn
Toxaphene	440	1,600	9.4	100	NAn	**ND (14)**	**ND (14)**	NAn
p,p'-DDD	2,000	7,200	66	401	NAn	ND (0.43)	ND (0.42)	NAn
p,p'-DDE	1,400	5,100	47	401	NAn	ND (0.43)	ND (0.42)	NAn
p,p'-DDT	1,700	7,000	67	401	NAn	ND (0.43)	ND (0.42)	NAn

Table 10 (cont'd). Chemical Results for Subsurface Soil Samples.

Sample ID	Nov 2010 EPA RSL Residential	Nov 2010 EPA RSL Industrial	Nov 2010 EPA RSL Groundwater Protection Risk-Based SSLs	Tbl 5-1 Screen[1] Soil	Upper Limit of Means[2] Subsurface	Upper Limit of Means[3] Subsurface	**73SB24-01** (silt/clay) (MW03)	**73SB01-05** (clay) (73SB24-MW03)	**73SB01-05D** (clay) (73SB24-MW03)	**73SB24-09** (silt/clay) (MW03)
Sample Date							13-Jan-09	02-Feb-11	02-Feb-11	13-Jan-09
Sample Depth					Soil (silt)	Soil (clay)	1'-3'	9'-11'	9'-11'	17'-19'
Volatile Organic Compounds (µg/Kg) (detected compounds reported)										
All Compounds							NAn			NAn
Acetone	6,100,000	63,000,000	4,500					98 UJb3m	350 Jm	
2-Butanone	N/A	N/A	N/A					ND (12) Jc3	15 Jc3	
Carbon Disulfide	820,000	3,700,000	310					ND (6)	ND (6) Ub3	
Chloro-methane	129,000	500,000	4.9					**3 J**	**5 J**	
Methyl Iodide	N/A	N/A	N/A					ND (6)	15 Jdm	
SemiVolatile Organic Compounds (µg/Kg)										
All Compounds							NAn	ND	NC	NAn
Metals (mg/Kg)										
Antimony	31	410	0.66	78	7.44	NA	NAn	**ND (2.8) DRm**	NC	NAn
Arsenic	0.39	1.6	0.0013	18	6.66	1.59	**1.4D**	**0.63 D**	NC	**ND (0.99)D**
Barium	15,000	190,000	300	330	207	220	NAn	61 DJdm	NC	NAn
Beryllium	160	2000	58	40	0.651	0.596	NAn	ND (0.57) DJc2	NC	NAn
Cadmium	70	800	1.4	32	0.57	0.54	NAn	ND (0.57) DJi	NC	NAn
Chromium	230	1,400	0.0083	0.4	47.9	114.5	NAn	**12 DJdi**	NC	NAn
Cobalt	23	300	0.49	13	63.1	26.9	NAn	**13 DJdi**	NC	NAn
Copper	3,100	41,000	51	70	120	246	**170J+mbD**	**200 DJdi**	NC	**420J+mbD**
Lead	400	800	14 (MCL based)	120	6.2	6.3	NAn	2.2 DJd	NC	NAn
Nickel	1,500	20,000	48	30	26.5	24.7	NAn	7.0 DJldi	NC	NAn
Selenium	390	5,100	0.95	1	1.19	5.94	NAn	**ND (2.8) DJmi**	NC	NAn
Silver	390	5,100	1.6	560	N/A	N/A	NAn	ND (0.57) DJic2	NC	NAn
Tin	47,000	610,000	5,500	N/A	0.475	4	NAn	ND (1.4) DJm	NC	NAn
Thallium	N/A	N/A	N/A	1	N/A	N/A	NAn	ND (0.57) D	NC	NAn
Vanadium	390	5,200	180	2	256	434	NAn	**160 DJdmic2**	NC	NAn
Zinc	23,000	310,000	680	50	92	88	**53D**	36 D	NC	**90D**
Mercury	5.6	34	0.03	0.1	0.067	0.108	**0.090D**	**0.048 D**	NC	**ND (0.030) D**

[1] Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-1 of the Corrective Measures Study Work Plan.
[2] Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).

Bold text indicates that constituent detection or detection limit exceeds one or more screening levels.
Multi-value blocks represent detections of the low level PAH result followed by the SVOC result for constituents where the analytes are evaluated by both analyses.

D Sample was diluted during analysis, elevating reporting limit.
N/A Not applicable.
NAn Sample not analyzed for this parameter.
NC Sample not collected. Insufficient sample volume.
ND Constituent not detected at the identified analytical method detection limit.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estmate with a negative bias; associated QC results are outside of the specified range. J++/J—indicates that the positive or negative bias is very strong.
R Result is rejected or unuseable either quantitatively or qualitatively; a data gap is indicated.
U The analyte should be treated as a non-detect at the reported value or the reported limit whichever is greater.
b Result is flagged due to method blank contamination; reported value is raised to the reporting limit for values between MDL and RL: and a positive bias is indicated.
b3 Result is flagged due to field, ambient, or trip blank contamination; Reported value is raised to the reporting limit for values between MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
c Result is flagged due to continuing calibration anomalies related to drift or response.
c2 Result is flagged due to initial calibration verification anomalies.
c3 Result is flagged due to continuing calibration anomalies related to drift or response.
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified.
h Result is flagged due to holding time failure; a low bias is indicated.
i Result is flagged due to ICP interference check failure (inorganics)
l Result is flagged due to LCS anomalies.
m Result is flagged due to matrix spike recoveries outside of the specified window.
p Result is flagged due to post-digestion spike failure (inorganics)
q Result is flagged due to quantitation anomaly.

Data Validation for Table 10:

Metals:

2008
Antimony data are flagged either UJ—mb or Rm. The data flagged UJ—are samples that originally displayed a positive result but which the validator modified to non-detects based on method blank contamination. All of the antimony data are also impacted by MS recoveries less than 30% resulting in R qualifiers for the samples that originally displayed a non-detect result. Based on professional judgement, the reviewer suggests that all antimony data be treated as through R-flagged and not used.

Samples 73SB02-04 and 73SB14-01 were flagged J+i for arsenic due to interference check samples (ICS) recoveries greater than the acceptance limit.

All of the chromium and cobalt samples were flagged J—m due to MS recoveries less than the lower QC limit.

Positive mercury results for 73SB02-01 and 73SB14-01 were changed to non-detects due to method blank contamination.

Nickel results were flagged J+p due to PDS recovery greater than the upper QC limit.

All of the samples were reanalyzed for arsenic due to extreme method blank contamination. The results of the reanalysis, which displayed acceptable QC performance, are reported in the data tables.

Due to elevated concentrations in some samples and/or matrix interferences, zinc and beryllium may have been analyzed either by methods SW-6010 or SW-6020.

Various results may display elevated reporting limits due to dilutions resulting from matrix interference or concentrations of analyte exceeding the linear range of the calibration curve. Reporting limits have been adjusted for dilution in the data tables.

Many samples were received at temperatures greater than the preservation requirement of 4°C +/- 2°C. Based on professional judgement, only VOC samples have been flagged due to this observation. Nontheless the data user is advised to consider this anomaly should a result very close to the threshold value be encountered. In that case, the data should be used conservatively and an exceedence should be noted.

2009
Extensive dilution was performed on all metals samples elevating reporting limits.

Matrix spike results were greater than the upper control limit for copper. Associated results were flagged J+. The method blank for copper displayed a positive result at 0.106 mg/Kg. All sample results were much greater than 5x the amount in the blank. No data flags were required.

One of the replicates for mercury failed to inject properly. The laboratory reported the result from the other two replicates. This is naot an accepted practice; however, as it is difficult to predict the bias associated with this approach no data flags were applied. In addition, multiple mercury CCVs are identified in the raw data to be out of control; however, this appears to result from incorrectly programming the control limits in the method file. No flags were applied.

2011
Antimony displayed a near zero recovery in the MS. All results were flagged R,m.

Calibration verification anomalies resulted in data qualifiers (J for detects; UJ for non-detects). Affected analytes are beryllium, silver, and vanadium. MS anomalies result in J and UJ flags for barium, selenium, tin, vanadium, and zinc. Duplicate relative percent differences (RPDs) greater than the control limit (CL) resulted in J flags for barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc. The ICS A displayed positive detections greater than the CL for cadmium, chromium, cobalt, copper, nickel, selenium, silver, vanadium, and zinc. Positive results were flagged J,i; non-detects were flagged UJ,i.

Pesticides:

2008
Most of the analytes for samples 73SB02-01, 73SB02-04, 73SB14-01 and 73SB14-04 were flagged R due to extremely low MS recoveries. Positive detections were flagged J.

LCS recoveries less than the QC limit resulted in UJ flags for aldrin, alpha-BHC, beta-BHC, and heptachlor in a broad portion of the soil samples. Likewise, in a broad portion of the data various analytes were flagged as estimates due to the result being reported from beyond the linear range of the calibration curve or due to large differences (>40%) in the results between the two columns (flagged q) or due to calibration verification anomalies (flagged c). The following convention was used in flagging data due to calibration anomalies: samples were flagged for calibration anomalies only if neither column displayed acceptable calibration results. As long as at least one column displayed acceptable performance, it is assumed that the result was reported from that column unless otherwise noted.

A small number of delta-BHC samples were qualified for method blank contamination.

Results for kepone may be biased due to florisil clean-up in samples displaying heavy matrix interference. These data should be used conservatively.

Many matrix spike recovery failures appear to be due to high levels of analyte in the samples relative to the method specified spike amount. In these cases, and in cases where surrogate recoveries are outside acceptance limits due to dilution, no data qualification was performed. Retention time updates were applied in the course of various pesticide analytical sequences. There is no discernable negative impact on the data as a result, based on professional judgement. Also, a number of analytes present in the calibration or other QC data were not reported in the EDD.

2009
No major anomalies were identified. Heptachlor epoxide, DDD, and DDT displayed continuing calibration recoveries greater than the upper QC limit. Positive results were flagged J+c.

The sample shipping coolers arrived at the laboratory open and without custody seals.

2011
None

PCBs:
2008
All analytes in samples 73SB02-01, 73SB02-04, 73SB14-01, and 73SB14-04 were flagged R due to extremely low MS recoveries.

VOCs:
2008
Virtually the entire VOC data set is impacted by failure to meet preservation temperature requirements and/or holding time requirements. IN accord with the reviewer's interpretation of the Region 2 guidelines, those samples adversey affected by temperature have been flagged either Jp or UJp and a negative bias is indicated. Those affected by holding time issues have been flagged either Jh or UJh and a negative bias is also indicated. These data should be used with conservatism in comparison to threshold values.

Matrix interferences resulted in internal standard area depression. In general terms, the reported area is only slightly less than the lower control limit. However, in contrast to the above, surrogate recoveries were generally nominal. Thus, it is apparent that the internal standards continued to perform their basic function and therefore no data flags were applied on this basis.

2011
Field blanks and trip blanks displayed positive detections for acetone and carbon disulfide. Positive results for these analytes in the associated samples were flagged U,b3 as appropriate. Continuing calibration anomalies were observed for 2-butanone and acetonitrile. Associated results were flagged UJ,c3, or J,c3 (if a detection). In the MS, 2-chloro-1,3-butadiene and acetone displayed recoveries less than the LCL. Positive results were flagged J,m and non-detects were flagged UJ,m. Methyl iodide displayed anomalies in the MS and MSD resulting in the single positive result being flagged J,dm.

SVOCs:
2008
Compounds including 1,4-phenylenediamine, 2-naphthylamine, 4-nitroquinoline-1-oxide, isosafrole, hexachlorocyclopentadiene and methapyriline were flagged R due to either LCS, MS, or ICV recoveries less than half the lower control limit.

UJ or J flags were applied to diallate, 1,4-naphthoquinone, methyl methanesulfonate, and aramite in a broad cross section of the data.

3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for the analysis. The sum of any positive defects for either of these compounds is reported as 4-methylphenol.

2011
In the MS and/or the LCS, 1,4-phenylenediamine, 2-napthylamine, 3,3-dimethylbenzene, methapyrilene, phentermine (a,a-dimethylphenethylamine), and methyl methanesulfonate displayed near zero recoveries. These analytes were flagged R,ml.

In the MS, 1,4-napthquinone and ethyl methanesulfonate displayed a recovery less than the LCL and was flagged UJ,m. In the LCS n-nitrosodiphenylamine displayed a recovery less than the LCL. This analyte was flagged UJ,l

LLPAHs:

2008
A variety of PAHs were flagged J due to matrix spike recoveries less than the lower control limit. As the soil matrix spike samples were, in most cases, heavily impacted by both elevated concentrations of target analyte and interferences, it is difficult to accurately assess the direction of bias.

2009:
No major anomalies were identified. The recovery of pyrene was greater than the upper control limit in the matrix spike and the duplicate relative percent differences for pyrene and fluoranthene were greater than the control limit. Pyrene was flagged Jm and fluoranthene was flagged Jd in the associated samples.

Table 11. Chemical Results for Groundwater Samples.

Sample ID	Nov 2010 EPA RSL Tap Water[1]	Federal Drinking Water[2] MCL	Table 5-2 Groundwater[3] Screening Level NAPR	Up Limit of Means[4]	**73MW01**	**73MW01A**	**73MW01**	**73MW01D**	**73MW02**	**73MW02**	**73MW02**
Sample Date				(x+2s)	10-Apr-08	10-Apr-08	31-Jan-11	31-Jan-11	10-Apr-08	16-Jan-09	31-Jan-11
Volatile Organic Compounds (µg/L) (detected compounds reported)											
Acetone	22,000	N/A	1000	N/A	4.4 Jp	3.8 Jp	ND (5)	5 Ub3	NAn	NAn	NAn
Carbon Disulfide	1,000	N/A	650	N/A	ND	ND	4.6 UJb3m	5.2UJb3m	NAn	NAn	NAn
Ethylbenzene	1.5	700	4.3	N/A	0.1 Jp	0.1 Jp	0.3 J	0.3 J	NAn	NAn	NAn
Toluene	2,300	1,000	37.0	N/A	ND	ND	0.3 J	0.3 J	NAn	NAn	NAn
SemiVolatile Organic Compounds (µg/L) (detected compounds reported)											
1-Methylnaphthalene	2.3	N/A	19	N/A	ND (0.05)	0.011J	ND (0.01)	ND (0.01)	NAn	NAn	NAn
Di/Bis(2-ethylhexyl)phthalate (DEHP)	4.8	6.0	360	N/A	**55**	**110**	5 Ub3	5 Ub3	NAn	NAn	NAn
Low Level PAHs (µg/L) (detected compounds reported)											
Naphthalene	0.14	N/A	23.5	N/A	NAn	NAn	0.050 Ub3	0.051 Ub3	NAn	NAn	NAn
Metals (mg/L)											
Antimony	15	6	500	11.19	ND (5)	ND (5)	ND (5.0)UJi	ND (5.0)UJi	ND (5)UJb3i	NAn	5 UJb3i
Arsenic	0.045	10	36	14.03	**ND (4) Jm**	**ND (4) Jm**	**2 Jb1i**	**2.2 Jb1i**	**35.1 Jm**	**31D**	**19di**
Barium	7,300	2,000	50,000	260	147 J-p	154 J-p	96 BJd	8.5 BUJdb1	132 J-p	NAn	81 BJd
Beryllium	73	4	310	5,400	ND (2)	ND (2)	1.0 (ND)Ji	ND 1.0Ji	ND (2)	NAn	ND (1.0)Ji
Cadmium	18	5	8.85	36.42	ND (2)	ND (2)	ND (0.50)Ji	ND (0.50)Ji	**12.8**	NAn	**15**
Chromium	55,000	100	50.4	6.5	ND (4)	**7.02**	ND (2.0)Jb2c2	ND (2.0)Jb2c2	**6.69**	NAn	**9.4 Jb2c2**
Cobalt	11	N/A	45	580.5	ND (4)	ND (4)	ND (5.0)	ND (5.0)	**277**	NAn	**120**
Copper	1,500	1,300/1,000	3.73	29	**ND (5)**	**ND (5)**	3.0 BUb3b1	1 Ub3b1	**57.6**	**61D**	**67 B**
Lead	N/A	15	8.52	1.3	**ND (4) Jm**	**ND (4) Jm**	ND (1.0)	ND (1.0)	**ND (4) Jm**	NAn	ND (1.0)
Mercury	0.57	2	1.11	0.157	**ND (0.2) J-m**	**ND (0.2) J-m**	ND (0.20)	ND (0.20)	**ND (0.2) J-m**	NAn	ND (0.20)
Nickel	730	N/A	8.28	84.1	**ND (10)**	**ND (10)**	1.1 J	ND (5.0)	**140**	**130D**	**120**
Selenium	180	50	71.1	23.92	ND (4) J-lm	18.8 J-lm	4.0 J	0.81 J	**61.6 J-lm**	NAn	**69**
Silver	180	100	0.23	3.67	**ND (2)**	**ND (2)**	ND (1.0)	ND (1.0)	**5.98**	**5.2D**	**3.5**
Thallium	N/A	2	21.3	N/A	**ND (4)**	**ND (4)**	ND (1.0)	ND (1.0)	**ND (4)**	NAn	ND (1.0)
Tin	22,000	N/A	N/A	N/A	ND (0.2)	ND (0.2)	ND (0.010)	ND (0.010)	ND (0.2)	NAn	ND (0.010)
Vanadium	180	N/A	120	20.96	ND (5)	ND (5)	5 UJb1	6.3 UJb1	ND (5)	NAn	ND (5.0) UJb1b2
Zinc	11,000	5,000	85.6	360.64	7.65 Jmp	ND (5) Jmp	5 UJb3c2	ND (5.0)	**154 Jmp**	NAn	**190**

Table 11(cont'd). Chemical Results for Groundwater Samples.

Sample ID	Nov 2010 EPA RSL Tap Water[1]	Federal Drinking Water[2] MCL	Table 5-2 Groundwater[3] Screening Level NAPR	Up Limit of Means[4]	**73MW03**	**73MW03A**	**73MW03**
Sample Date				(x+2s)	16-Jan-09	16-Jan-09	31-Jan-11
Volatile Organic Compounds (µg/L) (detected compounds reported)							
Carbon Disulfide	1,000	N/A	650	N/A	NAn	NAn	3.8UJb3m
SemiVolatile Organic Compounds (µg/L) (detected compounds reported)							
Di/Bis(2-ethylhexyl)phthalate (DEHP)	4.8	6.0	360	N/A	NAn	NAn	28 Ub3
Low Level PAHs (µg/L) (detected compounds reported)							
Fluoranthene	1,500	N/A	11	N/A	ND (0.05)	0.010J	ND (0.0097)
Naphthalene	0.14	N/A	23.5	N/A	ND	ND	0.049 Ub3
Phenanthrene	N/A	N/A	8.30	N/A	ND	ND	0.049 Ub3
Pyrene	1100	N/A	30.0	N/A	ND	ND	0.010 J
Dissolved Metals (µg/L)							
Antimony	15	6	500	11.19	NAn	NAn	5 UJb3i
Arsenic	0.045	10	36	14.03	**28D**	**26D**	**21di**
Barium	7,300	2,000	50,000	260	NAn	NAn	84 BJd
Beryllium	73	4	310	5,400	NAn	NAn	0.45 Ji
Cadmium	18	5	8.85	36.42	NAn	NAn	**9.0**
Chromium	55,000	100	50.4	6.5	NAn	NAn	2.4
Cobalt	11	N/A	45	580.5	NAn	NAn	**240**
Copper	1,500	1,300/1,000	3.73	29	**120D**	**130D**	**140 B**
Lead	N/A	15	8.52	1.3	NAn	NAn	ND (1.0)
Mercury	0.57	2	1.11	0.157	ND (0.2)	ND (0.2)	ND (0.2)
Nickel	730	N/A	8.28	84.1	**73D**	**73D**	**47**
Selenium	180	50	71.1	23.92	NAn	NAn	**63**
Silver	180	100	0.23	3.67	**3.6D**	**3.7D**	**1.1**
Thallium	N/A	2	21.3	N/A	NAn	NAn	ND (1.0)
Tin	22,000	N/A	N/A	N/A	NAn	NAn	ND (0.010)
Vanadium	180	N/A	120	20.96	NAn	NAn	ND (5.0) UJb1b2
Zinc	11,000	5,000	85.6	360.64	NAn	NAn	**90**

[1]-EPA Tap Water Regional Screening Levels for Chemical Contaminants at Superfund Sites.
[2]-US EPA Primary Maximum Allowable Concentration Level (MCL) in drinking water (Copper MCL indicates Primary Standard/Secondary Standard; Silver and Zinc MCLs indicate Secondary Standards).
[3]-Screening Levels developed for Naval Activity Puerto Rico as shown in Table 5-2 of the Corrective Measures Study Work Plan.
[4]-Upper Limit of Means as determined by the Naval Activity Puerto Rico Background Report (Baker, 2006).
Bold text indicates that the constituent detection or detection limit exceeds one or more screening levels

N/A Not Applicable.
NAn Not Analyzed.
B Analyte is found in method blank
D Result is flagged because the sample was diluted during preparation and analysis.
J Constituent estimated value below the analytical method detection limit or qualified during data validation. J+ indicates the reported result is an estimate with a positive bias; associated QC results are outside of the specified range. J- indicates the reported result is an estimate with a negative bias; associated QC results are outside of the specified range.
ND Constituent not detected at the identified analytical method detection limit.
U The analyte should be treated as a non-detect at the reported value or the reporting limit whichever is greater.
b1 Result is flagged due to method blank contamination; Reported value is raised to the reporting limit for values between the MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
b2 Result is flagged due to calibration blank contamination; Reported value is raised to the reporting limit for values netween MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
b3 Result is flagged due to field, ambient, or trip blank contamination; Reported value is raised to the reporting limit for values between MDL and RLand a positive bias is indicated; in the case of negative blank results a negative bias is indicated

c2	Result is flagged due to initial calibration verification anomalies
d	Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified.
i	Result is flagged due to internal standard (organic and ICP/LC MS) or ICP interference check failure (inorganic).
l	Result is flagged due to LCS anomalies
m	Result is flagged due to matrix spike recoveries outside the specified window.
p	Result is flagged due to preservation or handling problems, or due to post-digestion spike failure (metals only)

Data Validation for Table 11:

Metals:

2008
The beryllium results are flagged J-p due to low post digestion spike recovery.

Lead results were flatted Jm due to MS anomalies.

Mercury results were flagged J-m due to matrix effects.

Zinc results were flagged Jmp due to a variety of QC anomalies.

2009
Extensive dilution was performed on all metals samples elevating reporting limits. Copper was found in the method blank. Copper results were noto flagged because results were greater than 5x in the blank.

2011
Calibration anomalies resulted in data qualification (J,c2 or UJ,c2) for some antimony, chromium, and zinc results. Method, calibration, and field blanks displayed contamination that resulted in data qualifiers (U or UJ). Affected analytes include antimony, chromium, copper, vanadium, arsenic, barium, and zinc. Duplicate anomalies resulted in J flags for positive antimony, arsenic, and barium results. The ICS A displayed positive detections greater than the CL for antimony, arsenic, beryllium, and cadmium. Associated non-detects were flagged UJ,i; positive detections were flagged J,i.

VOCs:

2008
In both samples, trans-1,4-dichloro-2-butene results were rejected during data validation.

2011
Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis in the VOC fraction displayed recoveries greater than the upper control limit (UCL) for carbon disulfide. The positive results for carbon disulfide (in the field samples) were flagged UJ,m. The trip blank displayed positive detections for acetone and carbon disulfide. Positive results in the samples were flagged U,b3.

SVOCs:

2008
Results for several compounds, including 1,4-naphthoquinone, 1,4-phenylenediamine, isosafrole, and methapyriline, were rejected for most of the samples due to either LCS, MS, or ICV recoveries less than half the lower control limit.

2011
Di(2-ethylhexyl) phthalate displayed recoveries greater than the UCL). In the SIM fraction, field blank contamination lead for flagging naphthalene and phenanthrene positive results U,b3. Calibration anomalies observed do not bear on the reported results and no data qualification was required.

Low Level PAHs:

2009
Critically low recoveries were observed for numerous analytes in the matrix spike resulting in Rm qualifiers for non-detects and Jm flags for positive detections.

Naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and phenanthrene were identified as positive detections in one or more field blanks. Cross-applying these values to the remaining field and equipment blanks resulted in the application of Ub flags to a number of samples where the difference between the blank and the affected sample result was less than 5x. If a sample flagged U for this reason was also affected by severe matrix spike anomalies the sample results were rejected during data validation. Non-detect results for several other LLPAHs were rejected during data validation.

Table 12. Chemical Results for Equipment Rinsate Samples (March-April 2008).

Sample ID	**73ER-01**	**73ER-02 (Hold)**	**73-ER-03**	**73ER-04**	**73ER-05 (Hold)**	**73ER-06**	**73ER-07**
Date	31-Mar-08	1-Apr-08	1-Apr-08	2-Apr-08	3-Apr-08	7-Apr-08	10-Apr-08
Equipment Sampled	Shoe/sleeve/Al foil	Shoe/sleeve/Al foil	Vinyl gloves	Shoe/sleeve/Al foil	Shoe/sleeve/Al foil	Scoop/sleeve/shoe	GW sampling tubing
Volatile Organic Compounds (µg/L)							
1,1-Dichloroethene	0.3 Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	0.4 Jp
2-Butanone (MEK)	ND (5) Jp	NAn	ND (5) Jp	ND (5)	NAn	Lost Sample	ND (5) Jp
2-Hexanone	ND (5) Jp	NAn	ND (5) Jp	ND (5)	NAn	Lost Sample	ND (5) Jp
Acetone	ND (5) Jp	NAn	ND (5) Jp	ND (5)	NAn	Lost Sample	ND (5) Jp
Allyl chloride	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Benzene	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Bromomethane	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Carbon disulfide	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Chloromethane	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Ethylbenzene	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Methyl iodide	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Methylene chloride	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Styrene	ND (0.5) Jp	NAn	0.1 Jp	ND (0.5)	NAn	Lost Sample	ND (0.5) Jp
Toluene	0.1 Jp	NAn	1.9 Jp	ND (0.5)	NAn	Lost Sample	2.8 Jp
Vinyl chloride	ND (0.5) Jp	NAn	ND (0.5) Jp	ND (0.5)	NAn	Lost Sample	0.3 Jp
SemiVolatile Organic Compounds and Low Level Polycyclic Aromatic Hydrocarbons (µg/L)							
1-Methylnaphthalene	0.014J	NAn	ND (5)	0.013J	NAn	Lost Sample	0.011J
2-Methylnaphthalene	0.03J	NAn	0.015J	0.022J	NAn	Lost Sample	0.022J
Acenapthene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Acenaphthylene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Acetophenone	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Anthracene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Benz(a)anthracene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Benzo(a)pyrene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Benzo(b)fluoranthene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Benzo(g,h,i)perylene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Butylbenzylphthalate	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Chrysene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048) Jm
Dibenz(a,h)anthracene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Di(2-ethylhexyl)phthalate (DEHP)	3J	NAn	3J	ND (5)	NAn	Lost Sample	ND (5)
Fluoranthene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Fluorene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Indeno(1,2,3-cd)pyrene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Naphthalene	ND (5) Jl	NAn	0.062	0.045J	NAn	Lost Sample	0.057
Phenanthrene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)
Phenol	ND (5)	NAn	6	ND (5)	NAn	Lost Sample	ND (5)
Pyrene	ND (0.048)	NAn	ND (0.053)	ND (0.051)	NAn	Lost Sample	ND (0.048)

Table 12 (continued). Chemical Results for Equipment Rinsate Samples (March-April 2008).

Sample ID	**73ER-01**	**73ER-02 (Hold)**	**73-ER-03**	**73ER-04**	**73ER-05 (Hold)**	**73ER-06**	**73ER-07**
Date	31-Mar-08	1-Apr-08	1-Apr-08	2-Apr-08	3-Apr-08	7-Apr-08	10-Apr-08
Equipment Sampled	Shoe/sleeve/Al foil	Shoe/sleeve/Al foil	Vinyl gloves	Shoe/sleeve/Al foil	Shoe/sleeve/Al foil	Scoop/sleeve/shoe	GW sampling tubing
Organochlorine Pesticides and PCBs (ug/L)							
None detected.	--	NAn	--	--	NAn	NAn	NAn
Metals (µg/L)							
Antimony	ND (5) Jm	NAn	ND (5) Jm	ND (5)	ND (5)	ND (5)	ND (5)
Arsenic	ND (4)	NAn	ND (4)	ND (4)	ND (4)	ND (4)	ND (4) Jm
Barium	ND (5)	NAn	ND (5)	ND (5)	ND (5)	ND (5)	ND (5) J
Beryllium	ND (2) Jlc	NAn	ND (2) Jlc	ND (5) Jc	ND (5) Jc	ND (2) Jm	ND (2)
Cadmium	ND (2)	NAn	ND (2)	ND (2)	ND (2)	ND (2)	ND (2)
Chromium	ND (4)	NAn	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Cobalt	ND (4)	NAn	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Copper	ND (5)	NAn	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Lead	ND (4)	NAn	ND (4)	ND (4)	ND (4)	ND (4)	ND (4) Jm
Molybdenum	NAn	NAn	NAn	NAn	NAn	NAn	NAn
Nickel	ND (10)	NAn	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)
Selenium	ND (4)	NAn	ND (4)	ND (4) Jmpl	ND (4) Jmpl	ND (4) Jm	ND (4) J-lm
Silver	ND (2) Jl	NAn	ND (2) Jl	ND (2)	ND (2) b	ND (2)	ND (2)
Thallium	ND (4)	NAn	ND (4)	ND (4)	ND (4)	ND (4)	ND (4)
Tin	ND (200)	NAn	ND (200)	ND (200)	ND (200)	ND (200)	ND (200)
Vanadium	ND (5)	NAn	ND (5)	ND (5)	ND (5)	ND (5)	ND (5)
Zinc	ND (5) Jdb	NAn	ND (5) Jdb	ND (29.5) Jmdb	ND (5) Jmdb	ND (12.7)Jb	18.9
Mercury	ND (0.2)	NAn	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2) Jm

J Constituent estimated value below the analytical method detection limit or qualified during data validation. J- indicates that the result has a negative bias.
p Result is flagged due to preservation or handling problems (organics) or due to post-digestion spike failure (inorganics)
ND Constituent not detected at the identified analytical method detection limit.
l Result is flagged due to laboratory control sample anomalies
b Result is flagged due to method blank contamination or due to calibration blank contamination
NAn Not Analyzed.
m Result is flagged due to matrix spike recoveries outside the specified window
c Result is flagged due to continuing calibration anomalies related to drift or response (beryllium)
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified

Data Validation for Table 12:

Metals:

Several antimony results were flagged Jm due to depressed MS recoveries. Several beryllium samples were flagged J due to a combination of laboratory control sample and continuing calibration verification anomalies. Several selenium samples were flagged J due to a combination of laboratory control sample, MS< and PDS anomalies. Several silver results were flagged J due to poor LCS recoveries; sample 73ER-05 was flagged b due to blank contamination. All of the zinc results were flagged J due to a variety of QC anomalies.

Pesticides and PCBs:

No major or minor anomalies were identified during data validation.

VOCs:

The analyte trans-1,4-dichloro-2-butene was rejected during data validation in water sample 73ER-07. The positive result for toluene in sample 73ER-04 was changed to a non-detect due to method blank contamination. Virtually the entire data set is impacted by failure to meet preservation temperature requirements; those samples adversely affected by temperature were flagged Jp and a negative bias is indicated.

SVOCs:

Results for 1,4-naphthoquinone, 1,4-phenylenediamine, isosafarole,and methapyriline were rejected during data validation due to either LCS, MS, or ICV recoveries less than half the lower control limit. In sample ER-01 a broad cross section of positive detections were changed to non-detect and flagged J due to LCS recoveries less than the lower control limit.

PAHs:

Results for chrysene, 2-methylnaphthalene, and pyrene in some samples were flagged as estimates due to matrix spike anomalies.

Table 13. Chemical Results for Equipment Rinsate Samples (January 2009 and January-February 2011).

Sample ID	**73ER-08 (Hold)**	**73ER-09**	**73ER-10**
Date	13-Jan-09	14-Jan-09	15-Jan-09
Equipment Sampled	Unknown	Unknown	Unknown
Low Level Polycyclic Aromatic Hydrocarbons (µg/L)			
1-Methylnaphthalene	NAn	NAn	0.013J
2-Methylnaphthalene	NAn	NAn	0.022J
Acenaphthene	NAn	NAn	Rm
Acenaphthylene	NAn	NAn	Rm
Anthracene	NAn	NAn	Rm
Benz(a)anthracene	NAn	NAn	Rm
Benzo(a)pyrene	NAn	NAn	Rm
Benzo(b)fluoranthene	NAn	NAn	ND (0.054)
Benzo(g,h,i)perylene	NAn	NAn	Rm
Benzo(k)fluoranthene	NAn	NAn	ND (0.054)
Chrysene	NAn	NAn	ND (0.054)
Dibenz(a,h)anthracene	NAn	NAn	Rm
Fluoranthene	NAn	NAn	ND (0.054)
Fluorene	NAn	NAn	ND (0.054)
Indeno(1,2,3-cd)pyrene	NAn	NAn	Rm
Naphthalene	NAn	NAn	0.048J
Phenanthrene	NAn	NAn	Rm
Pyrene	NAn	NAn	Rm
PCBs and Pesticides (ug/L)			
Aroclor 1254	NAn	NAn	NAn
Aroclor 1260	NAn	NAn	NAn
Chlordane	NAn	ND (0.53)	ND (0.5)
Delta BHC	NAn	ND (0.011)	ND (0.01)
Dieldrin	NAn	ND (0.021)	ND (0.02)
Endosulfan sulfate	NAn	ND (0.021)	ND (0.02)
Endosulfan II	NAn	ND (0.021)	ND (0.02)
Endrin	NAn	ND (0.021)	ND (0.02)
Endrin aldehyde	NAn	ND (0.11)	ND (0.1)
Gamma BHC (hexachlorobenzene)	NAn	ND (0.011)	ND (0.01)
Heptachlor	NAn	ND (0.011)	ND (0.01)
Heptachlor epoxide	NAn	ND (0.011)	ND (0.01)
Kepone (chlordecone)	NAn	ND (0.21)	ND (0.21)
p,p'-DDD	NAn	ND (0.021)	ND (0.02)
p,p'-DDE	NAn	ND (0.021)	ND (0.02)
p,p'-DDT	NAn	ND (0.021)	ND (0.02)

Table 13 (contd). Chemical Results for Equipment Rinsate Samples (January 2009 and January-February 2011).

Sample ID	**73ER-08 (Hold)**	**73ER-09**	**73ER-10**	**EQ Blk GW**	**EQ Blk Soil**
Date	13-Jan-09	14-Jan-09	15-Jan-09	31-Jan-11	01-Feb-11
Equipment Sampled	Unknown	Unknown	Unknown	GW sampling tubing	Scoop/sleeve/shoe
VOCs (µg/L)					
Carbon Disulfide				4.9 Jm	2.7 Jm
SemiVolatile Organic Compounds (µg/L)					
Bis (2-Ethylhexyl) phthalate				15 Jm	ND
Low Level Polycyclic Aromatic Hydrocarbons (µg/L)					
Naphthalene				0.022 J	0.024 J
Phenanthrene				0.012 J	
Metals (µg/L)					
Antimony	NAn	NAn	NAn	0.46 Jdic2	ND (5.0)Ji
Arsenic	NAn	NAn	NAn	ND (2.0) UJi	ND (2.0) UJi
Barium	NAn	NAn	NAn	ND (5.0)	ND (5.0)
Beryllium	NAn	NAn	NAn	ND (1.0) Ji	ND (1.0) Ji
Cadmium	NAn	NAn	NAn	ND (0.50) Ji	ND (0.50) Ji
Chromium	NAn	NAn	ND (2.5) D	ND (2.0) Jb2c2	ND (2.0) Jb2c2
Cobalt	NAn	NAn	ND (5) D	ND (5.0)	ND (5.0)
Copper	NAn	ND (2) D	ND (2) D	1.5 BUb1	2.6 BUb1
Lead	NAn	NAn	NAn	ND (1.0)	ND (1.0)
Nickel	NAn	ND (5) D	NAn	ND (5.0)	0.31 J
Selenium	NAn	NAn	NAn	ND (5.0)	2.5 J
Silver	NAn	NAn	NAn	ND (1.0)	ND (1.0)
Thallium	NAn	NAn	NAn	ND (1.0)	ND (1.0)
Tin	NAn	NAn	NAn	ND (0.10)	ND (0.10)
Vanadium	NAn	ND (5)	NAn	ND (5.0) UJb1b2	5 UJb1b2
Zinc	NAn	ND (20) D	ND (20) D	3.7 Jc2	2.9 Jc2
Mercury	NAn	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.20)

Bold text indicates the constituent detection or detection limit exceeds one or more screening levels.

NAn Not Analyzed.
B Analyte is found in method blank.
J Constituent estimated value below the analytical method detection limit or qualified during data validation.
ND Constituent not detected at the identified analytical method detection limit.
b1 Result is flagged due to method blank contamination; Reported value is raised to the reporting limit for values between the MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
b2 Result is flagged due to calibration blank contamination; Reported value is raised to the reporting limit for values netween MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
c2 Result is flagged due to initial calibration verification anomalies
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD is greater than specified.
i Result is flagged due to internal standard (organic and ICP/LC MS) or ICP interference check failure (inorganic).
m Result is flagged due to matrix spike recoveries outside the specified window

Data Validation for Table 13:

Metals:
No major or minor anomalies were encountered during data validation.

Pesticides:

The closing calibration verifications displayed an evident lack of analytical control, and associated sample results were rejected during data validation.

PAHs:
Critically low recoveries were observed for numerous analytes in the matrix spike, resulting in data rejection for non-detects and Jm flags for positive detections.

Table 14. Chemical Results for Field Blanks (March-April 2008).

Sample ID	**73FB-01**	**73FB-02**	**73FB-03**	**73FB-03A**
Date	1-Apr-08	1-Apr-08	1-Apr-08	1-Apr-08
Water Type	Lab Grade Deionized	Distilled	NAPR Tap	NAPR Tap
Volatile Organic Compounds (µg/L)				
1,1-Dichloroethene	0.2 Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
2-Butanone (MEK)	ND (5) Jp	ND (5) Jp	ND (5)	ND (5)
2-Hexanone	ND (5) Jp	ND (5) Jp	ND (5)	ND (5)
Acetone	ND (5) Jp	3.7J	3.1J	3.1J
Allyl chloride	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
Benzene	ND (0.5) Jp	ND (0.5) Jp	ND (0.5	ND (0.5)
Bromodichloromethane	ND (0.5) Jp	ND (0.5) Jp	12	12
Carbon disulfide	ND (0.5) Jp	ND (0.5) Jp	0.3J	0.2J
Chloroform	ND (0.5) Jp	ND (0.5) Jp	38	34
Chloromethane	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
Dibromochloromethane	ND (0.5) Jp	ND (0.5) Jp	1.8	2.1
Ethylbenzene	ND (0.5) Jp	0.1 Jp	ND (0.5)	ND (0.5)
Methyl iodide	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
Methylene chloride	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
Styrene	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
Toluene	0.2 Jp	1.2 Jp	ND (0.5)	ND (0.5)
Vinyl chloride	ND (0.5) Jp	ND (0.5) Jp	ND (0.5)	ND (0.5)
SemiVolatile Organic Compounds and Low Level Polycyclic Aromatic Hydrocarbons (µg/L)				
1-Methylnaphthalene	0.012J	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
2-Methylnaphthalene	ND (2) / 0.021J	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Acenaphthene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Acenaphthylene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Acetophenone	ND (5)	ND (5)	ND (5)	ND (5)
Anthracene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Benz(a)anthracene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Benzo(a)pyrene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Benzo(b)fluoranthene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Benzo (k)fluoranthene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Benzo(g,h,i)perylene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Butylbenzylphthalate	ND (5)	ND (5)	ND (5)	ND (5)
Chrysene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Dibenz(a,h)anthracene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Di(2-ethylhexyl)phthalate (DEHP)	ND (5)	ND (5)	ND (5)	ND (5)
Fluoranthene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Fluorene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Indeno(1,2,3-cd)pyrene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Naphthalene	ND (5) / 0.056	ND (5) / 0.42	ND (5 / 0.051)	ND (5 / 0.051)
Phenanthrene	ND (5) / 0.012J	ND (5 / 0.050)	ND (5 / 0.051)	ND (5 / 0.051)
Phenol	ND (5)	ND (5)	ND (5)	ND (5)
Pyrene	ND (5 / 0.051)	ND (5 / 0.050)	ND (5 / 0.050)	ND (5 / 0.051)

Table 14 (contd). Chemical Results for Field Blanks (March-April 2008).

Sample ID	**73FB-01**	**73FB-02**	**73FB-03**	**73FB-03A**
Date	1-Apr-08	1-Apr-08	1-Apr-08	1-Apr-08
Water Type	Lab Grade Deionized	Distilled	NAPR Tap	NAPR Tap
Metals (µg/L)				
Antimony	ND (5) Jm	ND (5) Jm	ND (5)	ND (5)
Arsenic	ND (4)	ND (4)	ND (4)	ND (4)
Barium	ND (5)	ND (5)	ND (5)	5.28
Beryllium	ND (2) Jlc	ND (2) Jlc	ND (2) Jm	ND (2) Jm
Cadmium	ND (2)	ND (2)	ND (2)	ND (2)
Chromium	ND (4)	ND (4)	ND (4)	ND (4)
Cobalt	ND (4)	ND (4)	ND (4)	ND (4)
Copper	ND (5)	ND (5)	51.1	52.4
Lead	ND (4)	ND (4)	ND (4)	ND (4)
Molybdenum	NAn	NAn	NAn	NAn
Nickel	ND (10)	ND (10)	ND (10)	ND (10)
Selenium	ND (4)	ND (4)	ND (4) Jm	ND (4) Jm
Silver	ND (2) Jl	ND (2) Jl	ND (2)	ND (2)
Thallium	ND (4)	ND (4)	ND (4)	ND (4)
Tin	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
Vanadium	ND (5)	ND (5)	ND (5)	ND (5)
Zinc	ND (23.5) Jdb	ND (13.4) Jdb	40.5 Jm	32.8 Jm
Mercury	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
Pesticides and PCBs (µg/L)				
Aroclor 1254	ND (0.50)	ND (0.50)	ND (0.51)	ND (0.50)
Aroclor 1260	ND (0.50)	ND (0.50)	ND (0.51)	ND (0.50)
Chlordane	ND (0.50)	ND (0.50)	ND (0.51)	ND (0.50)
Delta BHC (cyclohexane)	ND (0.010)	ND (0.0099)	ND (ND (0.010)	ND (0.0099)
Endosulfan sulfate	ND (0.020)	ND (0.020)	ND (0.021)	ND (0.020)
Endosulfan II	ND (0.020)	ND (0.020)	ND (0.021)	ND (0.020)
Endrin	ND (0.020)	ND (0.020)	ND (0.021) Jc	ND (0.020) Jc
Endrin aldehyde	ND (0.10)	ND (0.099)	ND (0.010)	ND (0.099)
Gamma BHC (hexachlorobenzene)	ND (0.010)	ND (0.0099)	ND (0.010)	ND (0.0099)
Heptachlor	ND (0.010)	ND (0.0099)	ND (0.010)	ND (0.0099)
Heptachlor epoxide	ND (0.010)	ND (0.0099)	ND (0.010)	ND (0.0099)
Kepone (chlordecone)	ND (0.20)	ND (0.20)	ND (0.21) Jc	ND (0.20) Jc
Methoxychlor	ND (0.10)	ND (0.099)	ND (0.10)	ND (0.099)
p,p'-DDD	ND (0.020)	ND (0.020)	ND (0.021)	ND (0.020)
p,p'-DDE	ND (0.020)	ND (0.020)	ND (0.021)	ND (0.020)
p,p'-DDT	ND (0.020)	ND (0.020)	ND (0.021) Jc	ND (0.020) Jc

NAn Not Analyzed.
J Constituent estimated value below the analytical method detection limit or qualified during data validation.
ND Constituent not detected at the identified analytical method detection limit.
c Result is flagged due to initial calibration anomalies related to linearity or response (kepone) or continuing calibration anomalies related to drift or response (endrin, p,p'-DDT, beryllium)
m Result is flagged due to matrix spike recoveries outside the specified window
l Result is flagged due to LCS anomalies
b Result is flagged due to method blank contamination
d Result is flagged due to duplicate imprecision (including matrix spike duplicates); RPD greater than specified.

Data Validation for Table 14:

Metals:

Some of the antimony results were flagged Jm due to depressed MS recoveries. Some of the beryllium samples were flagged Jlc due to a combination of laboratory control sample 9LCS) and continuing calibration verification (CCV) anomalies. Additional beryllium samples were flagged Jm due to MS recoveries. Silver results were flagged J due to poor LCS recoveries or blank contamination. Some selenium samples were flagged J due to a combination of LCS, MS and PDS anomalies. All aqueous zinc results were flagged as estimates due to a variety fo QC anomalies.

Pesticides and PCBs:

Multiple detects in samples 73FB-03 and duplicate 73FB-03A were qualified as non-detect and flagged with J due to either calibration or matrix spike anomalies.

VOCs:

In samples 73FB-03 and 73FB-03A dichlorodifluoromethane results were flagged Jc2 due to low recovery in the initial calibration verification (ICV). Part of the VOC data set was impacted by failure to meet preservation temperature requirements and were flagged Jp with a negative bias indicated.

SVOCs:

Results for several compounds were rejected in a broad cross section of the data due to either LCS, MS, or ICV recoveries less than half the control limit, including 1,4-naphthoquinone, 1,4-phenylenediamine, isosafarole, and methapyriline. Non-detects for phenolic compounds were rejected during data validation in samples 73FB-03 and 73FB03A due to surrogate recoveries. Also rejected, but at a lesser frequency, were results for 2-naphthylene and diallate.

PAHs:

Results for a number of PAHs were rejected in samples 73FB-03 and 73FB-03A due to matrix spike anomalies. Results for chrysene, 2-methylnaphthalene, and pyrene were infrequently flagged as estimates due to matrix spike anomalies.

Table 15. Chemical Results for Field Blanks (January 2009).

Sample ID	**73FB-04**	**73FB-05**	**73FB-06**	**73FB-06A**
Date	16-Jan-09	16-Jan-09	16-Jan-09	16-Jan-09
Water Type	Lab Grade Deionized	Distilled	NAPR Tap	NAPR Tap
Low Level Polycyclic Aromatic Hydrocarbons (µg/L)				
1-Methylnaphthalene	Rm	Rm	Rm	Rm
2-Methylnaphthalene	0.018 Jm	Rm	Rm	Rm
Acenaphthene	Rm	Rm	Rm	Rm
Acenaphthylene	Rm	Rm	Rm	Rm
Anthracene	Rm	Rm	Rm	Rm
Benzo[a]anthracene	Rm	Rm	Rm	Rm
Benzo[a]pyrene	Rm	Rm	Rm	Rm
Benzo[b]fluoranthene	ND (0.062)	ND (0.058) Js	ND (0.050)	ND (0.051)
Benzo[g,h,i]perylene	Rm	Rm	Rm	Rm
Benzo[k]fluoranthene	ND (0.062)	ND (0.058) Js	ND (0.050)	ND (0.051)
Chrysene	ND (0.062)	ND (0.058) Js	ND (0.050)	ND (0.051)
Dibenz[a,h]anthracene	Rm	Rm	Rm	Rm
Fluoranthene	ND (0.062)	ND (0.058) Js	ND (0.050)	ND (0.051)
Fluorene	ND (0.062)	ND (0.058) Js	ND (0.050)	ND (0.051)
Indeno[1,2,3-cd]pyrene	Rm	Rm	Rm	Rm
Naphthalene	0.041 J	ND (0.058) Js	ND (0.050)	ND (0.051)
Phenanthrene	0.020 Jm	Rm	Rm	Rm
Pyrene	Rm	Rm	Rm	Rm
PCBs and Pesticides (ug/L)				
Aroclor 1254	No data	No data	No data	No data
Aroclor 1260	No data	No data	No data	No data
Chlordane	ND (0.56)	ND (0.53)	Rc	Rc
Delta BHC	ND (0.011)	0.0058 J	Rc	Rc
Dieldrin	ND (0.022)	ND (0.021)	Rc	Rc
Endosulfan sulfate	ND (0.022)	ND (0.021)	Rc	Rc
Endosulfan II	ND (0.022)	ND (0.021)	Rc	Rc
Endrin	ND (0.022)	ND (0.021)	Rc	Rc
Endrin aldehyde	ND (0.11)	ND (0.11)	Rc	Rc
Gamma BHC (hexachlorobenzene)	ND (0.011)	ND (0.011)	Rc	Rc
Heptachlor	ND (0.011)	ND (0.011)	Rc	Rc
Heptachlor epoxide	ND (0.011)	ND (0.011)	Rc	Rc
Kepone (chlordecone)	ND (0.22)	ND (0.21)	Rc	Rc
p,p'-DDD	ND (0.022)	ND (0.021)	Rc	Rc
p,p'-DDE	ND (0.022)	ND (0.021)	Rc	Rc
p,p'-DDT	ND (0.022) Jc	ND (0.021) Jc	Rc	Rc

Table 15 (contd). Chemical Results for Field Blanks (January 2009).

Sample ID	**73FB-04**	**73FB-05**	**73FB-06**	**73FB-06A**
Date	16-Jan-09	16-Jan-09	16-Jan-09	16-Jan-09
Water Type	Lab Grade Deionized	Distilled	NAPR Tap	NAPR Tap
Metals (µg/L)				
Arsenic	ND (5) D	ND (5) D	ND (5) D	ND (5) D
Chromium	3.1 D	2.9 D	3.1 D	2.6 D
Cobalt	ND (5) D	ND (5) D	ND (5) D	ND (5) D
Copper	ND (2) D	ND (2) D	6.7 D	11 D
Nickel	ND (5) D	ND (5) D	ND (5) D	ND (5) D
Silver	ND (2) D	ND (2) D	ND (2) D	ND (2) D
Vanadium	ND (5)	ND (5)	ND (5)	ND (5)
Zinc	ND (20) D	ND (20) D	ND (20) D	ND (20) D
Mercury	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)

R Data is rejected or unuseable either quantitatively or qualitatively; a data gap is indicated.
m Result is flagged due to matrix spike recoveries outside the specified window
J Constituent estimated value below the analytical method detection limit or qualified during data validation.
ND Constituent not detected at the identified analytical method detection limit.
s Result is flagged due to surrogate recovery failures.
c Result is flagged due to continuing calibration anomalies related to drift or response
D Sample was diluted during analysis, elevating reporting limit.

Data Validation for Table 15:

Metals:

Extensive dilution was performed on all metals samples, elevating reporting limits.

Pesticides and PCBs:

The closing calibration verifications for pesticides displayed an evident lack of analytical control; associated samples were flagged Rc.

DDT was flagged Jc due to slight to modest calibration anomalies in some samples.

No data was found in available information regarding analysis of PCBs for these samples.

PAHs:

Critically low recoveries were observed for numerous analytes in the matrix spike resulting in Rm qualifiers for non-detects and Jm flags for positive detections.

Naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, and phenanthrene were identified as positive detections in one or more field blans. Cross-applying these values to the remaining field and equipment blanks resulted in the application of Ub flags to a number of samples where the difference between the blank and affected sample result was less than 5x. If a sample flagged U for this reason was also affected by severe matrix spike anomalies the final flag for those samples is URbm. Sample FB-05 displayed a surrogate failure such that any previously unflagged results were flagged UJs.

Table 16. Bird Species Reported at NAPR.

Common Name		
Pied-billed grobe	Red-billed tropic bird	Brown pelican
Brown booby	Magnificent frigatebird	Great blue heron
Louisiana heron	Snowy egret	Great egret
Striated heron	Little blue heron	Cattle egret
Least bittern	Yellow–crowned night heron	Black-crowned night heron
White-cheeked pintail	Blue-winged teal	American widgeon
Red-tailed hawk	Osprey	Merlin
Clapper rail	American coot	Caribbean coot
Common gallinule	Piping plover	Semipalmated plover
Black-bellied plover	Wilson's plover	Killdeer
Ruddy turnstone	Black-necked stilt	Whimbrel
Spotted sandpiper	Pectoral sandpiper	Short-billed dowithcher
Greater yellowlegs	Lesser yellowlegs	Willet
Stilt sandpiper	Pectoral sandpiper	Laughing gull
Royal tern	Sandwich tern	Bridled tern
Least tern	Brown noddy	White-winged dove
Zenaida dove	White-crowned pigeon	Mourning dove
Red-necked pigeon	Common ground dove	Bridled quail dove
Ruddy quail dove	Caribbean parakeet	Smooth-billed ani
Yellow-billed cuckoo	Mangrove cockoo	Short-eared owl
Chuck-will's widow	Common nighthawk	Antillean crested hummingbird
Green-throated carib	Antillean mango	Belted kingfisher
Gray kingbird	Loggerhead king	Stolid flycathcer
Carribbean elania	Purple martin	Cave swallow
Barn Swallow	Northern mockingbird	Pearly-eyed thrasher
Red-legged thrush	Black-whickered vireo	American redstart
Parula warbler	Prairie warbler	Yellow warbler
Magnolia warbler	Cape May warbler	Black-throated blue warbler
Adelaide's warbler	Palm warbler	Black and white warbler
Ovenbird	Northern water thrush	Bananaquit
Striped-headed tanager	Shiny cowbird	Black-cowled oriole
Great Antillean grackle	Yellow-shouldered blackbird	Hooded Mannikin
Yellow faced grassquit	Black-faced grassquit	Least sandpiper
Western sandpiper	Puerto Rican woodpecker	Rock dove
Puerto Rican emerald	Puerto Rican flycatcher	Pin-tailed whydah
Spice finch	Ruddy duck	Peregrine falcon
Marbled godwit	Puerto Rican lizard cuckoo	Prothonotary warbler
Green – winged teal	Orange-cheeked waxbill	Roseate tern
Least grebe	West Indian whistling duck	Puerto Rican screech owl
Puerto Rican tody		

Table 17. Threatened and Endangered Plants and Animals at NAPR.

Common Name	Federal Status	Commonwealth Status
Mammals		
West Indian Manatee	E	E
Reptiles		
Puerto Rican boa	E	E
Hawksbill turtle	E	E
Leatherback turtle	E	E
Loggerhead turtle	T	T
Green turtle	T	T
Virgin Islands tree boa	E	E
Birds		
Yellow-shouldered blackbird	E	E
Brown pelican	---	E
Peregrin Falcon	---	E
Least tern	---	V
Piping Plover	T	T
Least grebe	---	T
West Indian whistling duck	---	T
Caribbean coot	---	T
Roseate tern	T	T
Snowy plover	---	V
Plants		
Cobra negra	T	T

Key:

E = Endangered

T = Threatened

V = Vulnerable

Table 18. Log Kow Values for Organic Chemicals at SWMU 73.

Chemical	Log K_{ow}	Reference	Bioaccumulative Chemical
Benzo[a]anthracene	5.70	USEPA 1995	Yes
Benzo[a]pyrene	6.11	USEPA 1995	Yes
Benzo[b]fluoranthene	6.20	USEPA 1995	Yes
Benzo[g,h,i]perylene	6.70	USEPA 1995	Yes
Benzo[k]fluoranthene	6.20	USEPA 1995	Yes
Chrysene	5.70	USEPA 1995	Yes
Endrin	5.06	USEPA 1995	Yes
Fluoranthene	5.12	USEPA 1995	Yes
Indeno[1,2,3-cd]pyrene	6.65	USEPA 1995	Yes
Pyrene	5.11	USEPA 1995	Yes
Chlordane	6.32	USEPA 1995	Yes
Dieldrin	5.40	SRC 1998	Yes
Heptachlor	6.26	USEPA 1995	Yes
Heptachlor epoxide	5.00	USEPA 1995	Yes
Kepone	5.30	USEPA 1995	Yes
p,p'-DDD	6.10	USEPA 1995	Yes
p,p'-DDE	6.76	USEPA 1995	Yes
p,p'-DDT	6.53	USEPA 1995	Yes
Aroclor 1254	6.79	SRC 1998	Yes
Aroclor 1248	6.34	SRC 1998	Yes
Aroclor 1260	8.27	SRC 1998	Yes
2-butanone	0.28	USEPA 1995	No
acetone	-0.24	USEPA 1995	No
carbon disulfide	2.00	USEPA 1995	No
methyliodide	1.51	SRC 1998	No

Notes:

K_{ow} = Ocatnol-Water Partitian Coefficient
SRC = Syracuse Research Corporation
USEPA = United States Environmental Protection Agency

* An organic chemical is considered a bioaccumulative chemical if its Log K_{ow} value is greater than or equal to 3.0.

USEPA. 1995. Internal Report on Summary of Measured, Calculated and Recommended Log K_{ow} Values. Environmental Research Laboratory, Athens, GA. April 10, 1995.

Syracuse Research Corporation (SRC). 1998. Experimental Octanol/Water Partition Coefficient (Log P) Database.

http://www.syrres.com/esc/default.htm

Table 19. Soil Bioconcentration Factors Used for Terrestrial Plants and Soil Bioaccumulation Factors Used For Terrestrial Invertebrates.

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference	Value	Reference
PAHs:				
Benzo[a]anthracene	0.540	USEPA 2007	1.42	USEPA 2007
Benzo[a]pyrene	0.820	USEPA 2007	1.27	USEPA 2007
Benzo[b]fluoranthene	0.480	USEPA 2007	1.25	USEPA 2007
Benzo[g,h,i]perylene	1.600	USEPA 2007	1.09	USEPA 2007
Benzo[k]fluoranthene	0.820	USEPA 2007	1.25	USEPA 2007
Chrysene	1.050	USEPA 2007	1.42	USEPA 2007
Endrin	1.00	Assumed	1.00	Assumed
Fluoranthene	6.000	USEPA 2007	1.68	USEPA 2007
Indeno[1,2,3-cd]pyrene	0.150	USEPA 2007	1.11	USEPA 2007
Pyrene	3.700	USEPA 2007	1.65	USEPA 2007
Pesticides and PCBs:				
Chlordane	1.000	Assumed	1.00	Assumed
Dieldrin	2.222	USEPA 2007	1.00	Assumed
Heptachlor	1.000	Assumed	1.00	Assumed
Heptachlor epoxide	1.000	Assumed	1.00	Assumed
Kepone	1.000	Assumed	1.00	Assumed
p,p'-DDD	1.000	Assumed	1.00	Assumed
p,p'-DDE	0.620	USEPA 2007	1.00	Assumed
p,p'-DDT	0.079	USEPA 2007	1.00	Assumed
Aroclor 1254	0.01	USEPA 2007	1.13	Assumed
Metals:				
Barium	0.447	Bechtel Jacobs 1998	0.16	Sample et al. 1998
Chromium	0.084	Bechtel Jacobs 1998	3.16	Sample et al. 1998
Cobalt	0.025	Bechtel Jacobs 1998	0.29	Sample et al. 1998
Copper	0.625	Bechtel Jacobs 1998	1.53	Sample et al. 1998
Lead	0.468	Bechtel Jacobs 1998	1.52	Sample et al. 1998
Nickel	1.411	Bechtel Jacobs 1998	4.73	Sample et al. 1998

Table 19 (cont'd). Soil Bioconcentration Factors Used for Terrestrial Plants and Soil Bioaccumulation Factors Used For Terrestrial Invertebrates.

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	**Reference**	**Value**	**Reference**
Metals:				
Selenium	3.012	Bechtel Jacobs 1998	1.34	Sample et al. 1998
Vanadium	0.010	Bechtel Jacobs 1998	0.09	Sample et al. 1998
Zinc	1.820	Bechtel Jacobs 1998	12.89	Sample et al. 1998
Mercury	5.00	Bechtel Jacobs 1998	20.63	Sample et al. 1998

Notes:
BCF = Bioconcentration Factor
BAF = Bioaccumulation Factor
PAH = Polynuclear Aromatic Hydrocarbon

Table References:

Bechtel Jacobs. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for U.S. Department of Energy. BJC/OR-133.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL
Environmental Restoration Program. ES/ER/TM-220

United States Environmental Protection Agency (USEPA). 2007. Attachement 4-1 of Guidance for Developing Ecological Screening Levels Eco-SSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs.
(Office of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55.

Table 20. Plant-to-Omnivorous Mammal BCFs Used to Estimate Chemical Concentrations in Small Mammal Tissue.

Chemical	FCM3	FCM2	Reference	Bamammal	Reference	Plant-Omnivore BCF
PAHs:						
Benzo[a]anthracene	8.00	1.00	USEPA 1999	0.0399	CHPPM 2007	0.0003
Benzo[a]pyrene	11.00	1.00	USEPA 1999	0.0376	CHPPM 2007	0.0003
Benzo[b]fluoranthene	12.00	1.00	USEPA 1999	0.0362	CHPPM 2007	0.0003
Benzo[g,h,i]perylene	14.00	1.00	USEPA 1999	0.0294	CHPPM 2007	0.0003
Benzo[k]fluoranthene	12.00	1.00	USEPA 1999	0.0365	CHPPM 2007	0.0003
Chrysene	8.00	1.00	USEPA 1999	0.0399	CHPPM 2007	0.0003
Endrin	7.10	1.00	USEPA 1999	0.0351	CHPPM 2007	0.0003
Fluoranthene	3.60	1.00	USEPA 1999	0.0392	CHPPM 2007	0.0003
Indeno[1,2,3-cd]pyrene	14.00	1.00	USEPA 1999	0.0294	CHPPM 2007	0.0003
Pyrene	3.60	1.00	USEPA 1999	0.0384	CHPPM 2007	0.0003
Pesticides and PCBs:						
Chlordane	13.00	1.00	USEPA 1999	0.0406	CHPPM 2007	0.0004
Dieldrin	5.50	1.00	USEPA 1999	0.0338	CHPPM 2007	0.0003
Heptachlor	12.00	1.00	USEPA 1999	0.0308	CHPPM 2007	0.0003
Heptachlor epoxide	3.20	1.00	USEPA 1999	0.0407	CHPPM 2007	0.0004
Kepone	4.80	1.00	USEPA 1999	1.0000	CHPPM 2007	0.0086
p,p'-DDD	11.00	1.00	USEPA 1999	0.0376	CHPPM 2007	0.0003
p,p'-DDE	14.00	1.00	USEPA 1999	0.0399	CHPPM 2007	0.0003
p,p'-DDT	14.00	1.00	USEPA 1999	0.0325	CHPPM 2007	0.0003
Aroclor 1254	1.00	1.00	USEPA 1999	0.03	CHPPM 2007	0.0003
Metals:						
Barium	1.00	1.00	USEPA 1999	0.0002	CHPPM 2007	0.000001
Chromium	1.00	1.00	USEPA 1999	0.0055	CHPPM 2007	0.000047
Cobalt	1.00	1.00	USEPA 1999	0.0200	CHPPM 2007	0.0002
Copper	1.00	1.00	USEPA 1999	0.0100	Baes et al. 1984	0.0001
Lead	1.00	1.00	USEPA 1999	0.0003	CHPPM 2007	0.000003
Nickel	1.00	1.00	USEPA 1999	0.0060	CHPPM 2007	0.00005
Selenium	1.00	1.00	USEPA 1999	0.0023	CHPPM 2007	0.00002
Vanadium	1.00	1.00	USEPA 1999	0.0025	CHPPM 2007	0.000001
Zinc	1.00	1.00	USEPA 1999	0.0001	CHPPM 2007	0.0022
Mercury	1.00	1.00	USEPA 1999	0.2500	Baes et al. 1984	0.0003

Notes:
BCF = Bioconcentration Factor
PAH = Polynuclear Aromatic Hydrocarbon

Table References

CHPPM. 2007. Development of Fate and Transport Parameter Datasets for Use in Environmental Health Risk Assessments Version 4. Aberdeen Proving Ground (MD): U.S. Army Center for Health Promotion and Preventive Medicine, Environmental Health Risk Assessment Program.

Baes CF, Sharp RD, Sjoreen AL, Shor RW. 1984. Review and Analysis of Parameters and Assessing Transport of Environmentally Released Radionuclides Through Agriculture. Oak Ridge (TN): Oak Ridge National Laboratory.

Table 21. Soil-to-Omnivorous Mammal BCFs Used to Estimate Chemical Concentrations in Small Mammal Tissue.

Chemical	Soil-Omnivore BAF (dry weight)	
	Value	Reference
PAHs:		
Benzo[a]anthracene	1.00	Assumed
Benzo[a]pyrene	1.00	Assumed
Benzo[b]fluoranthene	1.00	Assumed
Benzo[g,h,i]perylene	1.00	Assumed
Benzo[k]fluoranthene	1.00	Assumed
Chrysene	1.00	Assumed
Endrin	1.00	Assumed
Fluoranthene	1.00	Assumed
Indeno[1,2,3-cd]pyrene	1.00	Assumed
Pyrene	1.00	Assumed
Pesticides and PCBs:		
Chlordane	1.00	Assumed
Dieldrin	1.00	Assumed
Heptachlor	1.00	Assumed
Heptachlor epoxide	1.00	Assumed
Kepone	1.00	Assumed
p,p'-DDD	1.00	Assumed
p,p'-DDE	1.00	Assumed
p,p'-DDT	1.00	Assumed
Aroclor 1254	1.00	Assumed
Metals:		
Barium	0.360	Sample et al. 1998
Chromium	0.349	Sample et al. 1998
Cobalt	0.025	Sample et al. 1998
Copper	0.554	Sample et al. 1998
Lead	0.286	Sample et al. 1998
Nickel	0.589	Sample et al. 1998
Selenium	1.340	Sample et al. 1998
Vanadium	0.018	Sample et al. 1998
Zinc	2.782	Sample et al. 1998
Mercury	0.192	Sample et al. 1998

Notes:
BCF = Bioconcentration Factor
BAF = Bioaccumulation Factor
PAH = Polynuclear Aromatic Hydrocarbon

Table References: ES/ER/TM-220

Table 22. Conservative Exposure Parameters For Upper Trophic Level Receptors.

Receptor	Body Weight (kg)		Food Ingestion Rate (kg/day-dw)		Area Use
	Value	Reference	Value	Reference	Factor
Birds:					1.00
American robin	0.064	USEPA 1993	0.0057	Levey and Karasov 1989	1.00
Mourning dove	0.105	Tomlinson et al. 1994	0.0179	Nagy 1987 [1]	1.00
Red-tailed hawl	0.957	USEPA 1993	0.0395	Sample and Suter II 1994	1.00
Mammals:					1.00
Small mammal omnivore (prey)	0.175	Jackson 1992	0.0176	Nagy 1987 [2]	1.00

Notes:
[1] = an allometric equation for birds was used
[2] = an allometric equation for rodents was used
kg = kilograms
kg/day-dry = kilograms (dry weight) of food ingestion per day
USEPA = United States Environmental Protection Agency

Table References

Jackson, W.B. 1992. Norway Rat and Allies. Chapter 54 in Chapman, J.A. and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management, and Economics. The Johns Hopkins University Press, Baltimore, MD.

Levey, D.J. and W.H. Karasov. 1989. Digestive Responses of Temperate Birds Switched to Fruit or Insect Diets. Auk. 106: 675-686.

Nagy, K.A. 1987. Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds. Ecol. Monogr. 57:111-128

Sample, B. E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-125.

Tomlinson, R.E., D.D. Dolton, R.R. Mirarchi. 1994. Mourning Dove. In T.C. Tacha and C.E. Braun (eds), Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. Fish and Wildlife Agencies, Washington, D.C.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

Table 23. Dietary Composition for Upper Trophic Level Receptors.

Receptor	Dietary Composition (percent)				Soil Ingestion (percent)	
	Terr. Plants	Soil Invert.	Small Mammals	Reference	Value	Reference
Birds:						
American robin	12.0	78.9 [1]	0	Martin et al. 1951	9.1	Sample and Suter II 1994
Mourning dove	95.0	0	0	Tomlinson et al. 1994	5.0	Assumed
Red-tailed hawl	0	0	97.5	USEPA 1993; *SS	2.5	Assumed
Mammals:						
Small mammal omnivore (prey)	49.0	49.0	0	Assumed	2.0	Assumed

Notes:

[1] = For dietary compositions the highest percentage of terrestrial insects was reported for spring

*SS = Sample and Suter II 1994 reference

USEPA = United States Environmental Protection Agency

Table References

Martin, A.C., H.S. Zim, and A.L. Nelson. 1951. American Wildlife and Plants: A Guide to Wildlife Food Habits. Dover Publications, Inc. New York, NY

Sample, B. E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-125

Tomlinson, R.E., D.D. Dolton, R.R. Mirarchi. 1994. Mourning Dove. In T.C. Tacha and C.E. Braun (eds), Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. Fish and Wildlife Agencies, Washington, D.C.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

Table 24. Results of the SLERA: Frequency and Surface Soil Chemicals Retained as Chemicals of Potential Concern.

Analyte	No. of Positive Detections/ No. of Samples	Maximum Value	Surface Soil Screening Value	Max HQ	Ecological COPC?	Comments
Volatile Organic Compounds (µg/kg)						
2-Butanone {MEK}	12/24	41.0	N/A	--	Yes	Data Gap
Acetone	23/24	410.0	N/A	--	Yes	Data Gap
Bromomethane	2/24	6.0	N/A	--	Yes	Data Gap
Carbon disulfide	9/24	6.0	N/A	--	Yes	Data Gap
Methyl iodide	2/24	22.0	N/A	--	Yes	Data Gap
PAHs (µg/kg)						
Benzo[a]anthracene	30/30	4000.0	1,200	3.33	Yes	HQ≥1
Benzo[a]pyrene	30/30	3400.0	1,200	2.83	Yes	HQ≥1
Benzo[b]fluoranthene	30/30	4800.00	1,200	4.00	Yes	HQ≥1
Benzo[g,h,i]perylene	30/30	1800.0	1,200	1.50	Yes	HQ≥1
Benzo[k]fluoranthene	30/30	1900.0	1,200	1.58	Yes	HQ≥1
Chrysene	30/30	4200.0	1,200	3.50	Yes	HQ≥1
Fluoranthene	30/30	1900.0	1,200	1.58	Yes	HQ≥1
Indeno[1,2,3-cd]pyrene	30/30	1700.0	1,200	1.42	Yes	HQ≥1
Pyrene	30/30	3100.0	1,200	2.58	Yes	HQ≥1
Pesticides and PCBs (µg/kg)						
Aroclor 1248	1/9	8400.0	N/A	--	Yes	Data Gap
Aroclor 1254	6/33	8400.0	N/A	--	Yes	Data Gap
Aroclor 1260	17/33	8400.0	N/A	--	Yes	Data Gap
Chlordane	2/9	9800.0	100	98.0	Yes	HQ≥1
Delta-BHC	2/24	480	201	2.3	Yes	HQ≥1
Dieldrin	10/33	980.0	401	2.4	Yes	HQ≥1
Endosulfan sulfate	2/24	980.0	100	9.8	Yes	HQ≥1
Endrin aldehyde	2/24	980.0	100	9.8	Yes	HQ≥1

Table 24 (cont'd). Results of the SLERA: Frequency and Surface Soil Chemicals Retained as Chemicals of Potential Concern.

Analyte	No. of Positive Detections/ No. of Samples	Maximum Value	Surface Soil Screening Value	Max HQ	Ecological COPC?	Comments
Pesticides and PCBs (µg/kg)						
Heptachlor	6/33	480.0	100	4.8	Yes	HQ≥1
Heptachlor epoxide	6/24	480.0	100	4.8	Yes	HQ≥1
Kepone	9/33	43000	100	430.0	Yes	HQ≥1
Methoxychlor	2/24	4800	100	48.0	Yes	HQ≥1
p,p'-DDD	5/33	5500.0	401	13.7	Yes	HQ≥1
p,p'-DDE	28/33	9600.0	401	23.9	Yes	HQ≥1
p,p'-DDT	26/33	77000.0	401	192.0	Yes	HQ≥1
Metals (mg/kg)						
Barium	45/45	430.0	330.0	1.30	Yes	HQ≥1
Chromium	52/52	180.0	.40	450.0	Yes	HQ≥1
Cobalt	55/55	290.0	13.0	22.3	Yes	HQ≥1
Copper	55/55	290.0	70.0	4.1	Yes	HQ≥1
Lead	45/45	370.0	120.0	3.0	Yes	HQ≥1
Nickel	47/47	63.0	30.0	2.1	Yes	HQ≥1
Thallium	3/38	2.0	1.0	2.0	Yes	HQ≥1
Vanadium	49/49	330.0	2.0	165.0	Yes	HQ≥1
Zinc	62/62	500.0	50.0	10.0	Yes	HQ≥1
Mercury	56/60	4.4	.10	44.0	Yes	HQ≥1

Notes:

HQ = hazard quotient
N/A= not available
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram

Table 25. Results of the SLERA: Frequency and SubSurface Soil Chemicals Retained as Chemicals of Potential Concern.

Analyte	No. of Positive Detections/ No. of Samples	Maximum Value	Surface Soil Screening Value	Max HQ	Ecological COPC?	Comments
Volatile Organic Compounds (µg/kg)						
2-Butanone	1/2	10.0	N/A	--	Yes	Data Gap
Acetone	2/2	37.0	N/A	--	Yes	Data Gap
Bromomethane	0/2	5.0	N/A	--	Yes	Data Gap
Carbon disulfide	1/2	5.0	N/A	--	Yes	Data Gap
Chloromethane	0/2	5.0	N/A	--	Yes	Data Gap
Methyl iodide	0/2	5.0	N/A	--	Yes	Data Gap
Allyl chloride	0/2	5.0	N/A	--	Yes	Data Gap
Pesticides and PCBs (µg/kg)						
Endrin	1/1	1100.0	401	2.7	Yes	HQ≥1
Chlordane	1/1	900.0	100	9.0	Yes	HQ≥1
p,p'-DDD	1/1	1100.0	401	2.7	Yes	HQ≥1
p,p'-DDE	1/1	3100.0	401	7.7	Yes	HQ≥1
p,p'-DDT	1/1	14000.0	401	34.9	Yes	HQ≥1
Metals (mg/kg)						
Chromium	3/3	46.0	.40	115.0	Yes	HQ≥1
Cobalt	3/3	55.0	13.0	4.2	Yes	HQ≥1
Copper	3/3	460.0	70.0	6.5	Yes	HQ≥1
Selenium	1/3	1.1	1.0	1.1	Yes	HQ≥1
Vanadium	3/3	300.0	2.0	150.0	Yes	HQ≥1
Zinc	3/3	600.0	50.0	12.0	Yes	HQ≥1
Mercury	2/3	0.1	0.1	1.5	Yes	HQ≥1

Notes:

HQ = hazard quotient
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram

Table 26. Results of the SLERA: Frequency and Groundwater Chemicals Retained as Chemicals of Potential Concern.

Analyte	No. of Positive Detections/ No. of Samples	Maximum Value	Ground Water Screening Value	Max HQ	Ecological COPC?	Comments
Pesticides and PCBs (µg/kg)						
p,p'-DDD	2/3	0.1	0.03	3.3	Yes	HQ≥1
p,p'-DDT	1/3	0.1	0.001	100.0	Yes	HQ≥1
Metals (mg/kg)						
Cadmium	2/5	15.0	8.85	1.69	Yes	HQ≥1
Cobalt	5/8	277.0	45.0	6.1	Yes	HQ≥1
Copper	6/7	140.0	3.7	37.5	Yes	HQ≥1
Nickel	6/9	140.0	8.28	16.9	Yes	HQ≥1
Silver	4/6	5.9	0.2	26.0	Yes	HQ≥1
Zinc	4/5	190.0	85.6	2.2	Yes	HQ≥1

Notes:

HQ = hazard quotient
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram

Table 27. Hazard Quotients for Terrestrial Food Web Exposures: Surface Soil.

Chemical	Red-tailed hawk			American robin			Mourning Dove		
	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT
Chlordane	1.1	0.23	0.5	0.4	0.0	0.1	0.7	0.1	0.3
p,p'-DDD	23.7	2.3	7.5	9.8	0.9	3.1	18.7	1.8	5.9
p,p'-DDE	66.2	6.6	20.9	18.6	1.8	5.8	1.9	0.1	0.6
p,p'-DDT	422.5	42.2	133.6	137.5	13.7	43.4	262.0	26.2	82.8
Aroclor 1254	14.4	0.5	4.5	4.0	0.4	1.2	0.4	0.0	0.1
Endrin aldehyde	2.6	0.2	0.8	8.7	0.8	2.7	16.6	1.6	5.2
Kepone	2.4		0.9	2.2	0.3	0.8	4.3	0.6	1.6
Chromium	6.8	0.6	2.1	15.6	1.5	4.9	0.6	0.0	0.2
Cobalt	0.7	0.0	0.2	3.0	0.3	0.9	0.4	0.0	0.1
Copper	0.4	0.1	0.2	8.7	2.9	5.08	7.8	2.6	4.5
Vanadium	3.4	0.2	2.4	13.7	6.8	9.7	9.0	4.5	6.3
Zinc	8.7	0.9	2.9	32.2	3.5	10.7	10.4	1.1	3.4
Mercury	68.2	22.7	39.3	256.4	85.4	148.0	138.2	46.0	79.8

Notes:

Shaded cells indicate a hazard quotient greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration

Table 28. Hazard Quotients for Terrestrial Food Web Exposures: SubSurface Soil.

Chemical	Red-tailed hawk			American robin			Mourning Dove		
	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT
Endrin	2.3	0.0	0.7	9.8	0.9	3.1	15.7	1.5	4.9
p,p'-DDD	6.0	0.0	1.9	1.9	0.1	0.6	3.14	0.3	0.9
p,p'-DDE	17.2	0.0	5.4	6.0	0.1	1.9	0.5	0.0	0.1
p,p'-DDT	77.8	0.1	24.6	25.0	0.1	7.9	40.0	4.0	12.6
Chromium	1.1	0.1	0.3	3.9	0.0	1.2	0.1	0.0	0.0
Copper	3.5	1.2	2.0	13.2	0.0	7.6	1.5	0.5	0.9
Molybdenum	---	---	---	2.0	0.0	0.6	3.3	0.3	1.0
Vanadium	54.2	27.1	38.3	12.6	0.1	8.9	6.9	3.4	4.9
Zinc	---	---	---	38.7	0.0	12.8	10.5	1.1	3.4
Mercury	2.3	0.7	1.3	8.7	0.0	5.04	3.9	1.3	2.2

Notes:

Shaded cells indicate a hazard quotient greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration

Table 29. Uncertainties Associated with the Screening-Level Ecological Risk Assessment.

Key Methodology	**Discussion of Uncertainty**
Problem Formulation/Site Characterization	
Selected wildlife receptors are assumed to be present at the NAPR year round.	All species selected may not be present at the NAPR year round. However, based on professional judgment, they were chosen to be the most representative for the habitats at NAPR.
Identification of COPCs	
Chemicals without screening values and non-detects	Chemicals without screening values and non-detected chemicals were retained as COPCs
NOAEL screening values for assessing upper trophic levels	For upper trophic level receptors the use of NOAEL-based screening values is very conservative since it is not evident how much higher a dose must be before adverse effects are observed.
Exposure Point Concentrations	
Using maximum concentrations for upper trophic level receptors	Using maximum chemical concentrations to evaluate upper trophic level receptor exposure is conservative since these receptors are mobile and can have large home ranges.
Media-Specific Screening Values	
Using the minimum value from plant and earthworm screening values or the only available screening value	For some chemicals only a plant or earthworm soil screening value was available in the literature so assumptions were made in the SLERA that the selected screening value was protective of both receptor communities. Also, when a plant and earthworm value was present, the minimum value was selected for use in the SLERA.
Ingestion-based Screening Values	
Use of NOAELs and LOAELs derived from laboratory studies	NOAELs and LOAELs derived from laboratory studies with non-wildlife species may overestimate or underestimate potential risks if the sensitivities of the receptor and test species differ greatly
Using worse form of metals in the SLERA (i.e., methyl mercury)	The SLERA assumed that the metals (e.g., mercury) detected in soil was methyl mercury and NOAELs were selected based on that assumption. This likely resulted in an overestimation of potential risks.
Uncertainty factors are used to estimate chronic NOAELs.	Uncertainty factors are only used when such NOAELs did not exist.
Ecological Receptors	
Reptiles and amphibians were not selected as ecological receptors	Although exposure pathways to terrestrial reptiles and amphibians may exist, they were not evaluated due to the lack of life history and screening-level values for use in the SLERA.

Table 29(cont'd). Uncertainties Associated with the Screening-Level Ecological Risk Assessment.

Key Methodology	**Discussion of Uncertainty**
Exposure Routes	
Dermal and inhalation pathways are not evaluated.	These pathways are difficult to evaluate, because guidance and toxicological data is unavailable.
Food Web Exposure Modeling	
Chemical concentrations in terrestrial food items were modeled	Chemical concentrations in food items (plants, earthworms, and small mammals) were modeled using BAFs and BCFs instead of directly measured thus introducing uncertainty into risk estimates
Using a default factor of 1.0 when a BAF or BCF was unavailable	Using a default factor of 1.0 to estimate the concentration of chemicals in receptor prey may underestimate potential risks to upper trophic level receptors for chemicals that bioaccumulate
The BCF-FCM approach used to estimate COPC concentrations in terrestrial birds	The BCF-FCM approach was originally developed for aquatic food webs and not terrestrial webs. However, there is no other method available to estimate COPC concentrations in wildlife food items for upper trophic level receptors.
Use of Conservative exposure parameters	The use of maximum ingestion rates, minimum body weights, and an AUF of 1 tends to overestimate potential risks to upper trophic level receptors.

Table 30. Less Conservative Soil Biocencentration Factors Used for Terrestrial Plants and Soil Bioaccumulation Factors Used For Terrestrial Invertebrates.

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	**Reference**	**Value**	**Reference**
Metals:				
Copper	0.123	Bechtel Jacobs 1998	0.47	Sample et al. 1998
Zinc	0.358	Bechtel Jacobs 1998	2.48	Sample et al. 1998
Mercury	0.344	Bechtel Jacobs 1998	1.19	Sample et al. 1998

Notes:

BCF = Bioconcentration Factor
BAF = Bioaccumulation Factor

Table References

Bechtel Jacobs. 1998. Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants. Prepared for U.S. Department of Energy. BJC/OR-133. September 1998.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. Oak Ridge National Laboratory, Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-220

United States Environmental Protection Agency (USEPA). 2007. Attachement 4-1 of Guidance for Developing Ecological Screening Levels (Eco-SSLs): Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs. Ofice of Solid Waste and Emergency Response, Washington, D.C. OSWER Directive 9285.7-55

Table 31. Less Conservative Exposure Parameters For Upper Trophic Level Receptors.

Receptor	Body Weight (kg)		Food Ingestion Rate (kg/day-dw)		Area Use Factor
	Value	Reference	Value	Reference	
Birds:					1.00
American robin	0.077	USEPA 1993	0.0043	Levey and Karasov 1989	1.00
Mourning dove	0.127	Tomlinson et al. 1994	0.0152	Nagy 1987 [1]	1.00
Red-tailed hawl	1.126	USEPA 1993	0.0360	Sample and Suter II 1994	1.00
Mammals:					1.00
Small mammal omnivore	0.275	Jackson 1992	0.0148	Nagy 1987 [2]	1.00
(prey)					

Notes:

[1] = an allometric equation for birds was used

[2] = an allometric equation for rodents was used

kg = kilograms

kg/day-dry = kilograms (dry weight) of food ingestion per day

USEPA = United States Environmental Protection Agency

Table References:

Jackson, W.B. 1992. Norway Rat and Allies. Chapter 54 in Chapman, J.A. and G.A. Feldhamer (eds.), Wild Mammals of North America: Biology, Management, and Economics. The Johns Hopkins University Press, Baltimore, MD.

Levey, D.J. and W.H. Karasov. 1989. Digestive Responses of Temperate Birds Switched to Fruit or Insect Diets. Auk. 106: 675-686.

Nagy, K.A. 1987. Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds. Ecol. Monogr. 57:111-128

Sample, B. E. and G.W. Suter II. 1994. Estimating Exposure of Terrestrial Wildlife to Contaminants. Environmental Restoration Division, ORNL Environmental Restoration Program. ES/ER/TM-125

Tomlinson, R.E., D.D. Dolton, R.R. Mirarchi. 1994. Mourning Dove. In T.C. Tacha and C.E. Braun (eds), Migratory Shore and Upland Game Bird Management in North America. Int. Assoc. Fish and Wildlife Agencies, Washington, D.C.

USEPA. 1993. Wildlife Exposure Factors Handbook. Office of Research and Development, Washington, D.C. EPA/600/R-93/187a.

Table 32. Summary of Refined Hazard Quotients for Lower Trophic Level Receptors.

Chemical	Lower Trophic Level Receptors		
	Surface Soil	**Subsurface Soil**	**Ground Water**
Chlordane	HQ=22.4	HQ=9.0	---
Endrin	---	HQ=2.7	---
Endosulfan sulfate	HQ=2.2	---	---
Endrin aldehyde	HQ=2.2	---	---
Heptachlor	HQ=1.1	---	---
Kepone	HQ=96.3	---	---
Methoxychlor	HQ=10.8	---	---
p,p'-DDD	HQ=2.3	HQ=22.0	HQ=3.3
p,p'-DDE	HQ=6.1	HQ=62.0	HQ=0.7
p,p'-DDT	HQ=42.6	HQ=280.0	HQ=100.0
Cadmium	---	---	HQ=0.8
Cobalt	---	HQ=4.2	---
Copper	HQ=2.9	HQ=3.5	HQ=17.3
Thallium	HQ=1.4	---	---
Selenium	---	HQ=1.0	---
Silver	---	---	HQ=13.2
Zinc	HQ=3.0	HQ=5.1	---
Mercury	HQ=12.4	HQ=0.6	---

Notes:

Shaded cells indicate a hazard quotient greater than 1.0

HQ = Hazard Quotients
--- = Not applicable

Table 33. Summary of Descriptive and Distributional Statistics for Ecological COPCs.

Surface Soil (mg/kg)					
Substance	**Location**	**Frequency of detection**	**Mean**	**SD**	**Test/ p-value**
Barium	Background	20/20	81.8	1.83	t-test on logs p=.296
	SWMU 73	47/47	89.29	1.86	
Chromium	Background	21/21	24.9	12.4	t-test on logs p=.040
	SWMU 73	54/54	38.7	39.23	
Cobalt	Background	19/19	20.39	1.62	t-test on logs p=.573
	SWMU 73	54/54	19.85	2.01	
Copper	Background	19/19	77.2	45.4	t-test p=<.001
	SWMU 73	57/57	161.0	73.06	
Lead	Background	19/19	6.05	2.23	t-test on logs p=<.001
	SWMU 73	47/47	19.67	3.89	
Mercury	Background	18/21	0.04	2.05	t-test on logs p=.001
	SWMU 73	4/60	0.14	5.32	
Nickel	Background	20/20	9.03	1.65	t-test on logs p=<.001
	SWMU 73	40/40	17.03	1.72	
Selenium	Background	5/24	0.54	0.319	t-test on proportions p=.041
	SWMU 73	6/13	1.17	0.27	
Vanadium	Background	18/18	134.29	1.65	t-test on logs p=.225
	SWMU 73	51/51	142.21	1.71	
Zinc	Background	19/19	41.82	2.08	t-test on logs p=<.001
	SWMU 73	64/64	106.85	1.97	
Subsurface Soil (mg/kg)					
Beryllium	Background	9/14	0.32	0.31	t-test p=.964
	SWMU 73	3/3	0.16	0.02	
Chromium	Background	15/15	17.3	2.17	t-test on logs p=.001
	SWMU 73	6/6	70.09	1.94	
Cobalt	Background	14/14	19.10	2.15	t-test on logs p=.148
	SWMU 73	6/6	25.39	1.47	
Copper	Background	13/13	52.32	1.69	t-test on logs p=<.001
	SWMU 73	7/7	162.66	1.66	
Mercury	Background	2/15	0.021		t-test of proportions p=.0536
	SWMU 73	4/7	0.0268		
Selenium	Background	2/13	0.49	0.35	t-test of proportions p=.4893
	SWMU 73	1/3	0.70	0.35	
Vanadium	Background	14/14	125.63	65.17	t-test p=.121
	SWMU 73	6/6	173.33	81.89	
Zinc	Background	12/14	38.65	1.68	t-test on logs p=.006
	SWMU 73	7/7	117.45	2.31	

Table 33 (cont'd). Summary of Descriptive and Distributional Statistics for Ecological COPCs.

Groundwater (µg/l)					
Substance	**Location**	**Frequency of detection**	**Mean**	**SD**	**Test/ p-value**
Cadmium	Background	5/15	8.6	13.9	Cannot perform test – small sample size
	SWMU 73	3/5	7.61	6.7	
Cobalt	Background	9/14	131.1	224.7	Wilcoxon Rank Sum p=.784
	SWMU 73	5/8	80.1	117.9	
Copper	Background	6/14	71.7	157.2	Cannot perform test – small sample size
	SWMU 73	6/7	65.8	54.2	
Nickel	Background	8/14	25.0	29.5	Gehan test p=.201
	SWMU 73	7/10	51.6	59.4	
Silver	Background	3/15	1.5	1.0	Cannot perform- largest background value is a ND
	SWMU 73	5/7	2.9	2.1	
Zinc	Background	12/13	72.5	144.0	Students t-test- p=.128
	SWMU 73	5/5	89.3	83.8	

--- = Not enough data to determine distribution
ND = Non-detect

Table 34. Refined Hazard Quotients for Terrestrial Food Web Exposures: Surface Soil.

Chemical	Red-tailed hawk			American robin			Mourning Dove		
	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT
p,p'-DDD	3.1	0.3	0.9	1.0	0.1	0.3	2.1	0.2	0.6
p,p'-DDE	13.2	1.3	4.1	3.0	0.3	0.9	0.3	0.0	0.1
p,p'-DDT	2.2	0.2	0.6	19.5	1.9	6.1	40.3	4.0	12.7
Aroclor-1254	2.1	0.2	0.6	0.5	0.0	0.1	0.0	0.0	0.0
Endrin aldehyde	0.4	0.0	0.1	1.2	0.1	0.4	2.6	0.2	0.8
Copper	0.1	0.0	0.0	1.3	0.4	0.7	0.9	0.3	0.5
Zinc	0.4	0.0	0.1	1.2	0.1	0.4	0.4	0.0	0.1
Mercury	0.9	0.3	0.5	2.9	0.97	1.6	2.1	0.7	1.2

Notes:

Shaded cells indicate a hazard quotient greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration

Table 35. Refined Hazard Quotients for Terrestrial Food Web Exposures: SubSurface Soil.

Chemical	Red-tailed hawk			American robin			Mourning Dove		
	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT	NOAEL	LOAEL	MACT
Endrin	24.1	2.4	7.6	6.2	0.6	1.9	15.4	1.5	4.8
p,p'-DDD	5.2	0.5	1.6	1.2	0.1	0.3	3.0	0.3	0.9
p,p'-DDE	8.4	0.8	2.6	3.8	0.3	1.2	0.5	0.0	0.1
p,p'-DDT	61.4	6.1	19.4	16.0	1.6	5.0	39.3	3.9	12.4
Copper	5.8	1.9	3.4	1.6	0.5	0.9	1.4	0.4	0.8
Molybdenum	0.4	0.0	0.1	1.3	0.1	0.4	3.2	0.3	1.0
Zinc	0.0	0.0	0.0	2.1	0.2	0.7	0.9	0.1	0.3

Notes:

Shaded cells indicate a hazard quotient greater than 1.0

NOAEL = No Observed Adverse Effect Level
LOAEL = Lowest Observed Adverse Effect Level
MATC = Maximum Acceptable Toxicant Concentration

Table 36. Exposure Point Concentrations – Surface Soil.

Substance	Units Corrected EPC	EPC	Statistic	Max	Mean	SD
4,4'-DDD	0.99	985.1	95% Chebyshev UCL	5500	207.9	992.8
4,4'-DDE	2.45	2450	95% Chebyshev UCL	9600	457.1	1833
4,4'-DDT	17.08	17083	95% Chebyshev UCL	77000	2512	13403
Acenaphthylene	0.34	335.5	97.5% Chebyshev UCL	720	137.6	197.9
Aroclor-1248	8.4*	168584	95% Hall's Bootstrap UCL	8400	987.9	2780
Aroclor-1254	1.62	1618	95% Chebyshev UCL	8400	414.8	1585
Aroclor-1260	1.63	1625	95% Chebyshev UCL	8400	422.2	1585
Arsenic	6.56	6.56	95% Approximate Gamma UCL	12	5.57	3.2
Benz(a)anthracene	0.46	458.2	95% Adjusted Gamma UCL	4000	286.7	648.7
Benzo(a)pyrene	0.67	669.4	95% Chebyshev UCL	3400	279.5	558.6
Benzo(b)fluoranthene	0.59	591.5	95% Approximate Gamma UCL	4800	396.9	805.3
Benzo(g,h,i)perylene	0.41	410.2	95% Chebyshev UCL	1800	184.2	323.7
Benzo(k)fluoranthene	0.47	473.2	95% Chebyshev UCL	1900	226.8	353
Chlordane	2.24	2243	95% Chebyshev UCL	9800	473.5	1989
Chrysene	0.51	509.6	95% Adjusted Gamma UCL	4200	324.7	691.7
Dibenz[a,h]anthracene	0.12	124.3	95% Chebyshev UCL	560	40.7	105.1
Dieldrin	0.23	227.1	95% Chebyshev UCL	980	60.1	220
Endosulfan sulfate	0.22	221.9	95% Chebyshev UCL	980	44.55	199.3
Endrin aldehyde	0.22	221.7	95% Chebyshev UCL	980	44.35	199.3
Heptachlor	0.11	113.4	95% Chebyshev UCL	480	30	109.8
Heptachlor epoxide	0.11	108.8	95% Chebyshev UCL	480	21.94	97.59
Indeno(1,2,3-cd) pyrene	0.40	401	95% Chebyshev UCL	1700	185.1	309.2
Kepone	9.63	9632	97.5% Chebyshev UCL	43000	1498	7482
Methyl iodide	0.008	7.83	95% Student's-t UCL	22	6.5	3.51
Phenanthrene	0.13	125.6	95% Chebyshev UCL	450	50.56	94.28

*indicates maximum detection was used because estimated 95%UCL exceeded maximum detection in dataset.

Table 37. Exposure Point Concentrations – Subsurface Soil.

Substance	Units Corrected EPC	EPC	Statistic	Max	Mean	SD
4,4'-DDD	1.10	1337.00	99% Chebyshev UCL	1100.00	126.80	365.00
4,4'-DDE	3.10	3395.00	99% Chebyshev UCL	3100.00	332.60	973.20
4,4'-DDT	14.00*	88834.00	95% Hall's Bootstrap UCL	14000.00	1452.00	4410.00
Acenaphthylene	0.00	2.87	95% Student's-t UCL	4.30	2.08	1.07
Arsenic	0.87	0.87	95% Approximate Gamma UCL	1.40	0.66	0.33
Benz(a)anthracene	0.03	129.00	99% Chebyshev UCL	25.00	6.93	9.25
Benzo(a)pyrene	0.02	55.58	95% Chebyshev UCL	19.00	5.93	6.95
Benzo(b)fluoranthene	0.03	173.30	99% Chebyshev UCL	32.00	8.10	12.01
Benzo(g,h,i)perylene	0.03	28.94	95% Approximate Gamma UCL	8.70	4.15	3.37
Chromium	33.10	33.10	95% Student's-t UCL	46.00	26.13	13.44
Cobalt	29.35	29.35	95% Student's-t UCL	55.00	23.92	10.47
Dibenz[a,h]anthracene	0.01	5.59	95% Approximate Gamma UCL	8.70	3.02	2.62
Endosulfan II	I/O	I/O	I/O	I/O	I/O	I/O
Methyl iodide	0.01	10.25	95% Student's-t UCL	15.00	7.00	3.95
Phenanthrene	0.02	47.23	95% Chebyshev UCL	24.00	6.77	8.86

*indicates maximum detection was used because estimated 95%UCL exceeded maximum detection in dataset.
I/O indicates insufficient observations for statistical analysis. Maximum value used for EPC.

Table 38. Potentially Complete Exposure Pathways.

	Surface Soil			Subsurface Soil			Groundwater	
Receptor	Ingestion	Dermal Absorption	Inhalation	Ingestion	Dermal Absorption	Inhalation	Ingestion	Dermal Absorption
Industrial Worker	X	X	X					
Construction Worker	X	X	X	X	X	X		X
Adult Trespasser	X	X	X					
Youth Trespasser	X	X	X					
Future Adult Resident	X	X	X				X	
Future Child Resident	X	X	X				X	

Table 39. Exposure Assessment Values.

Pathway	Parameter	Industrial Workers	Construction Workers	Adult Trespassers	Youth Trespassers	Adult Residents	Child Residents
Common Values	Exposure Duration (years)	25	1	24	11	24	6
	Exposure Frequency (days/year)	250	250	52	52	350	350
	Averaging Time (noncarcinogenic) (years)	Same as Exposure Duration					
	Averaging Time (carcinogenic) (years)	70	70	70	70	70	70
	Body Weight (kg)	70	70	70	45	70	15
Soil Ingestion	Ingestion Rate (mg/day)	100	330	100	100	100	200
	Fraction Ingested	1	1	1	1	1	1
Dermal Absorption (soil)	Surface Area (cm^2)	3300	3300	5700	3200	5700	2800
	Adherence Factor	0.2	0.3	0.07	0.2	0.07	0.2
	Absorption Factor	Chemical Specific					
Inhalation	PEF	$1.32X10^9$					
	VF	Chemical Specific					
Dermal Contact w/Ground Water	Dermal Permeability Constant	Chemical Specific					
	Surface Area	N/A	3300 cm^2	N/A	N/A	N/A	N/A
	Events per day	N/A	1	N/A	N/A	N/A	N/A
Ingestion of Groundwater	L/day	N/A	N/A	N/A	N/A	1	2

Table 40. Toxicity Reference Values.

Substance	RSUB CASRN	RfD (mg/kg-day)	Source	RfC (mg/m^3)	Source	RfD_i	Source
1-Methylnaphthalene	90-12-0	7.00E-02	MRL	N/A	--	N/A	--
2-Methylnaphthalene	91-57-6	4.00E-03	IRIS	N/A	--	N/A	--
Acenaphthene	83-32-9	6.00E-02	IRIS	N/A	--	N/A	--
Acenaphthylene	208-96-8	N/A	IRIS	N/A	--	N/A	--
Acetone	67-64-1	9.00E-01	IRIS	3.09E+01	MRL	8.82E+00	CONV
Aldrin	309-00-2	3.00E-05	IRIS	N/A	--	N/A	--
Allyl chloride	107-05-1	N/A	--	1.00E-03	IRIS	2.86E-04	CONV
alpha-Hexachlorocyclohexane	319-84-6	8.00E-03	MRL	N/A	--	N/A	--
Anthracene	120-12-7	3.00E-01	IRIS	N/A	--	N/A	--
Antimony	7440-36-0	4.00E-04	IRIS	N/A	IRIS	N/A	--
Aroclor 1248	12672-29-6	N/A	--	N/A	--	N/A	--
Aroclor 1254	11097-69-1	2.00E-05	IRIS	N/A	--	N/A	--
Aroclor 1260	11096-82-5	N/A	--	N/A	--	N/A	--
Arsenic, inorganic	7440-38-2	3.00E-04	IRIS	1.50E-05	CalEPA	4.29E-06	CONV
Barium and compounds	7440-39-3	2.00E-01	IRIS	N/A	--	N/A	--
Benz(a)anthracene	56-55-3	N/A	--	N/A	--	N/A	--
Benz(b)fluoranthene	205-99-2	N/A	--	N/A	--	N/A	--
Benzene	71-43-2	4.00E-03	IRIS	3.00E-02	IRIS	8.57E-03	CONV
Benzo(a)pyrene	50-32-8	N/A	--	N/A	--	N/A	--
Benzo(g,h,i)perylene	191-24-2	N/A	IRIS	N/A	--	N/A	--
Benzo(k)fluoranthene	207-08-9	N/A	--	N/A	--	N/A	--
Beryllium compounds	**7440-41-7**	2.00E-03	IRIS	2.00E-02	IRIS	5.71E-03	CONV
beta-Hexachlorocyclohexane	319-85-7	N/A	--	N/A	--	N/A	--
Bis(2-ethylhexyl)phthalate	117-81-7	2.00E-02	IRIS	N/A	--	N/A	--
Butyl benzyl phthalate	85-68-7	2.00E-01	IRIS	N/A	--	N/A	--
Cadmium	**7440-43-9**	1.00E-03	IRIS	2.00E-05	CalEPA	5.71E-06	CONV
Carbon disulfide	75-15-0	1.00E-01	IRIS	7.00E-01	IRIS	2.00E-01	CONV
Carbon tetrachloride	56-23-5	4.00E-03	IRIS	1.00E-01	IRIS	2.86E-02	CONV
Chlordane	**12789-03-6**	5.00E-04	IRIS	7.00E-04	IRIS	2.00E-04	CONV
Chlordecone (Kepone)	143-50-0	3.00E-04	IRIS	N/A	--	N/A	--
Chlorobenzene	108-90-7	2.00E-02	IRIS	5.00E-02	PPRTV	1.43E-02	CONV
Chromium compounds	0-018*	3.00E-03	IRIS	1.00E-04	IRIS	2.86E-05	CONV
Chrysene	218-01-9	N/A	--	N/A	--	N/A	--
Cobalt compounds	0-153*	3.00E-04	PPRTV	6.00E-06	PPRTV	1.71E-06	CONV
Copper compounds	0-019*	N/A	--	N/A	--	N/A	--
Cyanide compounds	0-574*	N/A	--	N/A	--	N/A	--
DDD	72-54-8	N/A	--	N/A	--	N/A	--
DDE	72-55-9	N/A	--	N/A	--	N/A	--
DDT	50-29-3	5.00E-04	IRIS	N/A	--	N/A	--
delta-Hexachlorocyclohexane	319-86-8	N/A	--	N/A	--	N/A	--
Dibenzo(a,h)anthracene	53-70-3	N/A	--	N/A	--		
Dichloromethane	75-09-2	6.00E-02	IRIS	1.04E+00	MRL	2.97E-01	CONV
Dieldrin	60-57-1	5.00E-05	IRIS	N/A	--	N/A	--

Table 40. Toxicity Reference Values (Contd.).

Substance	RSUB CASRN	RfD (mg/kg-day)	Source	RfC (mg/m^3)	Source	RfD_i	Source
Endosulfan	115-29-7	6.00E-03	IRIS	N/A	--	N/A	--
Endosulfan sulfate	1031-07-8	N/A	--	N/A	--	N/A	--
Endrin	72-20-8	3.00E-04	IRIS	N/A	--	N/A	--
Endrin aldehyde	7421-93-4	3.00E-04	MRL	N/A	--	N/A	--
Ethylbenzene	100-41-4	1.00E-01	IRIS	1.00E+00	IRIS	2.86E-01	CONV
Fluoranthene	206-44-0	4.00E-02	IRIS	N/A	--	N/A	--
Fluorene	86-73-7	4.00E-02	IRIS	N/A	--	N/A	--
Heptachlor	76-44-8	5.00E-04	IRIS	N/A	--	N/A	--
Heptachlor epoxide	1024-57-3	1.30E-05	IRIS	N/A	--	N/A	--
Indeno(1,2,3-cd)pyrene	193-39-5	N/A	--	N/A	--	N/A	--
Lead and compounds (organic)	0-096*	N/A	--	N/A	--	N/A	--
m-Cresol	108-39-4	5.00E-02	IRIS	N/A	--	N/A	--
Mercury compounds	7439-97-6	3.00E-04	IRIS	3.00E-05	CalEPA	8.57E-06	CONV
Methoxychlor	72-43-5	5.00E-03	IRIS	N/A	--	N/A	--
Methyl bromide	74-83-9	1.40E-03	IRIS	5.00E-03	IRIS	1.43E-03	CONV
Methyl chloride	74-87-3		--	9.00E-02	IRIS	2.57E-02	CONV
Methyl ethyl ketone	78-93-3	6.00E-01	IRIS	5.00E+00	IRIS	1.43E+00	CONV
Methyl iodide	74-88-4	N/A	--	N/A	--	N/A	--
Molybdenum (soluble respirable)	**7439-98-7**	5.00E-03	IRIS	N/A	--	N/A	--
Naphthalene	91-20-3	2.00E-02	IRIS	3.00E-03	IRIS	8.57E-04	CONV
Nickel compounds	**0-024***	2.00E-02	IRIS	9.00E-05	MRL	2.57E-05	CONV
p-Cresol	106-44-5	N/A	--	N/A	--	N/A	--
Phenanthrene	85-01-8	N/A	--	N/A	--	N/A	--
Pyrene	129-00-0	3.00E-02	IRIS	N/A	--	N/A	--
Selenium compounds	**7782-49-2**	5.00E-03	IRIS	N/A	--	N/A	--
Silver compounds	**7440-22-4**	5.00E-03	IRIS	N/A	--	N/A	--
Sulfide		N/A		N/A			
Tetrachloroethylene	127-18-4	1.00E-02	IRIS	2.71E-01	MRL	7.74E-02	CONV
Tin compounds	0-169*	N/A	--	N/A	--	N/A	--
Toluene	108-88-3	8.00E-02	IRIS	5.00E+00	IRIS	1.43E+00	CONV
Vanadium compounds	**0-028***	5.00E-03	IRIS	N/A	--	N/A	--
Xylene (mixed)	1330-20-7	2.00E-01	IRIS	1.00E-01	IRIS	2.86E-02	CONV
Zinc compounds	**7440-66-6**	3.00E-01	IRIS	N/A	--	N/A	--

Table 40. Toxicity Reference Values (Contd.).

Substance	CSF_o (mg/kg-day)^-1	Source	URF (ug/m^3)^-1	Source	CSF_i (mg/kg-day)^-1	Source	WOE	GI_{ABS}	ABS
1-Methylnaphthalene	2.90E-02	PPRTV	N/A	--	N/A	--	--	1	--
2-Methylnaphthalene	N/A	--	N/A	--	N/A	--	--	1	--
Acenaphthene	N/A	--	N/A	--	N/A	--	--	1	0.13
Acenaphthylene	N/A	--	N/A	--	N/A	--	--	--	--
Acetone	N/A	--	N/A	--	N/A	--	--	1	--
Aldrin	1.70E+01	IRIS	4.90E-03	IRIS	1.72E+01	CONV	--	1	0.1
Allyl chloride	2.10E-02	CalEPA	6.00E-06	CalEPA	2.10E-02	CalEPA	--	1	--
alpha-Hexachlorocyclohexane	6.30E+00	IRIS	1.80E-03	IRIS	6.30E+00	CONV	--	1	0.1
Anthracene	N/A	--	N/A	--	N/A	--	--	1	0.13
Antimony	N/A	--	N/A	--	N/A	--	--	0.15	--
Aroclor 1248	N/A	--	N/A	--	N/A	--	--	1	0.14
Aroclor 1254	N/A	--	N/A	--	N/A	--	--	1	0.14
Aroclor 1260	N/A	--	N/A	--	N/A	--	--	1	0.14
Arsenic, inorganic	1.50E+00	CalEPA	3.30E-03	CalEPA	1.20E+01	CalEPA	--	1	0.03
Barium and compounds	N/A	--	N/A	--	N/A	--	--	0.07	--
Benz(a)anthracene	1.20E+00	CalEPA	1.10E-04	CalEPA	3.90E-01	CalEPA	--	1	0.13
Benz(b)fluoranthene	1.20E+00	CalEPA	1.10E-04	CalEPA	3.90E-01	CalEPA	--	1	0.13
Benzene	5.50E-02	IRIS	7.80E-06	IRIS	2.73E-02	CONV	A	1	--
Benzo(a)pyrene	7.30E+00	IRIS	1.10E-03	CalEPA	3.90E+00	CalEPA	--	1	0.13
Benzo(g,h,i)perylene	N/A	--	N/A	--	N/A	--	--	--	--
Benzo(k)fluoranthene	1.20E+00	CalEPA	1.10E-04	CalEPA	3.90E-01	CalEPA	--	1	0.13
Beryllium compounds	N/A	--	2.40E-03	CalEPA	8.40E+00	CalEPA	--	0.007	--
beta-Hexachlorocyclohexane	1.80E+00	IRIS	5.30E-04	IRIS	1.86E+00	CONV	--	1	0.1
Bis(2-ethylhexyl)phthalate	1.40E-02	IRIS	2.40E-06	CalEPA	8.40E-03	CalEPA	--	1	0.1
Butyl benzyl phthalate	1.90E-03	PPRTV	N/A	--	N/A	--	--	1	0.1
Cadmium	N/A	--	4.20E-03	CalEPA	1.50E+01	CalEPA	--	0.025	0.001
Carbon disulfide	N/A	--	N/A	--	N/A	--	--	1	--
Carbon tetrachloride	7.00E-02	IRIS	6.00E-06	IRIS	2.10E-02	CONV	--	1	--
Chlordane	1.30E+00	CalEPA	3.40E-04	CalEPA	1.20E+00	CalEPA	--	1	0.04
Chlordecone (Kepone)	1.00E+01	IRIS	4.60E-03	CalEPA	1.60E+01	CalEPA	--	1	0.1
Chlorobenzene	N/A	--	N/A	--	N/A	--	--	1	--
Chromium compounds	N/A	--	1.20E-02	IRIS	4.20E+01	CONV	--	0.013	
Chrysene	1.20E-01	CalEPA	1.10E-05	CalEPA	3.90E-02	CalEPA	--	1	0.13
Cobalt compounds			9.00E-03	PPRTV	3.15E+01	CONV	--	1	--
Copper compounds	N/A	--	N/A	--	N/A	--	--	0.57	--
Cyanide compounds	N/A	--	N/A	--	N/A	--	--	1	--
DDD	2.40E-01	IRIS	6.90E-05	CalEPA	2.40E-01	CalEPA	--	1	0.1
DDE	3.40E-01	IRIS	9.70E-05	CalEPA	3.40E-01	CalEPA	--	1	0.1
DDT	3.40E-01	IRIS	9.70E-05	IRIS	3.40E-01	CONV	--	1	0.03
delta-Hexachlorocyclohexane	N/A	--	N/A	--	N/A	--	--		--
Dibenzo(a,h)anthracene	4.10E+00	CalEPA	1.20E-03	CalEPA	4.10E+00	CalEPA	--	1	0.13
Dichloromethane	7.50E-03	IRIS	4.70E-07	IRIS	1.65E-03	CONV	--	1	--
Dieldrin	1.60E+01	IRIS	4.60E-03	IRIS	1.61E+01	CONV	--	1	0.1

Table 40. Toxicity Reference Values (Contd.).

Substance	CSF_o (mg/kg-day)^-1	Source	URF (ug/m^3)^-1	Source	CSF_i (mg/kg-day)^-1	Source	WOE	GI_{ABS}	ABS
Endosulfan	N/A	--	N/A	--	N/A	--	--	1	0.1
Endosulfan sulfate	N/A	--	N/A	--	N/A	--	--		--
Endrin	N/A	--	N/A	--	N/A	--	--	1	0.1
Endrin aldehyde	N/A	--	N/A	--	N/A	--	--	--	--
Ethylbenzene	1.10E-02	CalEPA	2.50E-06	CalEPA	8.70E-03	CalEPA	--	1	--
Fluoranthene	N/A	--	N/A	--	N/A	--	--	1	0.13
Fluorene	N/A	--	N/A	--	N/A	--	--	1	0.13
Heptachlor	4.50E+00	IRIS	1.30E-03	IRIS	4.55E+00	CONV	--	1	0.1
Heptachlor epoxide	9.10E+00	IRIS	2.60E-03	IRIS	9.10E+00	CONV	--	1	0.1
Indeno(1,2,3-cd)pyrene	1.20E+00	CalEPA	1.10E-04	CalEPA	3.90E-01	CalEPA	--	1	0.13
Lead and compounds (organic)	N/A	--	N/A	--	N/A	--	--	1	--
m-Cresol	N/A	--	N/A	--	N/A	--	--	1	0.1
Mercury compounds	N/A	--	N/A	--	--		--	0.07	--
Methoxychlor	N/A	--	N/A	--	N/A	--	--	1	0.1
Methyl bromide	N/A	--	N/A	--	--	--	--	1	--
Methyl chloride	N/A	--	N/A	--	--	--	--	1	--
Methyl ethyl ketone	N/A	--	N/A	--	--	--	--	1	--
Methyl iodide	N/A	--	N/A	--	N/A	--	--		--
Molybdenum (soluble respirable)	N/A	--	N/A	--	N/A	--	--	1	--
Naphthalene	N/A		3.40E-05	CalEPA	1.20E-01	CalEPA		1	0.13
Nickel compounds			2.60E-04	CalEPA	9.10E-01	CalEPA		0.04	--
p-Cresol	N/A	--	N/A	--	N/A	--	--	1	0.1
Phenanthrene	N/A	--	N/A	--	N/A	--	--		--
Pyrene	N/A	--	N/A	--	N/A	--	--	1	0.13
Selenium compounds	N/A	--	N/A	--	N/A	--	--	0.3	--
Silver compounds	N/A	--	N/A	--	N/A	--	--	0.04	--
Sulfide	N/A		N/A						
Tetrachloroethylene	5.10E-02	CalEPA	5.90E-06	CalEPA	2.10E-02	CalEPA		1	--
Tin compounds	N/A	--	N/A	--	N/A	--	--	1	--
Toluene	N/A	--	N/A	--	N/A	--	--	1	--
Vanadium compounds	N/A	--	N/A	--	N/A	--	--	0.026	--
Xylene (mixed)	N/A	--	N/A	--	N/A	--	--	1	--
Zinc compounds	N/A	--	N/A	--	N/A	--	--	1	--

Sources: IRIS –EPA Integrated Risk Information System; PPRTV – Provisional Peer Reviewed Toxicity Values; Cal EPA – California Environmental Protection Agency; WHO – World Health Organization; Conv. – units converted from available value

Table 41. Risk Assessment Results Summary.

		Future Child Resident		Future Adult Resident		Industrial Worker		Adult Trespasser		Youth Trespasser		Construction Worker	
Medium	**Route**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**
Surface Soil	**Ingestion**	2.4	1.4E-04	0.3	6.0E-05	0.3	4.5E-05	0.1	9.0E-06	1.3E-01	6.4E-06	1.1E+00	5.9E-06
	Dermal	0.6	3.6E-05	0.1	2.2E-05	0.2	2.7E-05	0.03	3.3E-06	8.0E-02	3.8E-06	3.1E-01	1.6E-06
	Inhalation	3.1E-04	1.2E-07	3.1E-04	4.7E-07	0.0	3.5E-07	4.6E-05	7.0E-08	5.6E-05	3.2E-08	2.2E-04	1.4E-08
	Total	***3.0E+00***	***1.8E-04***	***3.5E-01***	***8.3E-05***	***5.3E-01***	***7.2E-05***	***9.4E-02***	***1.2E-05***	***2.1E-01***	***1.0E-05***	***1.4E+00***	***7.6E-06***
Subsurface Soil	**Ingestion**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.4E-01	2.9E-07
	Dermal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1E-01	4.2E-08
	Inhalation	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-03	4.9E-09
	Total	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***NA***	***5.6E-01***	***3.4E-07***

Table 41. Risk Assessment Results Summary (Contd.).

		Future Child Resident		Future Adult Resident		Industrial Worker		Adult Trespasser		Youth Trespasser		Construction Worker	
Medium	**Route**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**	**HQ**	**Risk**
Ground water	**Ingestion**	*7.84*	*3.0E-04*	*3.4*	*5.1E-04*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	Dermal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*9.4E-02*	*4.1E-07*
	Total	**7.8E+00**	**3.0E-04**	**3.4E+00**	**5.1E-04**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	***9.4E-02***	***4.1E-07***
Cumulative Hazard and Risk		10.9	4.7E-04	3.7	5.9E-04	0.3	7.2E-05	0.05	1.2E-05	0.12	1.0E-05	1.4	8.3E-06

FIGURES

Figure 1. NAPR Installation and SWMU 73 Location Map, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Figure 2. SWMU 73 Phase II ECP Site Layout Map, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Figure 3. SWMU 73 Sample Locations Map, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Figure 4. SWMU 73 Groundwater Elevation Map 16 Jan 2009, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

Figure 5. SWMU 73 Groundwater El;evation Map, 31 Jan 2011, Naval Activity Puerto Rico, Ceiba, Puerto Rico.

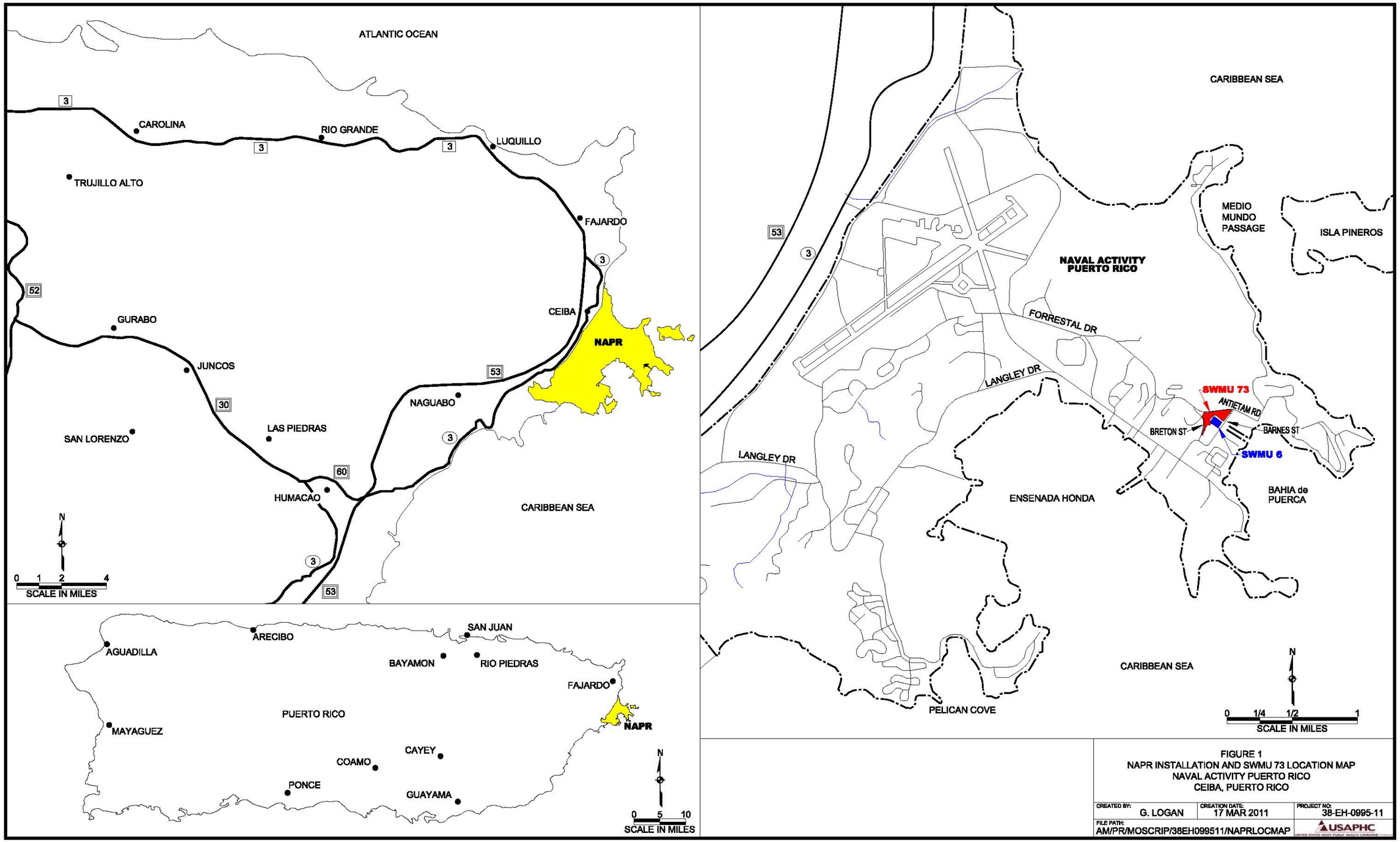
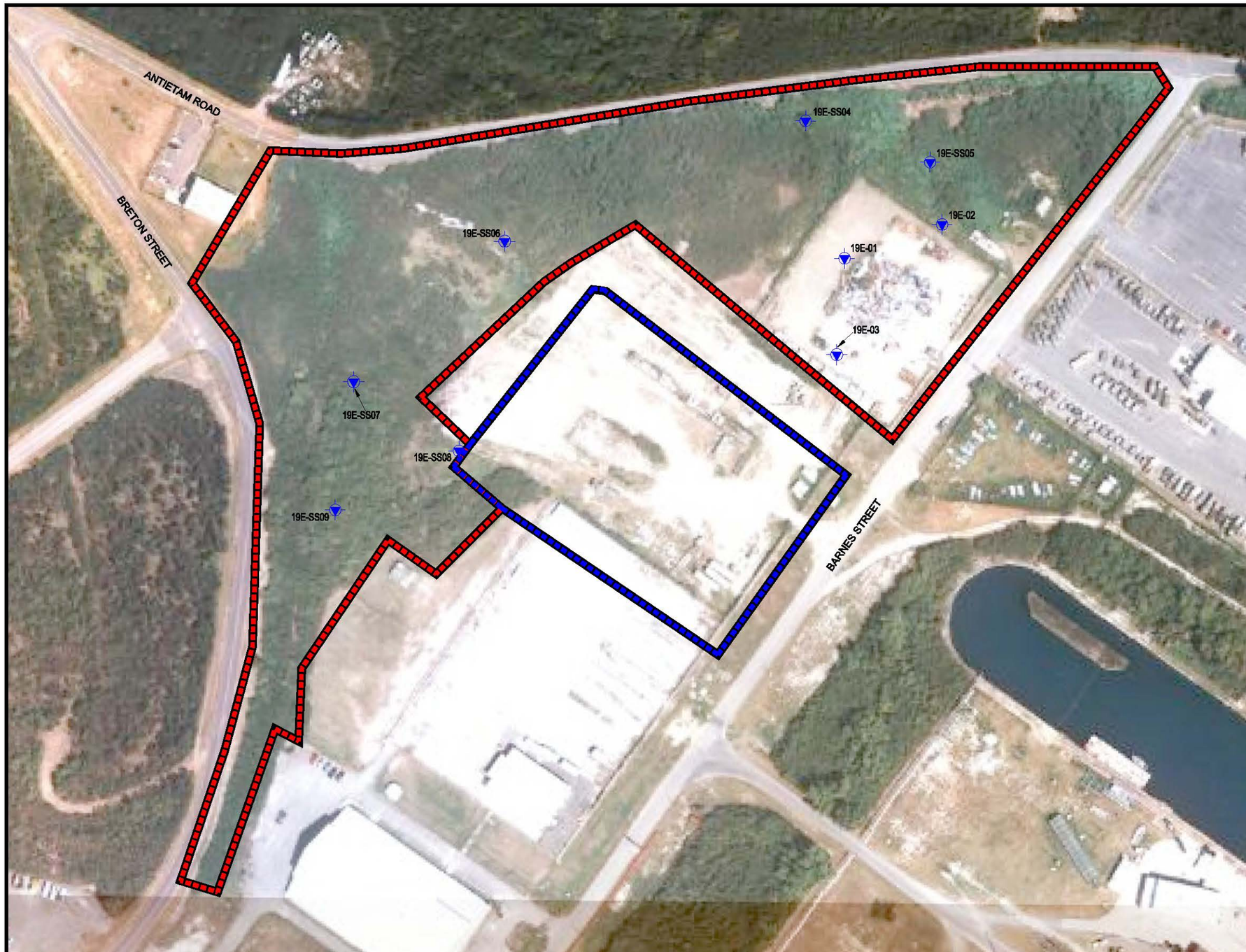


FIGURE 1
NAPR INSTALLATION AND SWMU 73 LOCATION MAP
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

CREATED BY:	CREATION DATE:	PROJECT NO:
G. LOGAN	17 MAR 2011	38-EH-0995-11

FILE PATH: AM/PR/MOSCRIP/38EH099511/NAPRLOCMAP

USAPHC



LEGEND

PRIOR INVESTIGATION SAMPLE

SWMU 73

SWMU 6

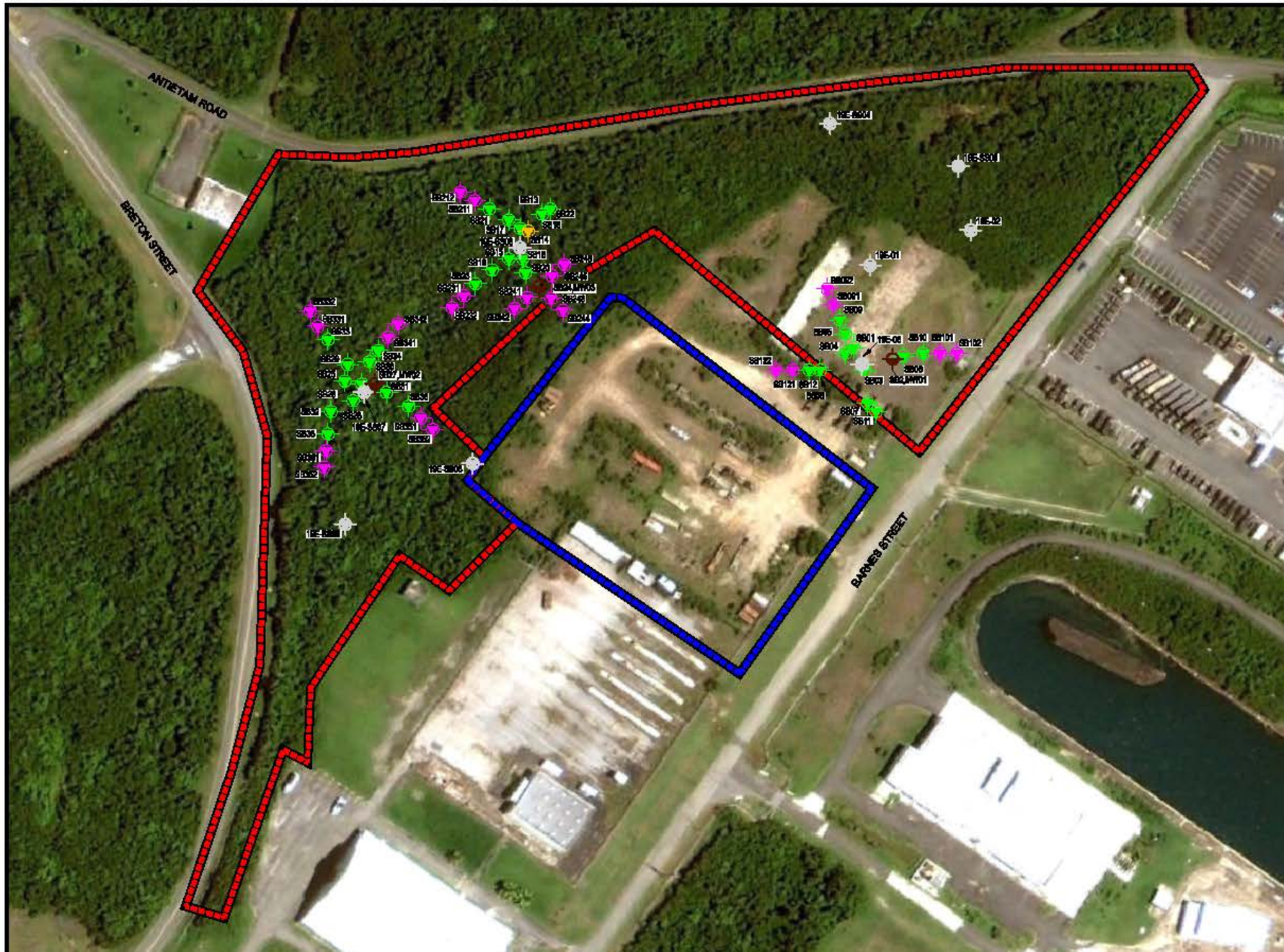
N

0 50 100 200

SCALE IN FEET

FIGURE 2
SWMU 73 PHASE II ECP SITE LAYOUT MAP
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

CREATED BY:	CREATION DATE:	PROJECT NO:
G. LOGAN	17 MAR 2011	38-EH-0995-11
FILE PATH: AMERICAS/PR/MOSCRIP/099511/ECPSAMPLOCM		USAPHC



LEGEND

- PRIOR INVESTIGATION SAMPLE
- SB24-MW01 SUBSURFACE SOIL, SURFACE SOIL SAMPLE, AND MONITORING WELL
- SB14 SUBSURFACE SOIL AND SURFACE SOIL SAMPLE
- SURFACE SOIL SAMPLE (APRIL-2008)
- SURFACE SOIL SAMPLE (JANUARY-2009)
- SWMU 73
- SWMU 6

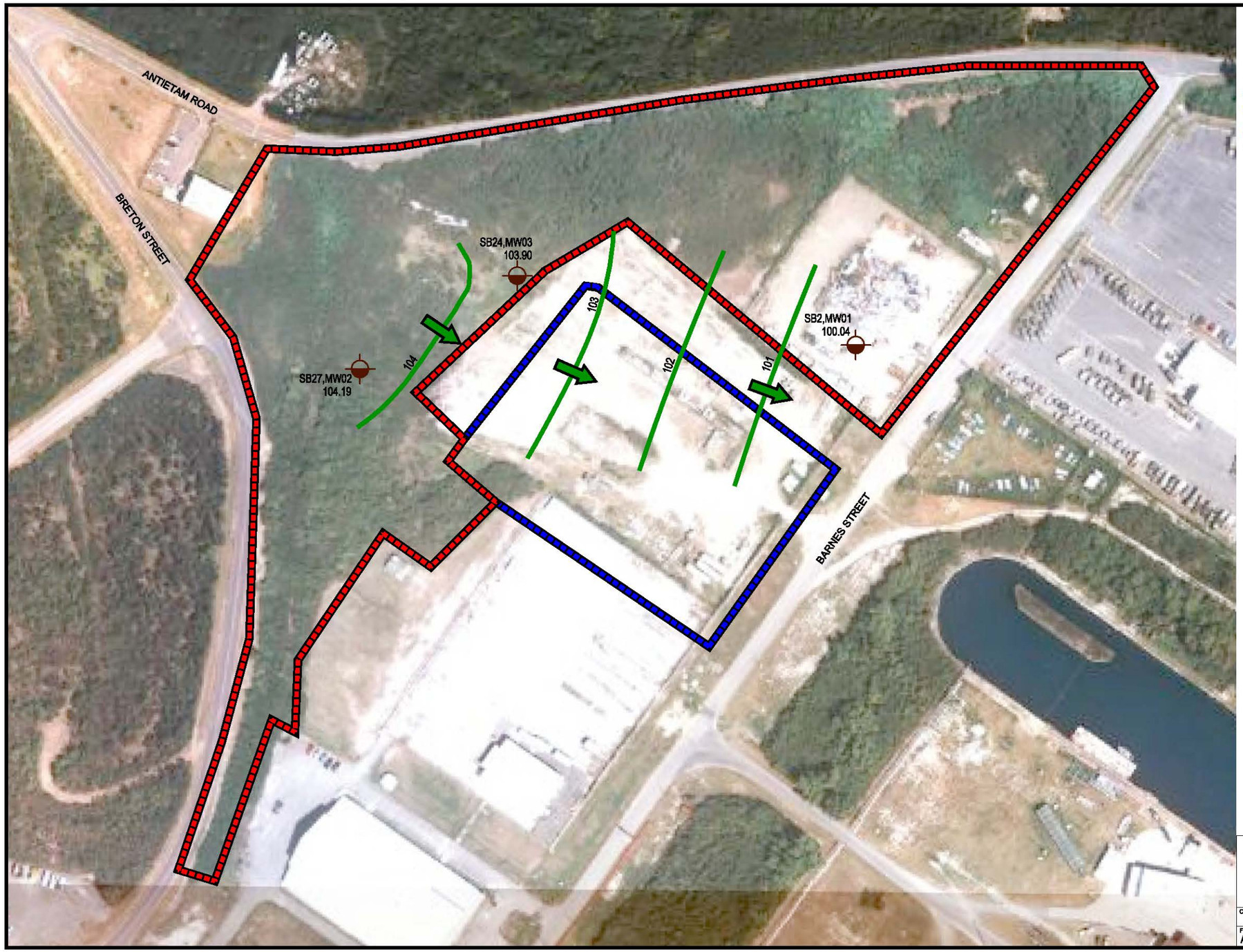
NOTE: SAMPLE LOCATIONS SB24-MW03 AND SB27-MW02 WERE RESAMPLED DURING FEBRUARY 2011 SAMPLE EVENT
SB24-MW03 SAMPLE ID 73SB01-05
SB27-MW02 SAMPLE ID 73SB03-05

N

0 50 100 200
SCALE IN FEET

FIGURE 3
SWMU 73 CMS SAMPLE LOCATIONS MAP
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

G. LOGAN	17 MAR 2009	38-EH-0995-11
AMERICAS/PR/MOSCRIP/0995-11/CMSSAMPLOCM		USAPHC



LEGEND

SB2,MW01 SUBSURFACE SOIL, SURFACE SOIL SAMPLE, AND MONITORING WELL

SWMU 73

SWMU 6

RELATIVE GROUNDWATER CONTOUR LINE

RELATIVE GROUNDWATER FLOW DIRECTION

Date: 16 JAN 09

Well No.	73MW01	73MW02	73MW03
Casing Elevation	109.04	115.27	114.67
Water Level	9.00	11.08	10.77
Groundwater Elevation	100.04	104.19	103.90

All Elevations are relative elevations.

N

0 50 100 200

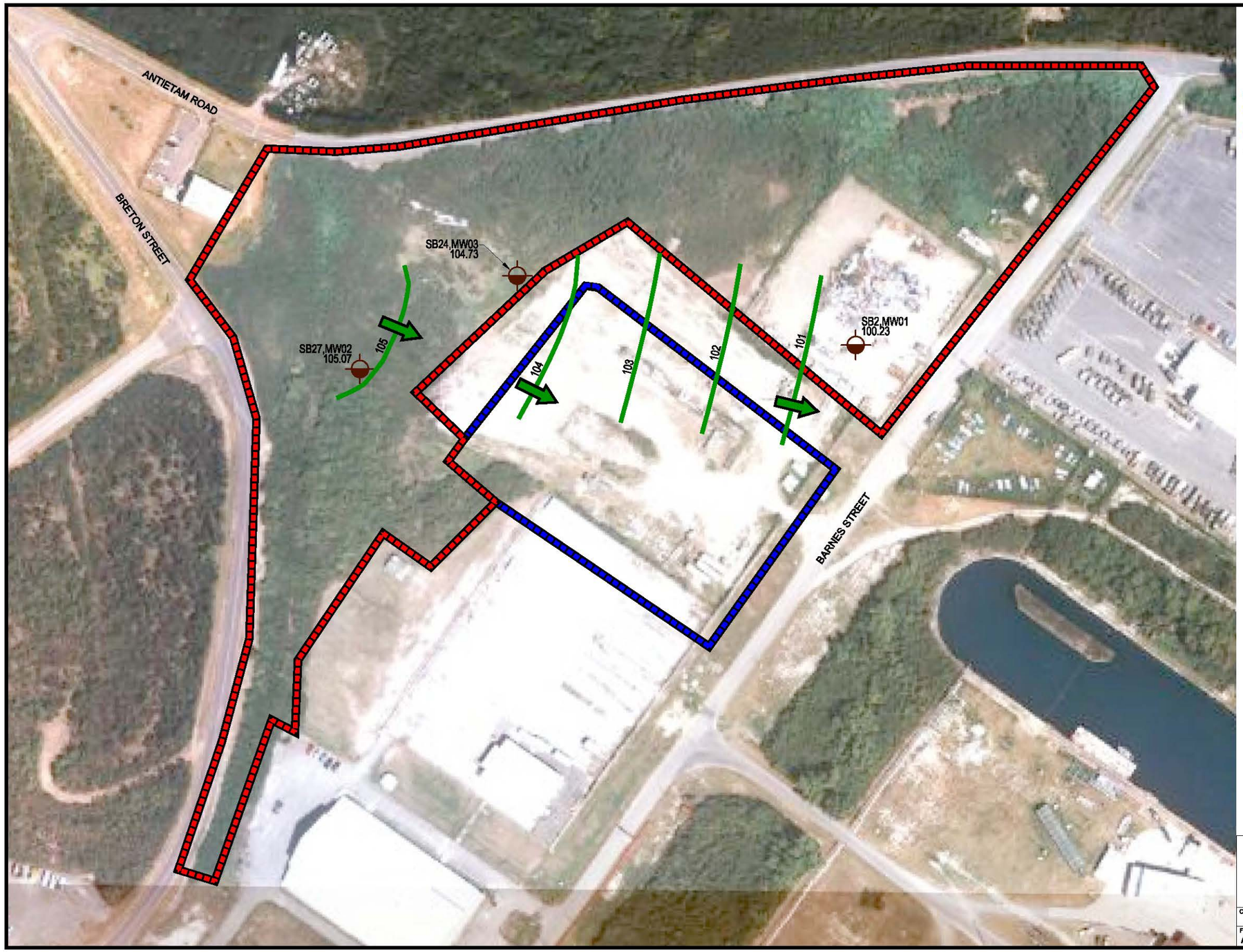
SCALE IN FEET

FIGURE 4
SWMU 73 GROUND WATER ELEVATION MAP, 16 JAN 2009
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

CREATED BY:	CREATION DATE:	PROJECT NO:
G. LOGAN	17 MAR 2009	38-EH-0995-11

FILE PATH: AMERICAS/PR/MOSCRIP/38EH099511/GWELMAP

USAPHC



LEGEND

SB2,MW01	SUBSURFACE SOIL, SURFACE SOIL SAMPLE, AND MONITORING WELL
	SWMU 73
	SWMU 6
	RELATIVE GROUNDWATER CONTOUR LINE
	RELATIVE GROUNDWATER FLOW DIRECTION

Date: 31 JAN 11

Well No.	73MW01	73MW02	73MW03
Casing Elevation	109.04	115.27	114.67
Water Level	8.81	10.20	9.94
Groundwater Elevation	100.23	105.07	104.73

All Elevations are relative elevations.

N

0 50 100 200
SCALE IN FEET

FIGURE 5
SWMU 73 GROUND WATER ELEVATION MAP, 31 JAN 2011
NAVAL ACTIVITY PUERTO RICO
CEIBA, PUERTO RICO

CREATED BY:	CREATION DATE:	PROJECT NO:
G. LOGAN	22 MAR 2011	38-EH-0995-11

FILE PATH: AMERICAS/PR/MOSCRIP/38EH099511/GWELMAP

USAPHC

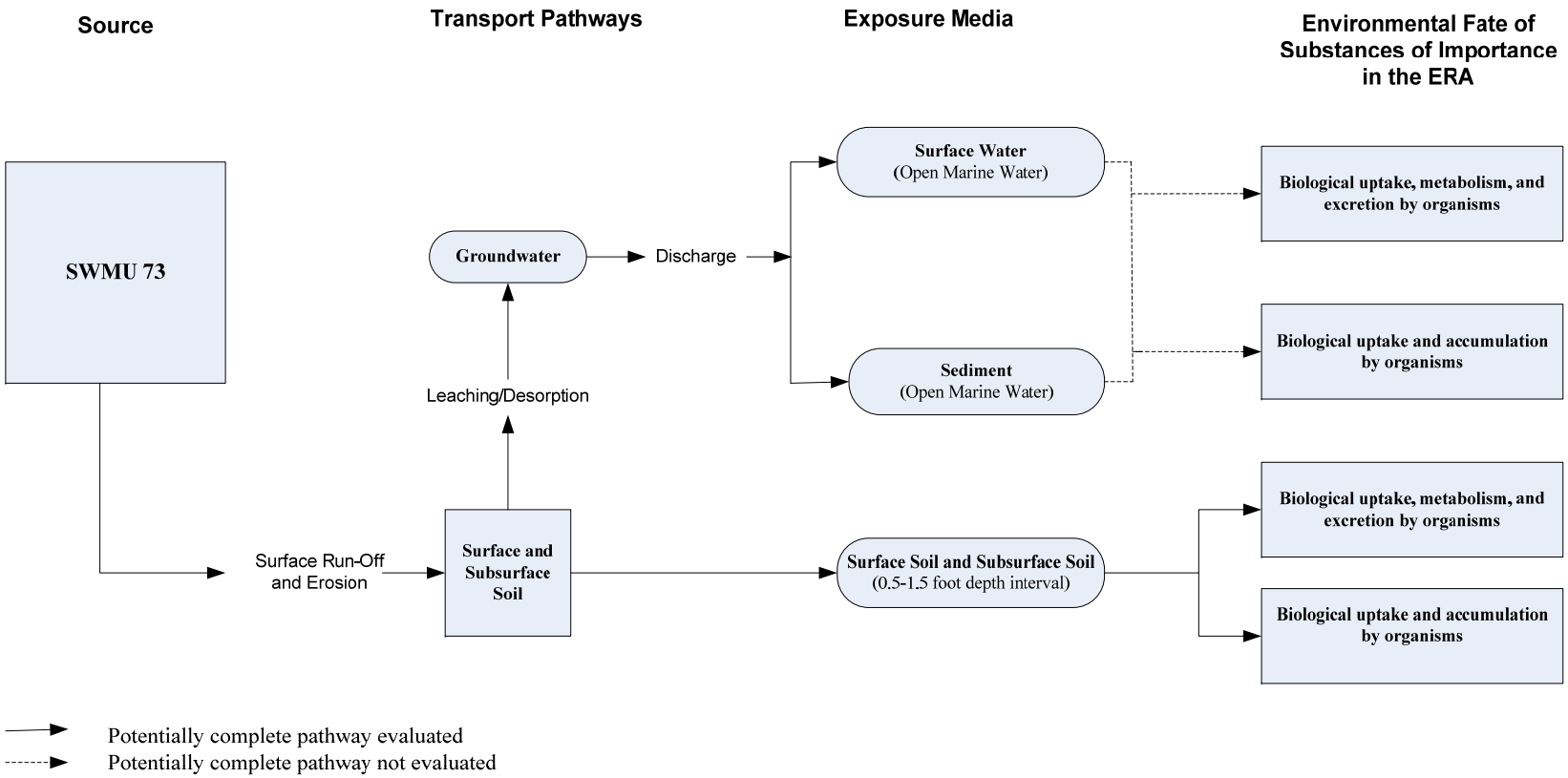


Figure 6. General Environmental Fate of Chemicals in SWMU 73 Media. This diagram is number 1 of 3 conceptual model diagrams for the Ecological Risk Assessment.

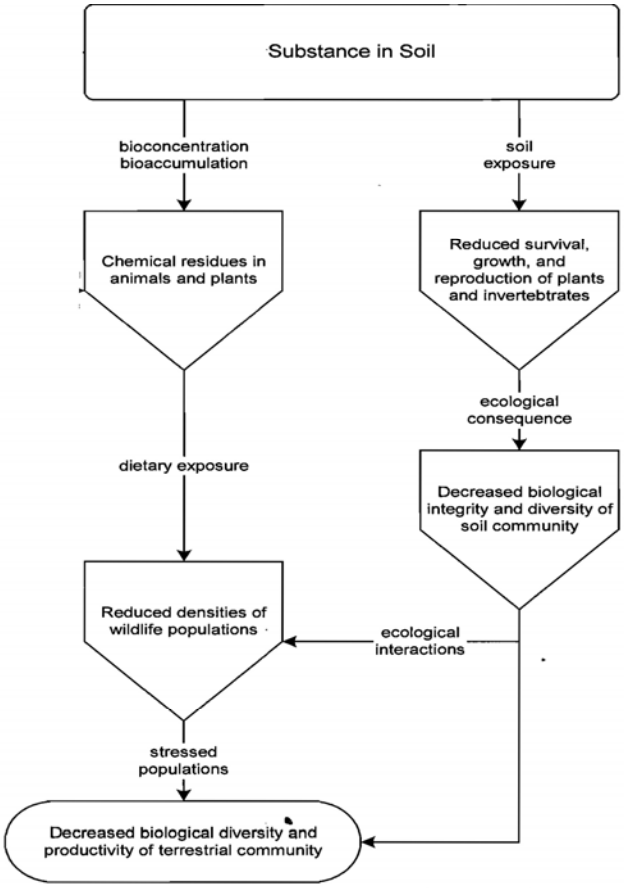


Figure 7. Hypothesized Ecological Consequences in Terrestrial Environments if Chemicals in SWMU 73 Media are Determined to be Ecologically Adverse. This diagram is number 2 of 3 conceptual model diagrams for the Ecological Risk Assessment.

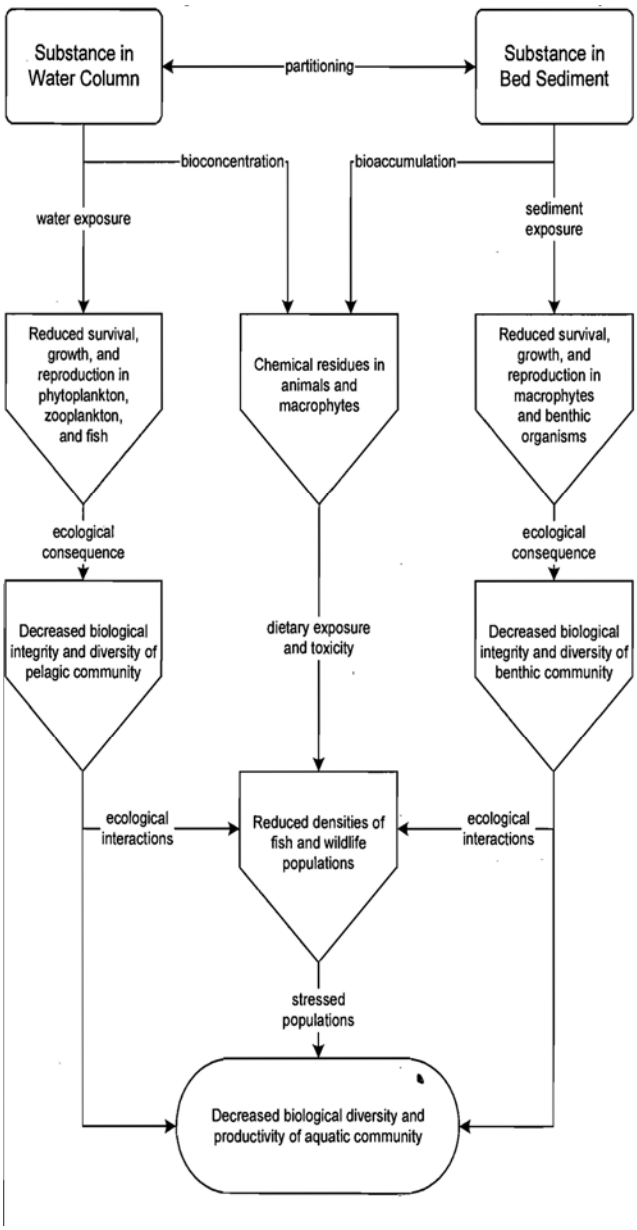


Figure 8. Hypothesized Ecological Consequences in Aquatic Environments if Groundwater Concentrations are Determined to be Ecologically Adverse. This diagram is number 3 of 3 conceptual model diagrams for the Ecological Risk Assessment.

APPENDIX A
JANUARY-FEBRUARY 2011 SAMPLING EVENT
FIELD LOGS

U.S. Army Public Health command (Prov)
Ground Water and Solid Waste Program
Ground Water Sampling Log

USAPHC

CMS-SWMU 73
CAMP MOSCRIP, PR
38-EH-0995-11

Well Data

Installation: Camp Moscrip Sample ID: MW 01 Date: 1-31-11 Time: 1320
Well Number: MW 01 Well Locked: Upon arrival? Yes * No
Well Inside Diameter: 2" Reference Point: ✓ top of well casing or ___ top protective casing
Water Level (WL): 8.81 Total Depth (TD): 17.55 Depth Pump Set:

Date	Time	Water Removed	Temperature (Centigrade)	pH (su)	Conductivity (uS/cm)	ORP (mV)	Dissolved O2 (%)	Turbidity (NTU)
	1325		40.8	6.96	7.09 mS/cm	-384	5.1	17.8
	1330		40.3	6.94	3.83	-383	11.4	8.55
	1335		40.0	6.96	3.75	-380	12.0	5.41
	1340		40.0	7.00	3.50	-374	14.1	2.54
	1345		39.8	7.04	3.20	-374	14.2	2.40
	1350		39.9	7.04	3.21	-373	14.3	2.27
	1355		39.8	7.03	3.21	-374	14.3	2.37

Well Sampling Data

Weather Conditions: Sun 82°F

Technician's Signature: Mamen
Sample Collection Method: Low-Flow
Pump Type: Peristalic
Pump Model: Cole Palmer
Avg. Flow Rate: 300 mL/min

Parameters Collected:

Sample Preservation:
Preserved By:

Sample Color: Clear
Sample Odor: Hydrogen Sulfide

Comments: * with wire tie. Dup taken MW-1D (14.5) MS+MSD Taken

Sample Taken Time: 1400

U.S. Army Public Health command (Prov)
Ground Water and Solid Waste Program
Ground Water Sampling Log

USAPHC

CMS-SWMU 73
CAMP MOSCRIP, PR
38-EH-0995-11

Well Data

Installation: Camp Moscrip Sample ID: MW-2 Date: 1-31-11 Time: 1630
Well Number: MW-2 Well Locked: Upon arrival? Yes____ No X
Well Inside Diameter: 2" Reference Point: ✓ top of well casing or____ top protective casing
Water Level (WL): 10.20 Total Depth (TD): 27.10 Depth Pump Set: 24'

Date	Time	Water Removed	Temperature (Centigrade)	pH (su)	Conductivity (uS/cm)	ORP (mV)	Dissolved O2 (%)	Turbidity (NTU)
	1640		34.3	6.45	35.5 ms/cm	149	93.7	430
	1645		34.1	6.43	34.4	201	84.3	217
	1650		34.1	6.43	35.9	240	79.8	75.1
	1655		34.0	6.44	35.2	379	61.2	36.2
	1700		33.9	6.45	35.6	470	61.8	11.1
	1705		33.9	6.46	35.2	471	61.4	7.0
	1710		33.9	6.45	34.9	471	61.7	8.3

Well Sampling Data

Weather Conditions: Setting Sun 79°F

Technician's Signature: Mann
Sample Collection Method: ✓ Low-Flow
Pump Type: Peristalic
Pump Model: Cole Palmer
Avg. Flow Rate: 300 ML/MN

Parameters Collected:

Sample Preservation:
Preserved By:

Sample Color: See NTU Recordings
Sample Odor: None

Comments:

Sample Taken Time: 1710

U.S. Army Public Health command (Prov)
Ground Water and Solid Waste Program
Ground Water Sampling Log

USAPHC

CMS-SWMU 73
CAMP MOSCRIP, PR
38-EH-0995-11

Well Data

Installation: Camp Moscript Sample ID: MW-3 Date: 1-31-11 Time: 1520
Well Number: MW-3 Well Locked: Upon arrival? Yes * No
Well Inside Diameter: 2" Reference Point: X top of well casing or ____ top protective casing
Water Level (WL): 9.94 Total Depth (TD): 32.2 Depth Pump Set: 28.9

Date	Time	Water Removed	Temperature (Centigrade)	pH (su)	Conductivity (uS/cm)	ORP (mV)	Dissolved O2 (%)	Turbidity (NTU)
1-31-11	1522		36.7	6.29	25.4 ms/cm	137	96.0	off scale
	1527		36.5	6.33	24.8	149	87.5	419
	1532		36.3	6.32	25.1	141	77.3	220
	1537		36.1	6.32	25.2	143	75.1	135
	1542		36.2	6.31	25.5	146	71.2	71.7
	1547		36.1	6.30	26.0	159	67.1	44.1
	1552		36.0	6.30	26.2	169	70.3	39.6
	1557		35.9	6.31	26.2	169	70.4	38.0
	1602		35.9	6.32	26.2	169	70.3	34.0
	1613							12.6
	1614							11.4
	1615							10.7
	1616							11.9
	1618							8.8
	1619							9.7

-collect metals sample

Well Sampling Data

Weather Conditions: Sun 85° F

Technician's Signature: [signature]
Sample Collection Method: ✓ Low-Flow
Pump Type: Peristalic
Pump Model: Cole Palmer
Avg. Flow Rate: 250 ML/min

Parameters Collected:

Sample Preservation:
Preserved By:

Sample Color: Cloudy to begin, Clearing as pumping
Sample Odor: NONE

Comments: * wire tie

Sample Taken Time: 1615

Location Camp Moscrip, PR Date Jan 2011

Project / Client

Log by B. Hammond C.P.G.

30 Jan - Travel to PR
0530 leave house
1430 at Marriott hotel in San Juan

31 Jan
0700 leave hotel
0845 meet mr. Fuentes Carrion at site
0930 Dave calibrates equipment
0945 Carlos key didn't work - he came out with another key
1030 have located all wells - cut path with machette to #2 & 3
- Dave Borchart arrives
1045 leave for Walmart
1245 Have ice, Distilled water & other supplies - back on site at mw01
1300 collect EQ Blank
SVOCs (2L) LL Pahs (2L) VOCs (3 40ml)
metals (1 .5 L)
VOCs preesened w/ drops of HCL
metals w/ nitric
1310 PTW - at M 8.81 DTW
17.55 total depth
2.0' from well TOC to grand surface

Location Camp Moscrip, PR Date Jan 2011

Project / Client

BPH

4 drums at MW-01
1 by entrance building labeled Decon
1 on pad Decon water (Augers) Water
April 08
2 by well
1 labeled Drill cuttings SB02/MW01
April 08 0-15'

1 Labeled development & purge water
April 08

Photos of all drums & collecting EQ Blank

1320 Top of Drum w/ soil cuttings is rusted & collapsed under weight of water level indicator. All drums likely same poor condition can't be moved
1400 collect MW-1, MS, MSD
1415 collect MW-1D
1445 Cleaning up & packing up purge water in last drum
1510 at MW03 DTW 9.94
Total depth 32.2
2.6' above grand surface
stick up & pad

Location Camp Moscrip, PR Date Jan 2011

Project / Client

BFI

1530 doing low flow measurements at MW-3

3 Drums Jan 09

1- Drill cuttings 20-33'

1- " 0-20'

1- purge water

All in poor condition

1615 collect sample in Amber liters

1619 continued purging until turbidity was < 10 NTU place ≈ 2.5 gal purge water in drum

1630 at MW-02

DTW 10.00

total depth 27.10

stick up 1.9' pad 3"

1635 Two drums for SB27/MW02 Approx

1- 0-25' soil cuttings

1- purge water

1710 collect sample

1715 2.5 gallons placed in purge water drum - now its ≈ 1" from top

1720 cleaned up leave site

1845 at Hotel in San Juan

- check ice in coolers.

1900 done 12 hr day

Location Camp Moscrip, PR Date Feb 2011

Project / Client

BFI

1 Feb 2011

0700 leave hotel

0830 get ice

0900 at site do equipment b/t

0945 collect equipment Blank

- pour distilled water through soil tube, cutting shoe & into aluminum pan then bottle

1020 at MW03 do soil probe

Done driving probe at 6' - 0.1 ppm on PID

1030 pre-probed to 8' w/ 3/4" probe

next probe with ≈ 1.25" probe

1130 hard driven soil tube to 10.5') 10min Break in AM

1150 very hard jacking out

- collect what samples I can

735B01-05 9'-11'

metals & SVOCs & LL PAHs

Soil is hard reddish brown clay

1250 10.01 DTW at MW03

10.27 DTW at MW02

1305 8.80 DTW at MW01

1330 - 1530 pack coolers

1730 Drop off samples at FedEx in San Juan 1800 at Hotel

Location Camp Moscrip, PR Date Feb 2011

Project / Client

BFP

1800 - 1900 email Fed Ex info to Labs

2 Feb

0700 leave hotel

0830 at reserve facility

0845 Drive 2nd sampler at MW03

0915 Drive Sampler to 12.5'

0945 sampler out of ground

pesticide sample from ≈ 11' & duplicate

VOC sample from ≈ 10.5' & duplicate MS & MSD

73-SB01-05

1045 Duane hand augering at 73SB03-05-MW2

gravel layer at ≈ 1.5' and again at 5-6'

1100 Duane at 9' - soil moist

1110 sample collected at 9' - 9.3' moist

reddish brown clay

1230 Doing chain of custodys & packing up

1400 finished packing coolers ready to head to Fed Ex

End of notes

Location Date

Project / Client

Blank

APPENDIX B
JANUARY-FEBRUARY 2011 SAMPLING EVENT
LABORATORY DATA VALIDATION REPORT

AE

AE – Environmental

Data Validation Report

Camp Moscrip, Puerto Rico

Prepared by:

AE - Environmental
7519 Green Valley Road
Frederick, Maryland 21701

Prepared for:

US Army Public Health Command
Blackhawk Road
Aberdeen Proving Ground, Maryland

March, 2011

AE

AE – Environmental

CERTIFICATION

March 15, 2011

I certify that to the best of my knowledge and belief the attached report is correct and complete within the terms and conditions and the Scope of Work provided by the USAPHC.

John F. Kearns
President
AE, LLC

1.0 Introduction

This report presents the findings of a technical review of analytical data from Lancaster and Microbac laboratories of Lancaster, PA and Baltimore, MD, respectively. Metals analyses for soil and water were performed by Microbac and organic analyses, consisting of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides, also in both soil and water, were performed by Lancaster. The SVOC analyses were conducted in two parts. Part one consisted of the US Environmental Protection Agency method SW-8270D and the second was an analysis of polycyclic aromatic hydrocarbons (PAH) by a modification of the 8270 technique called Selected Ion Monitoring (SIM). The analyte lists were project specific. The data will be used in comparison to fixed regulatory threshold values.

There are three aqueous samples from monitoring wells, two field blanks, and a trip blank in the aqueous set. There are two samples from soil borings in the soil data set. A field duplicate for each matrix was also provided. However, it should be noted that the chain of custody did not call for SVOC analysis of the soil duplicate.

This review consisted of a comparison of the data and its documentation to pre-established contractual and project-specific quality control specifications (Method Quality Objectives --- MQOs) for purposes of identifying data that is broadly unfit for use, and in particular indications of potential false negative data points. It is also intended to identify data that are biased or variable to a greater degree than is normal for the methods of analysis employed, and data that are affected by background contamination to the extent that they are not considered representative of site conditions. The specific elements of review are presented in the data review checklists.

The report consists of three sections in addition to this introduction describing methods of work, data review findings, and an assessment of data usability. These three sections are supported by two appendices: Data Verification Checklists and Data Tables.

2.0 Methods of Work

2.1 Data Review

The following sections describe the approach to data review employed in the course of this work.

2.1.1 Finalize Project-specific Data Verification Checklists

The specifications of our standard data review worksheets were modified to reflect the agreed upon project-specific acceptance criteria. Those finalized checklists were employed in the data review process discussed below.

2.1.2 Data Review

Analytical data packages were received from the laboratories after some initial consolidation and formatting at the US Army Public Health Command at Aberdeen Proving Ground, MD. Upon receipt, the data packages were logged in and a cursory completeness check on the hard copy deliverables was performed.

Upon acceptance, the data packages were referred to a Project Chemist (PC) for review. The PC verified the contents of the data packages against the requirements summarized in the appropriate data verification checklist for the methods of analysis involved. Any deviations from the requirements were noted on the verification checklists and supporting documentation pertaining to any such deviation retained for subsequent inclusion in the project records. As necessary, the PC applied data qualifying flags to the analytical result reported on the data tables.

2.2 Definitions and Qualifications

Definitions of data quality indicators (DQIs), data qualifying flags, and reason codes are presented in Tables 1 through 3, respectively. Reason codes identify the anomaly that resulted in the application of data qualifiers.

Table 1
Data Quality Indicators

Data Quality Indicator	Definition
Precision	The degree of agreement between measurements of the same property under the same conditions; variability. Variously measured as the relative percent difference (RPD), variance, standard deviation, or percent relative standard deviation (%RSD). Duplicate (or replicate) samples are used to assess precision.
Accuracy	The degree to which a measurement agrees with a known or standard value for the measured condition. It is generally measured through the use of standards and spikes and is reported as the percent recovery or the percent difference.
Representativeness	The degree to which a measured value accurately and precisely represents the population from which it is drawn. Representativeness may be inferred to some extent by assessment of field duplicates and blanks. However, it is primarily controlled by the statistical validity of the sampling plan.
Comparability	The degree to which one data set may be compared to another. This is a qualitative assessment based on the degree to which the methods of work employed and the sampling design for the two (or more) data sets are the same.
Completeness	The degree to which the data set provides sufficient numbers of data points to perform the specified data analyses, under the actual conditions of sampling and analysis compared to the assumptions of the project planning process.
Sensitivity	The degree to which an analytical measurement can be reliably differentiated from zero and/or reported with planned precision and accuracy. Also, the ability to discriminate between orders of magnitude in the measured continuum.

Table 2
Data Qualifier Definitions

Code/Flag	Interpretation
J	The reported result is an estimate; associated QC results are outside the specified range
UJ	The reported detection/reporting limit is an estimate; associated QC results are outside the specified range
R	The result is rejected or unusable either qualitatively or quantitatively; a data gap is indicated
U	The analyte should be treated as a non-detect at the reported value or the reporting limit whichever is greater.
Q or X	Self defined note; see commentary in report
+/-	When used in conjunction with another flag, indicates direction of bias if the direction can be identified. Double use (i.e., ++ or --) indicates that a very strong bias is observed.

Table 3
Reason Codes

Code	Interpretation
a	Not presently used
b_1	Result is flagged due to **method blank** contamination; Reported value is raised to the reporting limit for values between MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
b_2	Result is flagged due to **calibration blank** contamination; Reported value is raised to the reporting limit for values between MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
b_3	Result is flagged due to **field, ambient, or trip blank** contamination; Reported value is raised to the reporting limit for values between MDL and RL and a positive bias is indicated; in the case of negative blank results a negative bias is indicated.
c_1	Result is flagged due to **initial calibration** anomalies related to linearity or response.
c_2	Result is flagged due to **initial calibration verification** anomalies
c_3	Result is flagged due to **continuing calibration** anomalies related to drift or response
d	Result is flagged due to **duplicate imprecision** (including matrix spike duplicates); RPD greater than specified
e	Not presently used
f	Not presently used
g	Not presently used
h	Result is flagged due to **holding time** failure; a low bias is indicated
i	Result is flagged due to **internal standard** (organic and ICP/LC MS) or **ICP interference check** failure (inorganic)
j	Not presently used
k	Not presently used
l	Result is flagged due to **LCS** anomalies
m	Result is flagged due to **matrix spike** recoveries outside the specified window
n	Not presently used
o	Not presently used
p	Result is flagged due to **post-digestion spike** failure (inorganics)
q	Result is flagged due to method of **quantitation** anomaly
r	Not presently used
s	Result is flagged due to **surrogate** recovery (organic) or **serial dilution** (inorganic) failures
t	Result is a **TIC** (organic); Result is flagged due to **tracer** recovery anomaly (radiological)
u	Not presently used
v	Not presently used
w	Not presently used
x,y,z	Self defined in report

3.0 Data Verification Findings

3.1 VOCs in Water

Major Anomalies: None.

Minor Anomalies: Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis in the VOC fraction displayed recoveries greater than the upper control limit (UCL) for carbon disulfide and allyl chloride. The positive results for carbon disulfide (in the field samples) were flagged UJ,m. Allyl chloride was not flagged (see comments below). The trip blank displayed positive detections for acetone and carbon disulfide. Positive results in the samples were flagged U,b3. Chloromethane also displayed recovery less than the lower control limit (LCL) in the MS/MSD and associated results were flagged UJ,m.

Comments: Allyl chloride exceeded that upper QC limit in the LCS. There were no positive detections and no data qualification was required. Minor calibration anomalies were observed but did not impact reported sample results.

3.2 SVOCs in Water

Major Anomalies: In the LCS, 1,4-phenylenediamine displayed a recovery approaching zero. Non-detects for this analyte were flagged R,l. In the MS, 4-nitroquinoline-1-oxide displayed a near zero recovery. This compound was flagged R,m in all samples. Two of three acid extractable surrogates displayed near zero recovery in sample MW-3. Phenolic compounds in this samples were flagged R,s.

Minor Anomalies: Aramite, methapyrilene, phentermine (a,a-dimethylphenethylamine), and 1,4-napthoquinone displayed recoveries in the MS less than the LCL (and di(2-ethylhexyl) phthalate greater than the UCL). Aramite, methapyrilene, and phentermine also displayed this anomaly in the LCS. These analytes were flagged J,m for positive detections and UJ,ml or UJ,m (as appropriate) for non-detects, unless previously flagged for field blank contamination (i.e., U,b3). The initial calibration verification (ICV) associated with these samples displayed an RSD greater than the UCL for N-nitrosodi-n-butylamine. This analyte was flagged UJ,c2 in all samples. In the SIM fraction, field blank contamination lead for flagging naphthalene and phenanthrene positive results U,b3. Calibration anomalies observed do not bear on the reported results and no data qualification was required.

Comments: In the SVOC fraction the reported results for bis(2-chloroisopropyl) ether represent the sum of this isomer and another called 2,2-oxybis(1-chloropropane). For the sake of consistency, the name of this analyte in the data tables has been “normalized” to the hard copy report (i.e., bis(2-chloroisopropyl) ether). The retention time for perylene-d12 in one of the CCVs was reported to be outside its normal acceptance window. The

laboratory suggests this is due to column clipping which is a fairly routine maintenance process. Based on professional judgment no flags were applied.

3.2 Pesticides in Water

Major Anomalies: None.

Minor Anomalies: None.

Comments: Please note that the only aqueous sample for pesticides was a field blank.

3.3 Metals in Water

Major Anomalies: None

Minor Anomalies: Calibration anomalies resulted in data qualification (J,c2 or UJ,c2) for some antimony, chromium, and zinc results. Method, calibration, and field blanks displayed contamination that resulted in data qualifiers (U or UJ). Affected analytes include antimony, chromium, copper, vanadium, arsenic, barium, and zinc. Duplicate anomalies resulted in J flags for positive antimony, arsenic, and barium results. The ICS A displayed positive detections greater than the CL for antimony, arsenic, beryllium, and cadmium. Associated non-detects were flagged UJ,i; positive detections were flagged J,i.

Comments: Data not provided with regard to internal standard recoveries. The laboratory reported results from multiple dilutions, thus, reporting limits are elevated in a number of samples.

3.5 VOCs in Soil

Major Anomalies: In the MS, styrene displayed a near zero recovery and associated results were flagged R,m.

Minor Anomalies: Field blanks and trip blanks displayed positive detections for acetone and carbon disulfide. Positive results for these analytes in the associated samples were flagged U,b3 as appropriate. Continuing calibration anomalies were observed for 2-butanone and acetonitrile. Associated results were flagged UJ,c3, or J,c3 (if a detection). In the MS, 2-chloro-1,3-butadiene and acetone displayed recoveries less than the LCL. Positive results were flagged J,m and non-detects were flagged UJ,m. Methyl iodide displayed anomalies in the MS and MSD resulting in the single positive result being flagged J,dm.

Comments: A single, modest, internal standard anomaly was associated with the matrix spike sample in this batch. As the surrogate recoveries were acceptable, indicating that the internal standard worked effectively in the analysis, no data qualifiers were applied.

3.6 SVOCs in Soil

Major Anomalies: In the MS and/or the LCS, 1,4-phenylenediamine, 2-napthylamine, 3,3-dimethylbenzene, methapyrilene, phentermine (a,a-dimethylphenethylamine), and methyl methanesulfonate displayed near zero recoveries. These analytes were flagged R,ml.

Minor Anomalies: In the MS, 1,4-napthquinone and ethyl methanesulfonate displayed a recovery less than the LCL and was flagged UJ,m. In the LCS n-nitrosodiphenylamine displayed a recovery less than the LCL. This analyte was flagged UJ,l

Comments: In the SVOC fraction the reported results for bis(2-chloroisopropyl) ether represent the sum of this isomer and another called 2,2-oxybis(1-chloropropane). For the sake of consistency, the name of this analyte in the data tables has been "normalized" to the hard copy report (i.e., bis(2-chloroisopropyl) ether). Three modest, internal standard anomalies were associated with the samples in this batch. As the surrogate recoveries were acceptable, indicating that the internal standard worked effectively in the analysis, no data qualifiers were applied.

3.7 Pesticides in Soil

Major Anomalies: None.

Minor Anomalies: None.

Comments: None.

3.8 Metals in Soil

Major Anomalies: Antimony displayed a near zero recovery in the MS. All results were flagged R,m.

Minor Anomalies: Calibration verification anomalies resulted in data qualifiers (J for detects; UJ for non-detects). Affected analytes are beryllium, silver, and vanadium. MS anomalies result in J and UJ flags for barium, selenium, tin, vanadium, and zinc. Duplicate relative percent differences (RPDs) greater than the control limit (CL) resulted in J flags for barium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc. The ICS A displayed positive detections greater than the CL for cadmium, chromium, cobalt, copper, nickel, selenium, silver, vanadium, and zinc. Positive results were flagged J,i; non-detects were flagged UJ,i.

Comments: Data not provided with regard to internal standard recoveries.

4.0 Data Quality Assessment

In this section any anomalies observed in terms of precision, accuracy, representativeness, completeness, comparability, and/or sensitivity will be highlighted and guidance provided regarding any limitations on use of the data.

4.1 Precision

The precision of these data was generally found to be acceptable. Minor to modest duplicate imprecision was observed in metals. Nothing in the assessment of precision resulted in the application of "R" flags and, from the perspective of precision, these data points are usable. In cases of precision anomalies, the data user is encouraged to use those data conservatively as the actual value in the sample may differ to some degree from the reported value.

4.2 Accuracy

The accuracy of these data were found to be generally acceptable. Nonetheless, matrix effects contributed to some biased results in the VOC, SVOC and metals data. Of particular concern are those instances in which recoveries were found to be depressed to a point where one cannot exclude the potential for false negatives. These results include antimony in the metals fraction, styrene in the VOC fraction and 1,4-phenylenediamine, 2-napthylamine, 3,3-dimethylbenzene, methapyrilene, phentermine (a,a-dimethylphenethylamine) and methyl methanesulfonate in the SVOC fraction. In addition, phenolic compounds in sample MW-3 were also flagged R. These results represent data gaps and may not be used for decision making. Less severe biases, both positive and negative were observed for a variety of other analytes but these results may be used as reported.

However, in comparing these data to fixed threshold values, the data user must keep these biases in mind such that when the value in the sample approaches the comparison threshold on either the lower or higher side, the worst-case scenario should be assumed unless a detailed analysis of the direction and magnitude of bias attributed to each datum is applied.

4.3 Representativeness

Representativeness is a DQI that depends to the largest degree on the sampling plan. Preservation status and holding times may also be a factor. And to some extent field blanks and duplicates can provide clues. In this case, blanks, preservation and holding times were found to be acceptable. Although some few data points were flagged due to field duplicate imprecision the reviewer did not observe any very significant differences except as addressed below under sensitivity.

4.4 Comparability

The internal comparability of data within media-method groups in this data set appears to be acceptable. The reviewer did not observe any procedural modifications that are expected to have discernable impact on data utility or interpretation. In the case where these data are to be combined with other data sets it will be prudent to assess comparability of results. Assuming that the same laboratories and same methods of analysis are employed in the future there is unlikely to be any significant impact on comparability.

4.5 Completeness

Overall, completeness is acceptable. However, on an analyte specific basis there are some data gaps. These are addressed in more detail above in section 4.2.

4.6 Sensitivity

Reporting limits were elevated in a significant number of instances either due to irresolvable matrix interferences or as a result of dilutions required to accommodate high analyte concentration in the samples. The data user is encouraged to ensure that reporting limits reported are lower than the applicable comparison criteria. If not, the comparison of non-detects to the threshold value is invalid.

APPENDIX C
JANUARY-FEBRUARY 2011 SAMPLING EVENT
LABORATORY ANALYTICAL DATA

DEPARTMENT OF THE ARMY
US Army Public Health Command (Provisional)
5158 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5403

MCHB-TS-L 08 Mar 2011

MEMORANDUM FOR USAPHC Program 38 (GWSWP) (5158 Blackhawk Road/Mr. Brian Hammond), MCHB-IP-EGW, Bldg 1677, Gunpowder, MD 21010

SUBJECT: DLS Final Analytical Report

1. This is DLS Final Analytical Report for:

Project Site:	Camp Moscrip, PR
SubJono:	0995
DLS Work Order #:	1847
Report Serial #:	6935

2. Please contact us if this report or any of our services did not meet your needs or expectations.

3. Point of contact for additional information is Mr. Ronald J. Swatski or Mr. David F. Morrow, DSN 584-2208 or commercial 410-436-2208.

MR. FREDERIC BELKIN FOR
LTC KEVIN K. PITZER
Laboratory Operations Manager

The information contained in this document and any attachments is confidential and is intended for the addressee only. Reading, copying, disclosure or use by anyone else is unauthorized. If you are not the intended recipient, please destroy this documnet and any attachments and advise the sender immediately by calling 410-436-2208/DSN 584-2208.

USAPHC (PROV)
Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

SAMPLE SUMMARY

Workorder: 1847 Camp Moscrip, PR

Lab ID	Sample ID	Matrix	Date Collected	Date Received
18470001	EQ GW	Water (Miscellaneous)	1/31/2011 13:00	2/3/2011 11:20
18470002	MW-1	Water (Miscellaneous)	1/31/2011 14:00	2/3/2011 11:20
18470003	MW-1D	Water (Miscellaneous)	1/31/2011 14:15	2/3/2011 11:20
18470004	MW-2	Water (Miscellaneous)	1/31/2011 17:10	2/3/2011 11:20
18470005	MW-3	Water (Miscellaneous)	1/31/2011 16:15	2/3/2011 11:20
18470006	EQ Blk Soil	Water (Miscellaneous)	2/1/2011 09:45	2/3/2011 11:20

CERTIFICATE OF ANALYSIS

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PROJECT SUMMARY

Workorder: 1847 Camp Moscrip, PR

Sample Comments

Lab ID: 18470001	**Sample ID:** EQ GW	**Sample Type:** SAMPLE
TEMP 2C		
Lab ID: 18470002	**Sample ID:** MW-1	**Sample Type:** SAMPLE
TEMP 2C		
Lab ID: 18470003	**Sample ID:** MW-1D	**Sample Type:** SAMPLE
TEMP 2C		
Lab ID: 18470004	**Sample ID:** MW-2	**Sample Type:** SAMPLE
TEMP 2C		
Lab ID: 18470005	**Sample ID:** MW-3	**Sample Type:** SAMPLE
TEMP 2C		
Lab ID: 18470006	**Sample ID:** EQ Blk Soil	**Sample Type:** SAMPLE
TEMP 2C		

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The following report(s) comprise the

Contractor Data Report(s) for Analytical Tests

performed at contract laboratories

in support of the US Army Public Health Command.

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COVER LETTER

February 14, 2011

Report No.: 11B0334

Heidi Taylor
Public Health Command

Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201

APG, MD 21010-5422

RE: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils

The report of analyses contains test results for samples received at Microbac Laboratories, Inc., Baltimore Division on 02/03/2011 15:38.

The enclosed results were obtained from and applicable to the sample(s) as received at the laboratory. All sample results are reported on an "as received" basis unless otherwise noted.

All data included in this report has been reviewed and meet the applicable project and certification specific requirements, unless otherwise noted.

This report has been paginated in its entirety and shall not be reproduced except in full, without the written approval of Microbac Laboratories, Inc.

We appreciate the opportunity to service your analytical needs. If you have any questions, please feel free to contact us.

This Data Package contains the following:

- This Cover Page
- Sample Summary
- Case Narative
- Test Results
- QC Summary
- Notes and Definitions
- Cooler Receipt Log
- Chain of Custody
- Data

2/14/2011

Final report reviewed by: Lewis B. Gunn III/Project Manager Report issue date

All samples received in proper condition and results conform to ISO 17025 standards unless otherwise noted.

If we have not met or exceeded your expectations, please contact the Director or Trevor Boyce, President at tboyce@microbac.com or Robert Morgan, Chief Operation Officer, at rmorgan@microbac.com.

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Type	Date Sampled	Date Received
18470001 EQ GW	11B0334-01	Water	Not Specified	01/31/2011 13:00	02/03/2011 15:38
18470002 MW-1	11B0334-02	Water	Not Specified	01/31/2011 14:00	02/03/2011 15:38
18470003 MW-1D	11B0334-03	Water	Not Specified	01/31/2011 14:15	02/03/2011 15:38
18470004 MW-2	11B0334-04	Water	Not Specified	01/31/2011 17:10	02/03/2011 15:38
18470005 MW-3	11B0334-05	Water	Not Specified	01/31/2011 16:15	02/03/2011 15:38
18470006 EQ Blk Soil	11B0334-06	Water	Not Specified	02/01/2011 09:45	02/03/2011 15:38

Microbac Laboratories, Inc., Baltimore Division

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Lewis B. Gunn III, Project Manager

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Baltimore Division
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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

CASE NARRATIVE

Public Health Command
Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Heidi Taylor
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201
APG , MD 21010-5422

6 sample(s) were received by Kimberly L. Novak of Microbac laboratories, Baltimore Division on 2/3/2011 3:38:00 PM and sample(s) condition(s) were checked and found to be acceptable unless otherwise noted in the 'Cooler Receipt Log' or 'Statement of Qualifications' sections of this report. The samples were logged into the LIMS by Kimberly L. Novak on 2/4/2011 11:09:00 AM and compared to the client DQO. Any deviations from the client DQO and method specific quality control requirements are noted in the 'Statement of Data Qualifications'.

Other Notes/Comments:

The 200.8 analysis was repeated due to multiple failing Quality Control Standards, the instrument was recalibrated and the re-analysis Quality Control Standards were within acceptance limits except where noted in the Statement of Data Qualifications.

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

STATEMENT OF DATA QUALIFICATIONS

All samples recieved in proper condition unless otherwise noted below.
All quality control parameters were meet unless otherwise noted below.

Qualifications:

Analyte is found in method blank.

Analyte & Samples(s) Qualified:

Barium

1107121-BS1, 1107121-DUP1, 1107121-MS1, 1107121-MSD1, 1107121-PS1, 11B0334-02[18470002 MW-1], 11B0334-03[18470003 MW-1D], 11B0334-04[18470004 MW-2], 11B0334-05[18470005 MW-3]

Copper

1107121-BS1, 1107121-DUP1, 1107121-MS1, 1107121-MSD1, 1107121-PS1, 11B0334-01[18470001 EQ GW], 11B0334-02[18470002 MW-1], 11B0334-03[18470003 MW-1D], 11B0334-04[18470004 MW-2], 11B0334-05[18470005 MW-3], 11B0334-06[18470006 EQ Blk Soil]

Lead

1107121-BS1, 1107121-DUP1, 1107121-MS1, 1107121-MSD1, 1107121-PS1

Qualifications:

Sample Duplicate RPD was out of acceptance limits. The result concentration was within 5 times the reporting limit and the difference was less than the reporting limit.

Analyte & Samples(s) Qualified:

Antimony

1107121-DUP1

Arsenic

1107121-DUP1

Vanadium

1107121-DUP1

Qualifications:

CCV recovery was above acceptance limits. The concentration was below the reporting limit.

Analyte & Samples(s) Qualified:

Antimony

M1B1103-CCV1

Beryllium

M1B1103-CCV2

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470001 EQ GW

11B0334-01 (Water) Sampled: 01/31/2011 13:00; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1602	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1009	APS	EPA 200.7/6010B	U
Nickel	ND	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Zinc	**3.7**	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	J
Vanadium	ND	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Thallium	ND	1.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Selenium	ND	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Lead	ND	1.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Copper	**1.5**	1.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	B
Arsenic	ND	2.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Silver	ND	1.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Antimony	**0.46**	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	J
Cobalt	ND	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Barium	ND	5.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Beryllium	ND	1.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Cadmium	ND	0.50	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U
Chromium	ND	2.0	ug/L	020911 1312	021011 1600	PBK	EPA 200.8/6020	U

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470002 MW-1

11B0334-02 (Water) Sampled: 01/31/2011 14:00; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1609	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1012	APS	EPA 200.7/6010B	U
Lead	ND	1.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Chromium	ND	2.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Zinc	**2.8**	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	J
Vanadium	**0.54**	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	J
Thallium	ND	1.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Silver	ND	1.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Selenium	**4.0**	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	J
Nickel	**1.1**	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	J
Antimony	ND	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Copper	**3.0**	1.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	B
Cobalt	ND	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Arsenic	**1.2**	2.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	J
Barium	**96**	5.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	B
Beryllium	ND	1.0	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U
Cadmium	ND	0.50	ug/L	020911 1312	021011 1605	PBK	EPA 200.8/6020	U

Microbac Laboratories, Inc., Baltimore Division

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Lewis B. Gunn III, Project Manager

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470003 MW-1D

11B0334-03 (Water) Sampled: 01/31/2011 14:15; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1611	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1027	APS	EPA 200.7/6010B	U
Arsenic	**2.2**	2.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	
Cobalt	ND	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Selenium	**0.81**	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	J
Nickel	ND	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Thallium	ND	1.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Lead	ND	1.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Copper	**0.28**	1.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	J, B
Silver	ND	1.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Chromium	ND	2.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Cadmium	ND	0.50	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Barium	**8.5**	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	B
Antimony	ND	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Zinc	ND	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U
Vanadium	**6.3**	5.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	
Beryllium	ND	1.0	ug/L	020911 1312	021011 1626	PBK	EPA 200.8/6020	U

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470004 MW-2

11B0334-04 (Water) Sampled: 01/31/2011 17:10; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1613	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1032	APS	EPA 200.7/6010B	U
Nickel	**120**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Zinc	**190**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Vanadium	ND	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	U
Thallium	ND	1.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	U
Selenium	**69**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Lead	ND	1.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	U
Copper	**67**	1.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	B
Antimony	**1.7**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	J
Silver	**3.5**	1.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Cobalt	**120**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Arsenic	**19**	2.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Barium	**81**	5.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	B
Beryllium	ND	1.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	U
Cadmium	**15**	0.50	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	
Chromium	**9.4**	2.0	ug/L	020911 1312	021011 1631	PBK	EPA 200.8/6020	

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470005 MW-3

11B0334-05 (Water) Sampled: 01/31/2011 16:15; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1615	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1036	APS	EPA 200.7/6010B	U
Chromium	**2.4**	2.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Vanadium	ND	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	U
Thallium	ND	1.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	U
Silver	**1.1**	1.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Selenium	**63**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Nickel	**47**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Lead	ND	1.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	U
Zinc	**90**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Copper	**140**	1.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	B
Cobalt	**240**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Antimony	**0.61**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	J
Arsenic	**21**	2.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	
Barium	**84**	5.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	B
Beryllium	**0.45**	1.0	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	J
Cadmium	**9.0**	0.50	ug/L	020911 1312	021011 1636	PBK	EPA 200.8/6020	

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18470006 EQ Blk Soil

11B0334-06 (Water) Sampled: 02/01/2011 09:45; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Mercury, Total by EPA 200/7000 Series Methods								
Mercury	ND	0.20	ug/L	020711 1212	020711 1618	APS	EPA 245.1/7470A	U
Metals, Total by EPA 200/6000 Series Methods								
Tin	ND	0.010	mg/L	020911 1308	021011 1040	APS	EPA 200.7/6010B	U
Arsenic	ND	2.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Copper	**2.6**	1.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	B
Silver	ND	1.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Selenium	**2.5**	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	J
Nickel	**0.31**	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	J
Vanadium	**0.85**	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	J
Lead	ND	1.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Thallium	ND	1.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Cobalt	ND	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Chromium	ND	2.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Cadmium	ND	0.50	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Barium	ND	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Antimony	ND	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U
Zinc	**2.9**	5.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	J
Beryllium	ND	1.0	ug/L	020911 1312	021011 1641	PBK	EPA 200.8/6020	U

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Mercury, Total by EPA 200/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107015 - Metals_Hg_Prep										
Blank (1107015-BLK1)				Prepared & Analyzed: 02/07/2011						
Mercury	ND	0.20	ug/L							U
LCS (1107015-BS1)				Prepared & Analyzed: 02/07/2011						
Mercury	1.97	0.20	ug/L	2.002		98.6	85-115			
Duplicate (1107015-DUP1)		**Source: 11B0237-01**		Prepared & Analyzed: 02/07/2011						
Mercury	ND	0.20	ug/L		ND				20	U
Matrix Spike (1107015-MS1)		**Source: 11B0237-01**		Prepared & Analyzed: 02/07/2011						
Mercury	1.97	0.20	ug/L	2.002	ND	98.6	70-130		20	
Matrix Spike Dup (1107015-MSD1)		**Source: 11B0237-01**		Prepared & Analyzed: 02/07/2011						
Mercury	1.90	0.20	ug/L	2.002	ND	95.0	70-130	3.71	20	
Batch M1B0806 - 1107015										
Instrument Blank (M1B0806-IBL1)				Prepared & Analyzed: 02/07/2011						
Mercury	ND	0.20	ug/L							U

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 200/6000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107120 - EPA 200.2 ICP										
Blank (1107120-BLK1)				Prepared: 02/09/2011 Analyzed: 02/10/2011						
Tin	ND	0.010	mg/L							U
LCS (1107120-BS1)				Prepared: 02/09/2011 Analyzed: 02/10/2011						
Tin	0.966	0.010	mg/L	1.000		96.6	85-115		20	
Duplicate (1107120-DUP1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Tin	ND	0.010	mg/L		ND				20	U
Matrix Spike (1107120-MS1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Tin	0.997	0.010	mg/L	1.000	ND	99.7	80-120		20	
Matrix Spike Dup (1107120-MSD1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Tin	1.01	0.010	mg/L	1.000	ND	101	80-120	1.49	20	
Batch 1107121 - EPA 200.2 ICPMS										
Blank (1107121-BLK1)				Prepared: 02/09/2011 Analyzed: 02/10/2011						
Lead	2.02	1.0	ug/L							
Vanadium	4.95	5.0	"							J
Zinc	ND	5.0	"							U
Thallium	ND	1.0	"							U
Silver	ND	1.0	"							U
Selenium	ND	5.0	"							U
Nickel	ND	5.0	"							U
Arsenic	0.612	2.0	"							J
Copper	1.52	1.0	"							
Antimony	ND	5.0	"							U
Barium	7.85	5.0	"							
Beryllium	ND	1.0	"							U
Cadmium	ND	0.50	"							U
Chromium	ND	2.0	"							U
Cobalt	ND	5.0	"							U

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 200/6000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107121 - EPA 200.2 ICPMS										
LCS (1107121-BS1)				Prepared: 02/09/2011 Analyzed: 02/10/2011						
Zinc	193	5.0	ug/L	200.0		96.3	85-115		20	
Copper	200	1.0	"	200.0		100	85-115		20	B
Thallium	212	1.0	"	200.0		106	85-115		20	
Silver	108	1.0	"	100.0		108	85-115		20	
Selenium	199	5.0	"	200.0		99.3	85-115		20	
Antimony	220	5.0	"	200.0		110	85-115		20	
Lead	208	1.0	"	200.0		104	85-115		20	B
Vanadium	210	5.0	"	200.0		105	85-115		20	
Chromium	212	2.0	"	200.0		106	85-115		20	
Cadmium	194	0.50	"	200.0		97.2	85-115		20	
Beryllium	188	1.0	"	200.0		94.1	85-115		20	
Barium	200	5.0	"	200.0		100	85-115		20	B
Arsenic	203	2.0	"	200.0		101	85-115		20	
Cobalt	207	5.0	"	200.0		103	85-115		20	
Nickel	210	5.0	"	200.0		105	85-115		20	
Duplicate (1107121-DUP1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Antimony	0.496	5.0	ug/L		1.02			69.1	20	R3, J
Lead	0.628	1.0	"		0.726			14.5	20	J, B
Copper	0.388	1.0	"		0.442			13.0	20	J, B
Cobalt	ND	5.0	"		ND				20	U
Chromium	ND	2.0	"		ND				20	U
Cadmium	ND	0.50	"		ND				20	U
Beryllium	ND	1.0	"		ND				20	U
Arsenic	0.823	2.0	"		1.48			57.2	20	R3, J
Silver	ND	1.0	"		ND				20	U
Barium	59.6	5.0	"		58.8			1.35	20	B
Nickel	1.08	5.0	"		1.07			1.02	20	J
Thallium	ND	1.0	"		ND				20	U
Vanadium	2.56	5.0	"		1.89			30.1	20	R3, J
Zinc	205	5.0	"		201			2.18	20	
Selenium	ND	5.0	"		0.620				20	U

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Metals, Total by EPA 200/6000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107121 - EPA 200.2 ICPMS										
Matrix Spike (1107121-MS1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Lead	202	1.0	ug/L	200.0	0.726	101	70-130		20	B
Zinc	383	5.0	"	200.0	201	91.0	70-130		20	
Vanadium	189	5.0	"	200.0	1.89	93.5	70-130		20	
Thallium	202	1.0	"	200.0	ND	101	70-130		20	
Silver	108	1.0	"	100.0	ND	108	70-130		20	
Nickel	195	5.0	"	200.0	1.07	97.1	70-130		20	
Copper	199	1.0	"	200.0	0.442	99.2	70-130		20	B
Arsenic	207	2.0	"	200.0	1.48	103	70-130		20	
Chromium	204	2.0	"	200.0	ND	102	70-130		20	
Cadmium	206	0.50	"	200.0	ND	103	70-130		20	
Beryllium	195	1.0	"	200.0	ND	97.7	70-130		20	
Barium	256	5.0	"	200.0	58.8	98.7	70-130		20	B
Cobalt	197	5.0	"	200.0	ND	98.4	70-130		20	
Antimony	229	5.0	"	200.0	1.02	114	70-130		20	
Selenium	198	5.0	"	200.0	0.620	98.9	70-130		20	
Matrix Spike Dup (1107121-MSD1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Zinc	367	5.0	ug/L	200.0	201	83.2	70-130	4.16	20	
Nickel	202	5.0	"	200.0	1.07	100	70-130	3.24	20	
Selenium	192	5.0	"	200.0	0.620	95.5	70-130	3.46	20	
Silver	113	1.0	"	100.0	ND	113	70-130	4.98	20	
Vanadium	207	5.0	"	200.0	1.89	102	70-130	8.93	20	
Lead	210	1.0	"	200.0	0.726	104	70-130	3.58	20	B
Cadmium	204	0.50	"	200.0	ND	102	70-130	0.712	20	
Thallium	205	1.0	"	200.0	ND	102	70-130	1.53	20	
Chromium	215	2.0	"	200.0	ND	107	70-130	5.15	20	
Beryllium	195	1.0	"	200.0	ND	97.4	70-130	0.255	20	
Barium	250	5.0	"	200.0	58.8	95.7	70-130	2.35	20	B
Arsenic	206	2.0	"	200.0	1.48	102	70-130	0.521	20	
Antimony	241	5.0	"	200.0	1.02	120	70-130	5.15	20	
Copper	192	1.0	"	200.0	0.442	95.6	70-130	3.70	20	B
Cobalt	195	5.0	"	200.0	ND	97.7	70-130	0.672	20	

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 200/6000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107121 - EPA 200.2 ICPMS										
Post Spike (1107121-PS1)		**Source: 11B0237-01**		Prepared: 02/09/2011 Analyzed: 02/10/2011						
Beryllium	51.6		ug/L	50.00	0.0840	103	75-125			
Zinc	246		"	50.00	201	89.7	75-125			
Vanadium	46.3		"	50.00	1.89	88.9	75-125			
Thallium	49.3		"	50.00	-0.0110	98.6	75-125			
Silver	26.4		"	25.00	0.115	105	75-125			
Selenium	49.3		"	50.00	0.620	97.3	75-125			
Nickel	49.6		"	50.00	1.07	97.1	75-125			
Lead	50.0		"	50.00	0.726	98.6	75-125			B
Copper	49.2		"	50.00	0.442	97.5	75-125			B
Cobalt	48.1		"	50.00	-0.0110	96.2	75-125			
Cadmium	51.7		"	50.00	0.191	103	75-125			
Barium	105		"	50.00	58.8	93.3	75-125			B
Arsenic	52.5		"	50.00	1.48	102	75-125			
Antimony	53.8		"	50.00	1.02	106	75-125			
Chromium	47.8		"	50.00	-0.838	97.3	75-125			
Batch M1B1004 - 1107120										
Instrument Blank (M1B1004-IBL1)				Prepared & Analyzed: 02/09/2011						
Tin	ND	0.010	mg/L							U

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 245.1/7470A

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: Hg
Calibration: UNASSIGNED
Control Limt: +/- 10.00%
Sequence: M1B0806

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B0806-ICV1	Mercury	3.003	2.98	99.3	ug/L	EPA 245.1/7470A
M1B0806-CCV1	Mercury	3.003	2.89	96.2	ug/L	EPA 245.1/7470A
M1B0806-CCV2	Mercury	3.003	2.87	95.7	ug/L	EPA 245.1/7470A
M1B0806-CCV3	Mercury	3.003	2.85	94.8	ug/L	EPA 245.1/7470A

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.7/6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: Varian ICP
Calibration: UNASSIGNED
Control Limt: +/- 10.00%
Sequence: M1B1004

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1004-ICV1	Tin	1.000	1.01	101	mg/L	EPA 200.7/6010B
M1B1004-CCV4	Tin	1.000	0.963	96.3	mg/L	EPA 200.7/6010B
M1B1004-CCV5	Tin	1.000	0.978	97.8	mg/L	EPA 200.7/6010B
M1B1004-CCV6	Tin	1.000	0.986	98.6	mg/L	EPA 200.7/6010B
M1B1004-CCV7	Tin	1.000	0.980	98.0	mg/L	EPA 200.7/6010B

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10014
Control Limt: +/- 10.00%
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R		Units	Method
M1B1103-ICV1	Antimony	40.00	47.3	118	*	ug/L	EPA 200.8/6020
	Arsenic	40.00	40.2	101		ug/L	EPA 200.8/6020
	Barium	40.00	37.6	94.1		ug/L	EPA 200.8/6020
	Beryllium	40.00	40.1	100		ug/L	EPA 200.8/6020
	Cadmium	40.00	40.4	101		ug/L	EPA 200.8/6020
	Chromium	40.00	41.2	103		ug/L	EPA 200.8/6020
	Cobalt	40.00	38.7	96.8		ug/L	EPA 200.8/6020
	Copper	40.00	40.7	102		ug/L	EPA 200.8/6020
	Lead	40.00	41.9	105		ug/L	EPA 200.8/6020
	Nickel	40.00	40.0	100		ug/L	EPA 200.8/6020
	Selenium	40.00	37.2	93.1		ug/L	EPA 200.8/6020
	Silver	20.00	21.9	110		ug/L	EPA 200.8/6020
	Thallium	40.00	40.1	100		ug/L	EPA 200.8/6020
	Vanadium	40.00	39.8	99.5		ug/L	EPA 200.8/6020
	Zinc	40.00	35.6	89.0	*	ug/L	EPA 200.8/6020
M1B1103-ICV2	Antimony	40.00	43.2	108		ug/L	EPA 200.8/6020
	Arsenic	40.00	42.2	105		ug/L	EPA 200.8/6020
	Barium	40.00	39.5	98.8		ug/L	EPA 200.8/6020
	Beryllium	40.00	39.2	98.1		ug/L	EPA 200.8/6020
	Cadmium	40.00	40.3	101		ug/L	EPA 200.8/6020
	Chromium	40.00	38.7	96.8		ug/L	EPA 200.8/6020
	Cobalt	40.00	41.1	103		ug/L	EPA 200.8/6020
	Copper	40.00	40.3	101		ug/L	EPA 200.8/6020

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10014
Control Limt: +/- 10.00%
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1103-ICV2	Lead	40.00	41.7	104	ug/L	EPA 200.8/6020
	Nickel	40.00	40.8	102	ug/L	EPA 200.8/6020
	Selenium	40.00	41.1	103	ug/L	EPA 200.8/6020
	Silver	20.00	21.7	108	ug/L	EPA 200.8/6020
	Thallium	40.00	41.8	104	ug/L	EPA 200.8/6020
	Vanadium	40.00	43.6	109	ug/L	EPA 200.8/6020
	Zinc	40.00	38.0	95.0	ug/L	EPA 200.8/6020
M1B1103-CCV1	Antimony	40.00	44.4	111 *	ug/L	EPA 200.8/6020
	Arsenic	40.00	42.3	106	ug/L	EPA 200.8/6020
	Barium	40.00	38.3	95.7	ug/L	EPA 200.8/6020
	Beryllium	40.00	41.0	103	ug/L	EPA 200.8/6020
	Cadmium	40.00	41.0	103	ug/L	EPA 200.8/6020
	Chromium	40.00	38.7	96.8	ug/L	EPA 200.8/6020
	Cobalt	40.00	38.6	96.6	ug/L	EPA 200.8/6020
	Copper	40.00	40.7	102	ug/L	EPA 200.8/6020
	Lead	40.00	40.6	102	ug/L	EPA 200.8/6020
	Nickel	40.00	39.9	99.6	ug/L	EPA 200.8/6020
	Selenium	40.00	37.9	94.7	ug/L	EPA 200.8/6020
	Silver	20.00	21.5	108	ug/L	EPA 200.8/6020
	Thallium	40.00	39.7	99.4	ug/L	EPA 200.8/6020
	Vanadium	40.00	43.3	108	ug/L	EPA 200.8/6020
	Zinc	40.00	36.3	90.7	ug/L	EPA 200.8/6020
M1B1103-CCV5	Antimony	40.00	41.7	104	ug/L	EPA 200.8/6020

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10014
Control Limt: +/- 10.00%
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1103-CCV5	Arsenic	40.00	41.2	103	ug/L	EPA 200.8/6020
	Barium	40.00	38.9	97.2	ug/L	EPA 200.8/6020
	Beryllium	40.00	40.8	102	ug/L	EPA 200.8/6020
	Cadmium	40.00	41.3	103	ug/L	EPA 200.8/6020
	Chromium	40.00	38.7	96.7	ug/L	EPA 200.8/6020
	Cobalt	40.00	40.8	102	ug/L	EPA 200.8/6020
	Copper	40.00	41.0	103	ug/L	EPA 200.8/6020
	Lead	40.00	40.6	102	ug/L	EPA 200.8/6020
	Nickel	40.00	40.2	100	ug/L	EPA 200.8/6020
	Selenium	40.00	39.7	99.2	ug/L	EPA 200.8/6020
	Silver	20.00	21.6	108	ug/L	EPA 200.8/6020
	Thallium	40.00	40.5	101	ug/L	EPA 200.8/6020
	Vanadium	40.00	41.6	104	ug/L	EPA 200.8/6020
	Zinc	40.00	37.4	93.6	ug/L	EPA 200.8/6020
M1B1103-CCV2	Antimony	40.00	43.2	108	ug/L	EPA 200.8/6020
	Arsenic	40.00	41.5	104	ug/L	EPA 200.8/6020
	Barium	40.00	38.7	96.8	ug/L	EPA 200.8/6020
	Beryllium	40.00	45.4	113 *	ug/L	EPA 200.8/6020
	Cadmium	40.00	41.6	104	ug/L	EPA 200.8/6020
	Chromium	40.00	39.0	97.6	ug/L	EPA 200.8/6020
	Cobalt	40.00	38.0	95.0	ug/L	EPA 200.8/6020
	Copper	40.00	39.9	99.9	ug/L	EPA 200.8/6020
	Lead	40.00	39.7	99.2	ug/L	EPA 200.8/6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10014
Control Limt: +/- 10.00%
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1103-CCV2	Nickel	40.00	38.3	95.8	ug/L	EPA 200.8/6020
	Selenium	40.00	39.6	98.9	ug/L	EPA 200.8/6020
	Silver	20.00	21.7	109	ug/L	EPA 200.8/6020
	Thallium	40.00	39.2	97.9	ug/L	EPA 200.8/6020
	Vanadium	40.00	39.0	97.5	ug/L	EPA 200.8/6020
	Zinc	40.00	36.4	91.0	ug/L	EPA 200.8/6020
M1B1103-CCV3	Antimony	40.00	42.1	105	ug/L	EPA 200.8/6020
	Arsenic	40.00	42.7	107	ug/L	EPA 200.8/6020
	Barium	40.00	39.0	97.6	ug/L	EPA 200.8/6020
	Beryllium	40.00	37.9	94.8	ug/L	EPA 200.8/6020
	Cadmium	40.00	41.5	104	ug/L	EPA 200.8/6020
	Chromium	40.00	39.0	97.5	ug/L	EPA 200.8/6020
	Cobalt	40.00	39.6	99.0	ug/L	EPA 200.8/6020
	Copper	40.00	41.8	104	ug/L	EPA 200.8/6020
	Lead	40.00	41.3	103	ug/L	EPA 200.8/6020
	Nickel	40.00	39.9	99.7	ug/L	EPA 200.8/6020
	Selenium	40.00	40.9	102	ug/L	EPA 200.8/6020
	Silver	20.00	21.6	108	ug/L	EPA 200.8/6020
	Thallium	40.00	40.7	102	ug/L	EPA 200.8/6020
	Vanadium	40.00	42.0	105	ug/L	EPA 200.8/6020
	Zinc	40.00	37.0	92.5	ug/L	EPA 200.8/6020
M1B1103-CCV4	Antimony	40.00	42.7	107	ug/L	EPA 200.8/6020
	Arsenic	40.00	40.4	101	ug/L	EPA 200.8/6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10014
Control Limt: +/- 10.00%
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1103-CCV4	Barium	40.00	37.8	94.5	ug/L	EPA 200.8/6020
	Beryllium	40.00	39.0	97.5	ug/L	EPA 200.8/6020
	Cadmium	40.00	41.5	104	ug/L	EPA 200.8/6020
	Chromium	40.00	40.5	101	ug/L	EPA 200.8/6020
	Cobalt	40.00	38.9	97.3	ug/L	EPA 200.8/6020
	Copper	40.00	40.2	100	ug/L	EPA 200.8/6020
	Lead	40.00	42.9	107	ug/L	EPA 200.8/6020
	Nickel	40.00	40.1	100	ug/L	EPA 200.8/6020
	Selenium	40.00	36.7	91.8	ug/L	EPA 200.8/6020
	Silver	20.00	21.8	109	ug/L	EPA 200.8/6020
	Thallium	40.00	40.6	101	ug/L	EPA 200.8/6020
	Vanadium	40.00	38.0	94.9	ug/L	EPA 200.8/6020
	Zinc	40.00	34.4	86.1 *	ug/L	EPA 200.8/6020

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 245.1/7470A

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: Hg
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B0806
Calibration: UNASSIGNED

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B0806-ICB1	Mercury	-0.00650	0.20	ug/L		EPA 245.1/7470A
1107015-BLK1	Mercury	-0.0178	0.20	ug/L		EPA 245.1/7470A
M1B0806-CCB1	Mercury	-0.0104	0.20	ug/L		EPA 245.1/7470A
M1B0806-CCB2	Mercury	-0.0106	0.20	ug/L		EPA 245.1/7470A
M1B0806-CCB3	Mercury	-0.00806	0.20	ug/L		EPA 245.1/7470A

BLANKS
EPA 200.7/6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: Varian ICP
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1004
Calibration: UNASSIGNED

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1004-ICB1	Tin	-0.00150	0.010	mg/L		EPA 200.7/6010B
M1B1004-CCB4	Tin	0.00265	0.010	mg/L		EPA 200.7/6010B
1107120-BLK1	Tin	-0.00402	0.010	mg/L		EPA 200.7/6010B
M1B1004-CCB5	Tin	0.000313	0.010	mg/L		EPA 200.7/6010B
M1B1004-CCB6	Tin	0.000177	0.010	mg/L		EPA 200.7/6010B
M1B1004-CCB7	Tin	-0.00364	0.010	mg/L		EPA 200.7/6010B

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-ICB1	Antimony	1.79	5.0	ug/L		EPA 200.8/6020
	Arsenic	0.403	2.0	ug/L		EPA 200.8/6020
	Barium	0.0160	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.0950	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.175	0.50	ug/L		EPA 200.8/6020
	Chromium	-0.906	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0840	5.0	ug/L		EPA 200.8/6020
	Copper	-0.0790	1.0	ug/L		EPA 200.8/6020
	Lead	-0.177	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.126	5.0	ug/L		EPA 200.8/6020
	Selenium	0.0670	5.0	ug/L		EPA 200.8/6020
	Silver	0.0880	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.137	1.0	ug/L		EPA 200.8/6020
	Vanadium	0.0160	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.690	5.0	ug/L		EPA 200.8/6020
M1B1103-CCB1	Antimony	1.90	5.0	ug/L		EPA 200.8/6020
	Arsenic	0.343	2.0	ug/L		EPA 200.8/6020
	Barium	0.0180	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.0750	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.181	0.50	ug/L		EPA 200.8/6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-CCB1	Chromium	-2.48	2.0	ug/L	*	EPA 200.8/6020
	Cobalt	-0.0830	5.0	ug/L		EPA 200.8/6020
	Copper	-0.0850	1.0	ug/L		EPA 200.8/6020
	Lead	-0.171	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.134	5.0	ug/L		EPA 200.8/6020
	Selenium	0.408	5.0	ug/L		EPA 200.8/6020
	Silver	0.130	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.100	1.0	ug/L		EPA 200.8/6020
	Vanadium	3.90	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.658	5.0	ug/L		EPA 200.8/6020
M1B1103-CCB5	Antimony	1.26	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.145	2.0	ug/L		EPA 200.8/6020
	Barium	0.0180	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.0780	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.175	0.50	ug/L		EPA 200.8/6020
	Chromium	-1.67	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0840	5.0	ug/L		EPA 200.8/6020
	Copper	-0.102	1.0	ug/L		EPA 200.8/6020
	Lead	-0.176	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.143	5.0	ug/L		EPA 200.8/6020

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-CCB5	Selenium	0.168	5.0	ug/L		EPA 200.8/6020
	Silver	0.0870	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.0400	1.0	ug/L		EPA 200.8/6020
	Vanadium	3.11	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.699	5.0	ug/L		EPA 200.8/6020
1107121-BLK1	Antimony	0.104	5.0	ug/L		EPA 200.8/6020
	Arsenic	0.612	2.0	ug/L		EPA 200.8/6020
	Barium	7.85	5.0	ug/L	*	EPA 200.8/6020
	Beryllium	0.128	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.179	0.50	ug/L		EPA 200.8/6020
	Chromium	-1.64	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0580	5.0	ug/L		EPA 200.8/6020
	Copper	1.52	1.0	ug/L	*	EPA 200.8/6020
	Lead	2.02	1.0	ug/L	*	EPA 200.8/6020
	Nickel	0.129	5.0	ug/L		EPA 200.8/6020
	Selenium	-0.153	5.0	ug/L		EPA 200.8/6020
	Silver	0.0710	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.0940	1.0	ug/L		EPA 200.8/6020
	Vanadium	4.95	5.0	ug/L		EPA 200.8/6020
	Zinc	1.07	5.0	ug/L		EPA 200.8/6020

Microbac Laboratories, Inc., Baltimore Division

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Lewis B. Gunn III, Project Manager

Microbac Laboratories, Inc.
Baltimore Division
2101 Van Deman Street • Baltimore, MD 21224
Phone: 410-633-1800
Fax: 410-633-6553
www.microbac.com

CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0334
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-CCB2	Antimony	1.25	5.0	ug/L		EPA 200.8/6020
	Arsenic	0.112	2.0	ug/L		EPA 200.8/6020
	Barium	0.0150	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.119	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.169	0.50	ug/L		EPA 200.8/6020
	Chromium	-0.924	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0830	5.0	ug/L		EPA 200.8/6020
	Copper	-0.105	1.0	ug/L		EPA 200.8/6020
	Lead	-0.177	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.149	5.0	ug/L		EPA 200.8/6020
	Selenium	0.0100	5.0	ug/L		EPA 200.8/6020
	Silver	0.0830	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.0970	1.0	ug/L		EPA 200.8/6020
	Vanadium	1.33	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.666	5.0	ug/L		EPA 200.8/6020
M1B1103-CCB3	Antimony	1.23	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.499	2.0	ug/L		EPA 200.8/6020
	Barium	0.0210	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.0750	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.176	0.50	ug/L		EPA 200.8/6020

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BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-CCB3	Chromium	-1.54	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0840	5.0	ug/L		EPA 200.8/6020
	Copper	-0.0350	1.0	ug/L		EPA 200.8/6020
	Lead	-0.175	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.141	5.0	ug/L		EPA 200.8/6020
	Selenium	-0.0660	5.0	ug/L		EPA 200.8/6020
	Silver	0.0850	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.136	1.0	ug/L		EPA 200.8/6020
	Vanadium	2.94	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.661	5.0	ug/L		EPA 200.8/6020
M1B1103-CCB4	Antimony	1.22	5.0	ug/L		EPA 200.8/6020
	Arsenic	-1.17	2.0	ug/L		EPA 200.8/6020
	Barium	0.0310	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.0810	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.175	0.50	ug/L		EPA 200.8/6020
	Chromium	-0.870	2.0	ug/L		EPA 200.8/6020
	Cobalt	-0.0830	5.0	ug/L		EPA 200.8/6020
	Copper	-0.0880	1.0	ug/L		EPA 200.8/6020
	Lead	-0.174	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.142	5.0	ug/L		EPA 200.8/6020

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BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1103
Calibration: MB10014

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1103-CCB4	Selenium	0.0610	5.0	ug/L		EPA 200.8/6020
	Silver	0.0890	1.0	ug/L		EPA 200.8/6020
	Thallium	-0.143	1.0	ug/L		EPA 200.8/6020
	Vanadium	3.05	5.0	ug/L		EPA 200.8/6020
	Zinc	-0.663	5.0	ug/L		EPA 200.8/6020

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 200.7/6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: Varian ICP
Calibration: UNASSIGNED
Sequence: M1B1004

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1004-IFA1	Tin		-0.02		mg/L
M1B1004-IFB1	Tin	1.000	0.94	94.3	mg/L

* Values outside of QC limits

INTERFERENCE CHECK SAMPLE

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10014
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1103-IFA1	Antimony		13.52		ug/L
	Arsenic		0.93		ug/L
	Barium		0.17		ug/L
	Beryllium		0.12		ug/L
	Cadmium		0.76		ug/L
	Chromium		-2.14		ug/L
	Cobalt		0.41		ug/L

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10014
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1103-IFA1	Copper		0.99		ug/L
	Lead		-0.04		ug/L
	Nickel		0.85		ug/L
	Selenium		1.25		ug/L
	Silver		1.98		ug/L
	Thallium		0.54		ug/L
	Vanadium		2.32		ug/L
	Zinc		0.34		ug/L
M1B1103-IFB1	Antimony		3.37		ug/L
	Arsenic	100.0	108.91	109	ug/L
	Barium		0.17		ug/L
	Beryllium		0.10		ug/L
	Cadmium	100.0	110.82	111	ug/L
	Chromium	200.0	210.01	105	ug/L
	Cobalt	200.0	208.44	104	ug/L
	Copper	200.0	205.21	103	ug/L
	Lead		-0.08		ug/L

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10014
Sequence: M1B1103

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1103-IFB1	Nickel	200.0	206.11	103	ug/L
	Selenium	100.0	104.45	104	ug/L
	Silver	50.00	57.19	114	ug/L
	Thallium		0.05		ug/L
	Vanadium	200.0	210.23	105	ug/L
	Zinc	100.0	97.31	97.3	ug/L

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.7/6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: UNASSIGNED
Laboratory ID: M1B1004-LCV1
Sequence: M1B1004
Standard ID: MB10722

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Tin	0.04000	0.0411	2.7	25.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: MB10014
Laboratory ID: M1B1103-LCV1
Sequence: M1B1103
Standard ID: MB10816

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1.000	1.66	65.6 *	20.00
Arsenic	1.000	1.09	9.3	20.00
Barium	1.000	1.03	2.8	20.00
Beryllium	1.000	1.04	4.0	20.00
Cadmium	1.000	1.21	21.0 *	20.00
Chromium	1.000	0.255	-74.5 *	20.00
Cobalt	1.000	0.935	-6.5	20.00
Copper	1.000	1.02	1.5	20.00
Lead	1.000	0.854	-14.6	20.00
Nickel	1.000	0.928	-7.2	20.00
Selenium	1.000	1.16	16.3	20.00
Silver	1.000	1.09	9.2	20.00
Thallium	1.000	0.818	-18.2	20.00
Vanadium	1.000	0.509	-49.1 *	20.00
Zinc	1.000	0.848	-15.2	20.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: MB10014
Laboratory ID: M1B1103-LCV2
Sequence: M1B1103
Standard ID: MB10815

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	5.000	5.30	5.9	20.00
Arsenic	5.000	5.34	6.9	20.00
Barium	5.000	4.82	-3.6	20.00
Beryllium	5.000	5.08	1.5	20.00
Cadmium	5.000	5.25	5.1	20.00
Chromium	5.000	4.42	-11.7	20.00
Cobalt	5.000	4.79	-4.2	20.00
Copper	5.000	5.18	3.5	20.00
Lead	5.000	4.92	-1.5	20.00
Nickel	5.000	4.91	-1.8	20.00
Selenium	5.000	5.05	0.9	20.00
Silver	5.000	5.13	2.5	20.00
Thallium	5.000	4.73	-5.5	20.00
Vanadium	5.000	4.33	-13.4	20.00
Zinc	5.000	6.02	20.4 *	20.00

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.7/6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: UNASSIGNED
Laboratory ID: M1B1004-HCV1
Sequence: M1B1004
Standard ID: MB10725

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Tin	20.00	19.9	-0.5	10.00

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 I
Calibration: MB10014
Laboratory ID: M1B1103-HCV1
Sequence: M1B1103
Standard ID: MB10819

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1000	1200	20.0 *	10.00
Arsenic	1000	1000	-0.001	10.00
Barium	1000	950	-5.0	10.00
Beryllium	1000	789	-21.1 *	10.00
Cadmium	1000	1030	3.1	10.00
Chromium	1000	1070	6.8	10.00
Cobalt	1000	992	-0.8	10.00
Copper	1000	1020	2.3	10.00
Lead	1000	1070	6.8	10.00
Nickel	1000	975	-2.5	10.00
Selenium	1000	959	-4.1	10.00
Silver	500.0	382	-23.7 *	10.00
Thallium	1000	1040	4.0	10.00
Vanadium	1000	1010	0.7	10.00
Zinc	1000	896	-10.4 *	10.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1847	Reported: 02/14/2011 16:28
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Notes and Definitions

V1	CCV recovery was above acceptance limits. The concentration was below the reporting limit.
U	Sample concentration is less than the MDL.
R3	Sample Duplicate RPD was out of acceptance limits. The result concentration was within 5 times the reporting limit and the difference was less than the reporting limit.
J	Analyte concentration is greater than the MDL but less than the reporting limit.
B	Analyte is found in method blank.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Certifications

Below is a list of certifications maintained by Microbac Laboratories, Inc. All data included in this report has been reviewed for and meets all project specific and quality control requirements of the applicable accreditation, unless otherwise noted. A complete list of individual analytes pursuant to each certification below is available upon request.

- A2LA (Microbiology): 410.02
- A2LA (Environmental): 410.01
- A2LA (ELLAP): 410.01
- CPSC: 1115
- Maryland: 109
- Pennsylvania (NELAC): 68-00339
- USDA: S-53726
- Virginia: 00152

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INSTALLATION - Camp Moscrip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)

ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	Arsenic Speciation	Pesticides	Arsenic Speciation	Any metals							
EQ GW	31 Jan 11	1300	X		GW	1				1							
MW-1	31 Jan 11	1400	X		GW	1				1							
MW-1D	31 Jan 11	1415	X		GW	1				1							
MW-2	31 Jan 11	1710	X		GW	1				1							
MW-3	31 Jan 11	1615	X		GW	1				1							
EQ Blk soil	1 Feb 11	0945	X		GW	1				1							
735B01-05	1 Feb 11	~~1150~~ 0950	X		~~GW~~ SO	1				1							
735B03-05	2 Feb 11	1110	X		SO	1				1							
735B03-05D	2 Feb 11	1110	X		SO	1				1							
										9							

9 <- Total Number of Containers

SHIPMENT METHOD - Fed Ex

Date Shipped - 2 Feb 2011 Ron Hurst

Matrix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
Preservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E REV 1 APR 10

USAPHC (PROV)
Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

TERMINOLOGY & ABBREVIATIONS

DF: Dilution Factor

DLS: Directorate of Laboratory Sciences

g: gram

J: The reported result is an estimated value; the result is between the method detection limit (MDL) and the reporting limit.

kg: kilogram

L: Liter

LCS: Laboratory Control Sample

LCSD: Laboratory Control Sample Duplicate

MDL: Method Detection Limit

mg: milligram

MS: Matrix Spike

MSD: Matrix Spike Duplicate

pCi: picocurie

Qual: Data Qualifier

RPD: Relative Percent Difference

(S): Surrogate Standard (Found in Analytical Results and QC Listings)

U: The analyte was not detected and is reported as less than the method reporting limit. Analytes not detected are reported as having a concentration below the reporting limit (as opposed to below the method detection limit (MDL)) due to the relatively high potential for reporting false negatives at the MDL.

ug: microgram

Uncert: Measurement Uncertainty (Reported in Radiochemical Analyses Only)

**Indicates QC failure. For example, recoveries or relative percent difference (RPD) out of range.

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DEPARTMENT OF THE ARMY
US Army Public Health Command (Provisional)
5158 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5403

MCHB-TS-L 04 Mar 2011

MEMORANDUM FOR USAPHC Program 38 (GWSWP) (5158 Blackhawk Road/Mr. Brian Hammond), MCHB-IP-EGW, Bldg 1677, Gunpowder, MD 21010

SUBJECT: DLS Final Analytical Report

1. This is DLS Final Analytical Report for:

Project Site:	Camp Moscrip, PR
SubJono:	0995
DLS Work Order #:	1848
Report Serial #:	6782

2. Please contact us if this report or any of our services did not meet your needs or expectations.

3. Point of contact for additional information is Mr. Ronald J. Swatski or Mr. David F. Morrow, DSN 584-2208 or commercial 410-436-2208.

MR. FREDERIC BELKIN FOR
LTC KEVIN K. PITZER
Laboratory Operations Manager

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Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

SAMPLE SUMMARY

Workorder: 1848 Camp Moscrip, PR

Lab ID	Sample ID	Matrix	Date Collected	Date Received
18480001	73SB01-05	Soil/Sludge/Sediment	2/1/2011 11:50	2/3/2011 11:20
18480002	73SB03-05	Soil/Sludge/Sediment	2/2/2011 11:10	2/3/2011 11:20
18480003	73SB03-05D	Soil/Sludge/Sediment	2/2/2011 11:10	2/3/2011 11:20

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PROJECT SUMMARY

Workorder: 1848 Camp Moscrip, PR

Sample Comments

Lab ID: 18480001 **Sample ID:** 73SB01-05 **Sample Type:** SAMPLE
TEMP 2C

Lab ID: 18480002 **Sample ID:** 73SB03-05 **Sample Type:** SAMPLE
TEMP 2C

Lab ID: 18480003 **Sample ID:** 73SB03-05D **Sample Type:** SAMPLE
TEMP 2C

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The following report(s) comprise the

Contractor Data Report(s) for Analytical Tests

performed at contract laboratories

in support of the US Army Public Health Command.

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COVER LETTER

March 01, 2011
Report No.: 11B0382

Heidi Taylor
Public Health Command
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201
APG, MD 21010-5422

RE: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils

Revised to update narrative and footnotes

The report of analyses contains test results for samples received at Microbac Laboratories, Inc., Baltimore Division on 02/03/2011 15:38.

The enclosed results were obtained from and applicable to the sample(s) as received at the laboratory. All sample results are reported on an "as received" basis unless otherwise noted.

All data included in this report has been reviewed and meet the applicable project and certification specific requirements, unless otherwise noted.

This report has been paginated in its entirety and shall not be reproduced except in full, without the written approval of Microbac Laboratories, Inc.

We appreciate the opportunity to service your analytical needs. If you have any questions, please feel free to contact us.

This Data Package contains the following:

- This Cover Page
- Sample Summary
- Case Narative
- Test Results
- QC Summary
- Notes and Definitions
- Cooler Receipt Log
- Chain of Custody
- Data

3/1/2011

Final report reviewed by: Lewis B. Gunn III/Project Manager Report issue date

All samples received in proper condition and results conform to ISO 17025 standards unless otherwise noted.

If we have not met or exceeded your expectations, please contact the Director or Trevor Boyce, President at tboyce@microbac.com or Robert Morgan, Chief Operation Officer, at rmorgan@microbac.com.

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

SAMPLE SUMMARY

Sample ID	Laboratory ID	Matrix	Type	Date Sampled	Date Received
18480001 73SB01-05	11B0382-01	Soil	Not Specified	02/01/2011 11:50	02/03/2011 15:38
18480002 73SB03-05	11B0382-02	Soil	Not Specified	02/02/2011 11:10	02/03/2011 15:38
18480003 73SB03-05D	11B0382-03	Soil	Not Specified	02/02/2011 11:10	02/03/2011 15:38

Microbac Laboratories, Inc., Baltimore Division

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

CASE NARRATIVE

Public Health Command
Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Heidi Taylor
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201
APG , MD 21010-5422

3 sample(s) were received by Melanie C. Duszynski of Microbac laboratories, Baltimore Division on 2/3/2011 3:38:00 PM and sample(s) condition(s) were checked and found to be acceptable unless otherwise noted in the 'Cooler Receipt Log' or 'Statement of Qualifications' sections of this report. The samples were logged into the LIMS by Melanie C. Duszynski on 2/4/2011 2:03:00 PM and compared to the client DQO. Any deviations from the client DQO and method specific quality control requirements are noted in the 'Statement of Data Qualifications'.

Other Notes/Comments:

The samples for 6020 analysis was repeated for all anaytes except Copper and Vanadium due to the fact that samples required dillutions and Continung Calibration Verification standards being outside of acceptance limits due to sample carryover and sample concentration effects on the instrument calibration. The instrument was recalibrated, samples were diluted and reanalyzed and were bracketed by acceptable Initial and Continuing Calibration Verifications, Blanks and Calibration checks (ICV, CCV, ICB, CCB, LCV, HCV).

M1B1807-LCV2 in the Statement of Qualifications is marked as being out of acceptance for Arsenic. This element was not reported from the analysis run that this LCV is associated with and I am unable to remove that particular footnote from the report. The samples were reanalyzed and the control standards were all within acceptance limits.

M1B1807-LCV2 was biased low outside of acceptance limits for Vanadium. Sample concentration was greater than 20X the low standard concentration, no impact on the data.

Report revised to update narrative and correct footnotes.

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

STATEMENT OF DATA QUALIFICATIONS

All samples recieved in proper condition unless otherwise noted below.
All quality control parameters were meet unless otherwise noted below.

Qualifications:

Analyte is found in method blank.

Analyte & Samples(s) Qualified:

Tin

1108173-BS1, 1108173-BS2, 1108173-MS1, 1108173-MSD1, 1108173-PS1

Qualifications:

Target analyte detected in method blank at or above reporting limit. The analyte concentration was below the reporting limit.

Analyte & Samples(s) Qualified:

Tin

1108173-BLK1

Qualifications:

The matrix spike recovery was out of acceptance limits. The post digestion spike recovery was acceptable.

Analyte & Samples(s) Qualified:

Tin

1108173-MS1, 1108173-MSD1

Qualifications:

QC not in acceptance limits.

Analyte & Samples(s) Qualified:

Arsenic

M1B1806-LCV2

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Qualifications:

The matrix spike recovery was out of acceptance limits. The post digestion spike recovery was acceptable.

Analyte & Samples(s) Qualified:

Antimony
1108178-MS2, 1108178-MSD2
Barium
1108178-MS2, 1108178-MSD2
Copper
1108178-MS2, 1108178-MSD1
Selenium
1108178-MS2
Vanadium
1108178-MSD1
Zinc
1108178-MS2

Qualifications:

Sample Duplicate RPD was out of acceptance limits. The result concentration was within 5 times the reporting limit and the difference was less than the reporting limit.

Analyte & Samples(s) Qualified:

Beryllium
1108178-DUP1, 1108178-DUP2, 1108178-DUP4, 1108178-DUP5
Selenium
1108178-DUP1, 1108178-DUP2, 1108178-DUP4, 1108178-DUP5
Silver
1108178-DUP1, 1108178-DUP2
Thallium
1108178-DUP1, 1108178-DUP2, 1108178-DUP3

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Qualifications:

Sample Duplicate RPDs were out of acceptance limits. Sample is non-homogeneous; all results reported in QC summary.

Analyte & Samples(s) Qualified:

Barium

1108178-DUP1, 1108178-DUP2, 1108178-DUP4, 1108178-DUP5

Chromium

1108178-DUP1, 1108178-DUP2, 1108178-DUP4, 1108178-DUP5

Copper

1108178-DUP1, 1108178-DUP2

Nickel

1108178-DUP1, 1108178-DUP2, 1108178-DUP4, 1108178-DUP5

Vanadium

1108178-DUP2, 1108178-DUP3

Zinc

1108178-DUP4, 1108178-DUP5

Qualifications:

CCV recovery was above acceptance limits. The concentration was below the reporting limit.

Analyte & Samples(s) Qualified:

Cadmium

M1B1807-CCV2

Qualifications:

ICV recovery was above acceptance limits. The concentration was below the reporting limit.

Analyte & Samples(s) Qualified:

Cadmium

M1B1807-ICV3

Selenium

M1B1807-ICV3

Qualifications:

LCV Biased low, sample concentration is greater than 20X the low standard.

Analyte & Samples(s) Qualified:

Vanadium

M1B1807-LCV2

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18480001 73SB01-05

11B0382-01 (Soil) Sampled: 02/01/2011 11:50; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Wet Chemistry								
% Solids	**77.61**	0.05	% by Weight	020411 1540	020711 0640	LCR	SM (20) 2540G	
Mercury, Total by EPA 7000 Series Methods								
Mercury	**0.048**	0.030	mg/kg dry	020811 1019	020811 1514	APS	SW846 7471A	D
Metals, Total by EPA 6000/7000 Series Methods								
Tin	ND	1.4	mg/kg dry	021711 1036	021811 1059	APS	EPA 6010B	U, D
Lead	**2.2**	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Zinc	**36**	5.7	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Thallium	ND	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Silver	ND	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Nickel	**7.0**	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Cobalt	**13**	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Chromium	**12**	2.8	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Cadmium	ND	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Barium	**61**	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Arsenic	**0.63**	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Antimony	ND	2.8	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Vanadium	**160**	2.8	mg/kg dry	021711 1101	021811 0855	PBK	EPA 6020	D
Copper	**200**	0.57	mg/kg dry	021711 1101	021811 0855	PBK	EPA 6020	D
Beryllium	ND	0.57	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D
Selenium	ND	2.8	mg/kg dry	021711 1101	022111 1332	PBK	EPA 6020	D

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18480002 73SB03-05

11B0382-02 (Soil) Sampled: 02/02/2011 11:10; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Wet Chemistry								
% Solids	**78.81**	0.05	% by Weight	020411 1540	020711 0640	LCR	SM (20) 2540G	
Mercury, Total by EPA 7000 Series Methods								
Mercury	ND	0.032	mg/kg dry	020811 1019	020811 1528	APS	SW846 7471A	D
Metals, Total by EPA 6000/7000 Series Methods								
Tin	ND	1.3	mg/kg dry	021711 1036	021811 1123	APS	EPA 6010B	U, D
Arsenic	ND	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Antimony	ND	2.5	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Vanadium	**76**	2.5	mg/kg dry	021711 1101	021811 0930	PBK	EPA 6020	D
Copper	**140**	0.50	mg/kg dry	021711 1101	021811 0930	PBK	EPA 6020	D
Beryllium	**0.91**	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Cadmium	ND	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Zinc	**120**	5.0	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Chromium	**7.2**	2.5	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Cobalt	**28**	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Lead	**0.95**	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Nickel	**15**	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Selenium	ND	2.5	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Silver	ND	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Thallium	ND	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D
Barium	**190**	0.50	mg/kg dry	021711 1101	022111 1418	PBK	EPA 6020	D

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

18480003 73SB03-05D

11B0382-03 (Soil) Sampled: 02/02/2011 11:10; Type: Not Specified

Analyte	Result	Reporting Limit	Units	Prepared	Analyzed	Analyst	Method	Notes
Microbac Laboratories, Inc., Baltimore Division								
Wet Chemistry								
% Solids	**77.48**	0.05	% by Weight	020411 1540	020711 0640	LCR	SM (20) 2540G	
Mercury, Total by EPA 7000 Series Methods								
Mercury	ND	0.029	mg/kg dry	020811 1019	020811 1530	APS	SW846 7471A	D
Metals, Total by EPA 6000/7000 Series Methods								
Tin	ND	1.2	mg/kg dry	021711 1036	021811 1127	APS	EPA 6010B	U, D
Chromium	**7.4**	2.4	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Cobalt	**17**	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Lead	**0.86**	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Nickel	**13**	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Selenium	ND	2.4	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Cadmium	ND	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Thallium	ND	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Copper	**180**	0.48	mg/kg dry	021711 1101	021811 0951	PBK	EPA 6020	D
Silver	ND	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Beryllium	**1.0**	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Barium	**180**	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Arsenic	ND	0.48	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Vanadium	**76**	2.4	mg/kg dry	021711 1101	021811 0951	PBK	EPA 6020	D
Zinc	**110**	4.8	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D
Antimony	ND	2.4	mg/kg dry	021711 1101	022111 1423	PBK	EPA 6020	D

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Wet Chemistry - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1106231 - % Solids										
Blank (1106231-BLK1)				Prepared: 02/04/2011 Analyzed: 02/07/2011						
% Solids	ND	0.05	% by Weight							
LCS (1106231-BS1)				Prepared: 02/04/2011 Analyzed: 02/07/2011						
% Solids	2.09	0.05	% by Weight	2.000		104	80-120			
% Moisture	97.91	0.05	"	100.0		97.9	80-120			
Duplicate (1106231-DUP1)		**Source: 11B0382-01**		Prepared: 02/04/2011 Analyzed: 02/07/2011						
% Solids	77.74	0.05	% by Weight		77.61			0.173	20	
% Moisture	22.26	0.05	"		22.39			0.603	20	

Microbac Laboratories, Inc., Baltimore Division

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Mercury, Total by EPA 7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1107038 - Metals_Hg_Prep										
Blank (1107038-BLK1)				Prepared & Analyzed: 02/08/2011						
Mercury	ND	0.025	mg/kg wet							D
LCS (1107038-BS1)				Prepared & Analyzed: 02/08/2011						
Mercury	17.3	1.2	mg/kg wet	16.30		106	71.5-128.1			D
Duplicate (1107038-DUP1)		Source: 11B0382-01		Prepared & Analyzed: 02/08/2011						
Mercury	0.0528	0.032	mg/kg dry		0.0482			9.04	20	D
Matrix Spike (1107038-MS1)		Source: 11B0382-01		Prepared & Analyzed: 02/08/2011						
Mercury	0.327	0.032	mg/kg dry	0.3157	0.0482	88.2	70-130			D
Matrix Spike Dup (1107038-MSD1)		Source: 11B0382-01		Prepared & Analyzed: 02/08/2011						
Mercury	0.340	0.032	mg/kg dry	0.3171	0.0482	92.0	70-130	4.11	20	D
Batch M1B0813 - 1107038										
Instrument Blank (M1B0813-IBL1)				Prepared & Analyzed: 02/08/2011						
Mercury	ND	0.00020	ug/L							

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108173 - EPA 3050B ICP										
Blank (1108173-BLK1)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	1.39	0.50	mg/kg wet							B3, D
LCS (1108173-BS1)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	132	5.1	mg/kg wet	135.0		97.6	76.9-123.1		20	D, B
LCS (1108173-BS2)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	1.01	0.010	mg/kg wet	1.000		101	76.9-123.1		20	B
Duplicate (1108173-DUP1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	ND	1.7	mg/kg dry		ND				20	U, D
Duplicate (1108173-DUP2)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	ND	1.6	mg/kg dry		ND				20	U, D
Matrix Spike (1108173-MS1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	16.3	1.4	mg/kg dry	28.44	ND	57.2	75-125		20	M1, D, B
Matrix Spike Dup (1108173-MSD1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Tin	19.1	1.5	mg/kg dry	30.11	ND	63.3	75-125	10.0	20	M1, D, B
Post Spike (1108173-PS1)		**Source: 11B0382-01**		Prepared & Analyzed: 02/18/2011						
Tin	0.888		mg/L	1.000	-0.0124	90.1	75-125			D, B
Batch 1108178 - EPA 3050B ICPMS										
Blank (1108178-BLK1)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Lead	ND	1.0	mg/kg wet							D
Nickel	ND	1.0	"							D
Zinc	ND	10	"							D
Vanadium	ND	5.0	"							D
Thallium	ND	1.0	"							D
Silver	ND	1.0	"							D
Antimony	ND	5.0	"							D
Cobalt	ND	1.0	"							D
Chromium	ND	5.0	"							D
Cadmium	ND	1.0	"							D
Beryllium	ND	1.0	"							D
Barium	ND	1.0	"							D

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Blank (1108178-BLK1)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Copper	ND	1.0	mg/kg wet							D
Selenium	ND	5.0	"							D
Blank (1108178-BLK3)				Prepared: 02/17/2011 Analyzed: 02/21/2011						
Cobalt	ND	1.0	mg/kg wet							D
Zinc	ND	10	"							D
Vanadium	ND	5.0	"							D
Thallium	ND	1.0	"							D
Silver	ND	1.0	"							D
Selenium	ND	5.0	"							D
Nickel	ND	1.0	"							D
Copper	ND	1.0	"							D
Chromium	ND	5.0	"							D
Cadmium	ND	1.0	"							D
Beryllium	ND	1.0	"							D
Barium	ND	1.0	"							D
Antimony	ND	5.0	"							D
Lead	ND	1.0	"							D
LCS (1108178-BS1)				Prepared: 02/17/2011 Analyzed: 02/18/2011						
Nickel	223	1.0	mg/kg wet	109.0		205	81.5-118.5		20	D
Cadmium	118	1.0	"	110.0		107	83-116.9		20	D
Zinc	339	10	"	299.0		113	80.3-120.2		20	D
Vanadium	117	5.1	"	110.0		106	68.1-131.9		20	D
Thallium	188	1.0	"	171.0		110	78.9-121.1		20	D
Silver	57.4	1.0	"	51.90		111	66.3-133.7		20	D
Selenium	232	5.1	"	207.0		112	80-120		20	D
Copper	78.5	1.0	"	74.70		105	82.9-116.4		20	D
Antimony	51.0	5.1	"	121.0		42.2	0-240		20	D
Chromium	89.1	5.1	"	93.40		95.4	80.3-119		20	D
Cobalt	161	1.0	"	133.0		121	83.1-116.2		20	D
Beryllium	98.3	1.0	"	92.10		107	83.4-117.2		20	D
Barium	406	1.0	"	325.0		125	79.2-120.8		20	D
Lead	163	1.0	"	152.0		107	81.2-118.8		20	D

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
LCS (1108178-BS2)				Prepared: 02/17/2011 Analyzed: 02/21/2011						
Copper	74.2	1.0	mg/kg wet	74.70		99.3	82.9-116.4		20	D
Zinc	311	10	"	299.0		104	80.3-120.2		20	D
Vanadium	118	5.1	"	110.0		107	68.1-131.9		20	D
Thallium	185	1.0	"	171.0		108	78.9-121.1		20	D
Silver	61.0	1.0	"	51.90		117	66.3-133.7		20	D
Selenium	216	5.1	"	207.0		104	80-120		20	D
Lead	170	1.0	"	152.0		112	81.2-118.8		20	D
Cobalt	148	1.0	"	133.0		111	83.1-116.2		20	D
Chromium	93.7	5.1	"	93.40		100	80.3-119		20	D
Cadmium	115	1.0	"	110.0		105	83-116.9		20	D
Beryllium	96.4	1.0	"	92.10		105	83.4-117.2		20	D
Barium	348	1.0	"	325.0		107	79.2-120.8		20	D
Antimony	50.8	5.1	"	121.0		42.0	0-240		20	D
Nickel	118	1.0	"	109.0		108	81.5-118.5		20	D
Duplicate (1108178-DUP1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Beryllium	0.428	0.68	mg/kg dry		0.571			28.7	20	R3, D
Nickel	271	0.68	"		380			33.4	20	R5, D
Vanadium	133	3.4	"		160			18.8	20	D
Thallium	0.346	0.68	"		0.784			77.5	20	R3, D
Silver	0.164	0.68	"		0.248			40.8	20	R3, D
Zinc	26.7	6.8	"		36.1			29.8	20	D
Selenium	2.11	3.4	"		2.92			32.4	20	R3, D
Copper	142	0.68	"		203			35.5	20	R5, D
Cobalt	11.2	0.68	"		12.3			9.05	20	D
Cadmium	ND	0.68	"		ND				20	D
Barium	49.1	0.68	"		67.5			31.4	20	R5, D
Antimony	ND	3.4	"		ND				20	D
Lead	1.52	0.68	"		2.15			34.4	20	D
Chromium	7.16	3.4	"		10.6			38.6	20	R5, D

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Duplicate (1108178-DUP2)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Beryllium	0.442	0.63	mg/kg dry		0.571			25.4	20	R3, D
Vanadium	127	3.2	"		160			23.4	20	R5, D
Silver	0.141	0.63	"		0.248			55.2	20	R3, D
Selenium	2.25	3.2	"		2.92			26.1	20	R3, D
Nickel	301	0.63	"		380			23.1	20	R5, D
Lead	1.88	0.63	"		2.15			13.1	20	D
Copper	137	0.63	"		203			38.9	20	R5, D
Cobalt	14.0	0.63	"		12.3			12.6	20	D
Cadmium	ND	0.63	"		ND				20	D
Barium	37.9	0.63	"		67.5			56.2	20	R5, D
Antimony	ND	3.2	"		ND				20	D
Zinc	29.7	6.3	"		36.1			19.5	20	D
Chromium	6.47	3.2	"		10.6			48.3	20	R5, D
Thallium	0.230	0.63	"		0.784			109	20	R3, D
Duplicate (1108178-DUP3)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Beryllium	ND	2.8	mg/kg dry		0.571				20	D
Vanadium	212	14	"		160			27.9	20	R5, D
Thallium	1.67	2.8	"		0.784			72.3	20	R3, D
Barium	68.3	2.8	"		67.5			1.27	20	D
Zinc	39.5	28	"		36.1			9.04	20	D
Cadmium	ND	2.8	"		ND				20	D
Chromium	3.17	14	"		10.6			108	20	D
Cobalt	14.0	2.8	"		12.3			12.9	20	D
Copper	229	2.8	"		203			11.8	20	D
Lead	2.47	2.8	"		2.15			14.1	20	D
Nickel	420	2.8	"		380			9.92	20	D
Selenium	3.57	14	"		2.92			19.8	20	D
Silver	0.692	2.8	"		0.248				20	D
Antimony	ND	14	"		ND				20	D

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Duplicate (1108178-DUP4)		**Source: 11B0382-01RE1**		Prepared: 02/17/2011 Analyzed: 02/21/2011						
Thallium	ND	0.68	mg/kg dry		0.518				20	D
Silver	ND	0.68	"		0.182				20	D
Selenium	1.79	3.4	"		2.27			23.7	20	R3, D
Nickel	4.25	0.68	"		6.98			48.6	20	R5, D
Barium	43.1	0.68	"		60.6			33.7	20	R5, D
Lead	1.39	0.68	"		2.16			42.9	20	D
Zinc	27.0	6.8	"		35.9			28.4	20	R5, D
Copper	135	0.68	"		197			37.6	20	D
Cobalt	10.9	0.68	"		12.7			15.0	20	D
Chromium	6.86	3.4	"		11.9			54.1	20	R5, D
Vanadium	129	3.4	"		167			25.6	20	D
Beryllium	0.416	0.68	"		0.560			29.6	20	R3, D
Antimony	ND	3.4	"		ND				20	D
Cadmium	ND	0.68	"		ND				20	D
Duplicate (1108178-DUP5)		**Source: 11B0382-01RE1**		Prepared: 02/17/2011 Analyzed: 02/21/2011						
Copper	119	0.63	mg/kg dry		197			49.4	20	D
Zinc	26.1	6.3	"		35.9			31.5	20	R5, D
Vanadium	140	3.2	"		167			17.6	20	D
Thallium	ND	0.63	"		0.518				20	D
Silver	ND	0.63	"		0.182				20	D
Selenium	1.73	3.2	"		2.27			27.2	20	R3, D
Lead	1.81	0.63	"		2.16			17.2	20	D
Cobalt	12.7	0.63	"		12.7			0.431	20	D
Chromium	7.84	3.2	"		11.9			41.4	20	R5, D
Cadmium	ND	0.63	"		ND				20	D
Beryllium	0.415	0.63	"		0.560			29.9	20	R3, D
Barium	32.6	0.63	"		60.6			59.9	20	R5, D
Antimony	ND	3.2	"		ND				20	D
Nickel	4.47	0.63	"		6.98			43.9	20	R5, D

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Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Matrix Spike (1108178-MS1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Copper	237	0.57	mg/kg dry	28.44	203	121	70-130		20	D
Zinc	79.8	5.7	"	28.44	36.1	154	70-130		20	D
Antimony	1.71	2.8	"	28.44	ND	6.01	70-130		20	D
Barium	112	0.57	"	28.44	67.5	158	70-130		20	D
Beryllium	29.7	0.57	"	28.44	0.571	103	70-130		20	D
Cadmium	30.9	0.57	"	28.44	ND	109	70-130		20	D
Chromium	32.5	2.8	"	28.44	10.6	77.1	70-130		20	D
Cobalt	51.1	0.57	"	28.44	12.3	136	70-130		20	D
Lead	31.3	0.57	"	28.44	2.15	103	70-130		20	D
Selenium	23.3	2.8	"	28.44	2.92	71.5	70-130		20	D
Silver	13.8	0.57	"	14.22	0.248	95.0	70-130		20	D
Thallium	27.6	0.57	"	28.44	0.784	94.4	70-130		20	D
Nickel	484	0.57	"	28.44	380	364	70-130		20	D
Vanadium	197	2.8	"	28.44	160	128	70-130		20	D
Matrix Spike (1108178-MS2)		**Source: 11B0382-01RE1**		Prepared: 02/17/2011 Analyzed: 02/21/2011						
Barium	98.2	0.57	mg/kg dry	28.44	60.6	132	70-130		20	M1, D
Zinc	74.8	5.7	"	28.44	35.9	137	70-130		20	M1, D
Vanadium	219	2.8	"	28.44	167	182	70-130		20	D
Thallium	28.1	0.57	"	28.44	0.518	97.0	70-130		20	D
Silver	14.7	0.57	"	14.22	0.182	102	70-130		20	D
Selenium	19.7	2.8	"	28.44	2.27	61.4	70-130		20	M1, D
Nickel	36.2	0.57	"	28.44	6.98	103	70-130		20	D
Lead	32.5	0.57	"	28.44	2.16	107	70-130		20	D
Copper	217	0.57	"	28.44	197	68.2	70-130		20	M1, D
Cobalt	49.1	0.57	"	28.44	12.7	128	70-130		20	D
Chromium	38.7	2.8	"	28.44	11.9	94.1	70-130		20	D
Cadmium	28.1	0.57	"	28.44	ND	98.9	70-130		20	D
Beryllium	28.1	0.57	"	28.44	0.560	96.8	70-130		20	D
Antimony	1.67	2.8	"	28.44	ND	5.88	70-130		20	M1, D

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Matrix Spike Dup (1108178-MSD1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Copper	225	0.60	mg/kg dry	30.11	203	74.0	70-130	48.3	20	M1, D
Zinc	73.5	6.0	"	30.11	36.1	124	70-130	21.3	20	D
Antimony	2.42	3.0	"	30.11	ND	8.05	70-130	29.1	20	D
Nickel	434	0.60	"	30.11	380	180	70-130	67.4	20	D
Barium	87.2	0.60	"	30.11	67.5	65.7	70-130	82.7	20	D
Beryllium	32.0	0.60	"	30.11	0.571	104	70-130	1.62	20	D
Cadmium	31.9	0.60	"	30.11	ND	106	70-130	2.58	20	D
Chromium	36.6	3.0	"	30.11	10.6	86.4	70-130	11.4	20	D
Cobalt	49.4	0.60	"	30.11	12.3	123	70-130	10.2	20	D
Lead	33.5	0.60	"	30.11	2.15	104	70-130	1.29	20	D
Selenium	24.6	3.0	"	30.11	2.92	72.0	70-130	0.617	20	D
Silver	16.0	0.60	"	15.06	0.248	105	70-130	9.61	20	D
Vanadium	202	3.0	"	30.11	160	137	70-130	6.26	20	M1, D
Thallium	30.2	0.60	"	30.11	0.784	97.7	70-130	3.39	20	D
Matrix Spike Dup (1108178-MSD2)		**Source: 11B0382-01RE1**		Prepared: 02/17/2011 Analyzed: 02/21/2011						
Nickel	37.9	0.60	mg/kg dry	30.11	6.98	103	70-130	0.167	20	D
Beryllium	31.5	0.60	"	30.11	0.560	103	70-130	5.85	20	D
Cadmium	31.5	0.60	"	30.11	ND	105	70-130	5.57	20	D
Chromium	37.0	3.0	"	30.11	11.9	83.3	70-130	12.1	20	D
Cobalt	49.3	0.60	"	30.11	12.7	122	70-130	5.08	20	D
Antimony	2.21	3.0	"	30.11	ND	7.35	70-130	22.3	20	M1, D
Lead	33.4	0.60	"	30.11	2.16	104	70-130	2.80	20	D
Zinc	73.8	6.0	"	30.11	35.9	126	70-130	8.30	20	D
Selenium	24.4	3.0	"	30.11	2.27	73.6	70-130	18.1	20	D
Silver	16.3	0.60	"	15.06	0.182	107	70-130	5.21	20	D
Thallium	29.9	0.60	"	30.11	0.518	97.5	70-130	0.440	20	D
Barium	78.5	0.60	"	30.11	60.6	59.5	70-130	76.0	20	M1, D
Vanadium	204	3.0	"	30.11	167	123	70-130	38.8	20	D
Copper	219	0.60	"	30.11	197	71.2	70-130	4.41	20	D

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1108178 - EPA 3050B ICPMS										
Post Spike (1108178-PS1)		**Source: 11B0382-01**		Prepared: 02/17/2011 Analyzed: 02/18/2011						
Lead	1050		ug/L	1000	75.4	97.8	75-125			D
Zinc	2230		"	1000	1270	96.5	75-125			D
Vanadium	6490		"	1000	5630	85.1	75-125			D
Thallium	1040		"	1000	27.5	101	75-125			D
Silver	515		"	500.0	8.71	101	75-125			D
Nickel	16500		"	1000	13400	316	75-125			D
Copper	8040		"	1000	7130	90.4	75-125			D
Cobalt	1460		"	1000	432	103	75-125			D
Chromium	1110		"	1000	372	73.6	75-125			D
Cadmium	1020		"	1000	0.543	102	75-125			D
Beryllium	1020		"	1000	20.1	100	75-125			D
Barium	3620		"	1000	2370	125	75-125			D
Antimony	1050		"	1000	6.52	104	75-125			D
Selenium	969		"	1000	103	86.7	75-125			D
Post Spike (1108178-PS2)		**Source: 11B0382-01RE1**		Prepared: 02/17/2011 Analyzed: 02/21/2011						
Antimony	2170		ug/L	2000	0.0150	109	75-125			D
Zinc	3030		"	2000	1260	88.4	75-125			D
Vanadium	8020		"	2000	5880	107	75-125			D
Thallium	2080		"	2000	18.2	103	75-125			D
Silver	1080		"	1000	6.38	107	75-125			D
Selenium	1770		"	2000	79.7	84.3	75-125			D
Nickel	2070		"	2000	245	91.0	75-125			D
Lead	2100		"	2000	75.7	101	75-125			D
Copper	8310		"	2000	6940	68.9	75-125			D
Cobalt	2320		"	2000	445	93.7	75-125			D
Chromium	2080		"	2000	419	83.1	75-125			D
Cadmium	1910		"	2000	4.46	95.5	75-125			D
Barium	4110		"	2000	2130	99.2	75-125			D
Beryllium	1900		"	2000	19.7	94.0	75-125			D

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Metals, Total by EPA 6000/7000 Series Methods - Quality Control Summary

Microbac Laboratories, Inc., Baltimore Division

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch M1B1805 - 1108173										
Instrument Blank (M1B1805-IBL1)				Prepared & Analyzed: 02/17/2011						
Tin	ND	0.010	mg/L							U

Microbac Laboratories, Inc., Baltimore Division

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

SW846 7471A

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: Hg
Calibration: UNASSIGNED
Control Limt: +/- 10.00%
Sequence: M1B0813

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B0813-ICV1	Mercury	3.003	3.03	101	ug/L	SW846 7471A
M1B0813-CCV1	Mercury	3.003	3.13	104	ug/L	SW846 7471A
M1B0813-CCV2	Mercury	3.003	3.14	104	ug/L	SW846 7471A

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: Varian ICP
Calibration: UNASSIGNED
Control Limt: +/- 10.00%
Sequence: M1B1805

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1805-ICV1	Tin	1.000	0.999	99.9	mg/L	EPA 6010B
M1B1805-CCV7	Tin	1.000	0.963	96.3	mg/L	EPA 6010B
M1B1805-CCV8	Tin	1.000	0.976	97.6	mg/L	EPA 6010B
M1B1805-CCV9	Tin	1.000	0.991	99.1	mg/L	EPA 6010B
M1B1805-CCVA	Tin	1.000	1.02	102	mg/L	EPA 6010B

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1806

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1806-CCV1	Antimony	40.00	40.4	101	ug/L	EPA 200.8/6020
	Arsenic	40.00	41.0	102	ug/L	EPA 200.8/6020
	Barium	40.00	40.1	100	ug/L	EPA 200.8/6020
	Beryllium	40.00	38.9	97.3	ug/L	EPA 200.8/6020
	Cadmium	40.00	40.8	102	ug/L	EPA 200.8/6020
	Chromium	40.00	37.1	92.8	ug/L	EPA 200.8/6020
	Copper	40.00	40.6	101	ug/L	EPA 200.8/6020
	Lead	40.00	40.5	101	ug/L	EPA 200.8/6020
	Manganese	40.00	39.0	97.5	ug/L	EPA 200.8/6020
	Nickel	40.00	41.0	103	ug/L	EPA 200.8/6020
	Selenium	40.00	42.8	107	ug/L	EPA 200.8/6020
	Silver	20.00	21.0	105	ug/L	EPA 200.8/6020
	Thallium	40.00	40.8	102	ug/L	EPA 200.8/6020

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1807-CCV1	Antimony	40.00	40.4	101	ug/L	EPA 6020
	Barium	40.00	40.1	100	ug/L	EPA 6020
	Beryllium	40.00	38.9	97.3	ug/L	EPA 6020
	Cadmium	40.00	40.8	102	ug/L	EPA 6020
	Chromium	40.00	37.1	92.8	ug/L	EPA 6020
	Cobalt	40.00	40.1	100	ug/L	EPA 6020
	Copper	40.00	40.6	101	ug/L	EPA 6020
	Lead	40.00	40.5	101	ug/L	EPA 6020
	Nickel	40.00	41.0	103	ug/L	EPA 6020
	Selenium	40.00	42.8	107	ug/L	EPA 6020
	Silver	20.00	21.0	105	ug/L	EPA 6020
	Thallium	40.00	40.8	102	ug/L	EPA 6020
	Vanadium	40.00	43.1	108	ug/L	EPA 6020
	Zinc	40.00	39.5	98.8	ug/L	EPA 6020
M1B1807-CCV2	Antimony	40.00	43.7	109	ug/L	EPA 6020
	Barium	40.00	42.7	107	ug/L	EPA 6020
	Beryllium	40.00	42.5	106	ug/L	EPA 6020
	Cadmium	40.00	44.8	112 *	ug/L	EPA 6020
	Chromium	40.00	41.3	103	ug/L	EPA 6020
	Cobalt	40.00	41.0	102	ug/L	EPA 6020
	Copper	40.00	42.7	107	ug/L	EPA 6020
	Lead	40.00	40.1	100	ug/L	EPA 6020
	Nickel	40.00	42.7	107	ug/L	EPA 6020

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R		Units	Method
M1B1807-CCV2	Selenium	40.00	42.0	105		ug/L	EPA 6020
	Silver	20.00	21.3	107		ug/L	EPA 6020
	Thallium	40.00	39.2	98.1		ug/L	EPA 6020
	Vanadium	40.00	38.0	95.0		ug/L	EPA 6020
	Zinc	40.00	40.9	102		ug/L	EPA 6020
M1B1807-ICV3	Antimony	40.00	41.7	104		ug/L	EPA 6020
	Barium	40.00	43.2	108		ug/L	EPA 6020
	Beryllium	40.00	41.8	105		ug/L	EPA 6020
	Cadmium	40.00	45.3	113	*	ug/L	EPA 6020
	Chromium	40.00	41.4	103		ug/L	EPA 6020
	Cobalt	40.00	41.9	105		ug/L	EPA 6020
	Copper	40.00	42.3	106		ug/L	EPA 6020
	Lead	40.00	39.9	99.7		ug/L	EPA 6020
	Nickel	40.00	43.3	108		ug/L	EPA 6020
	Selenium	40.00	44.8	112	*	ug/L	EPA 6020
	Silver	20.00	21.8	109		ug/L	EPA 6020
	Thallium	40.00	39.9	99.8		ug/L	EPA 6020
	Vanadium	40.00	43.7	109		ug/L	EPA 6020
	Zinc	40.00	41.2	103		ug/L	EPA 6020
M1B1807-CCV3	Antimony	40.00	38.4	96.1		ug/L	EPA 6020
	Barium	40.00	42.0	105		ug/L	EPA 6020
	Beryllium	40.00	38.3	95.8		ug/L	EPA 6020
	Cadmium	40.00	41.8	105		ug/L	EPA 6020

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1807-CCV3	Chromium	40.00	37.8	94.5	ug/L	EPA 6020
	Cobalt	40.00	41.0	102	ug/L	EPA 6020
	Copper	40.00	40.7	102	ug/L	EPA 6020
	Lead	40.00	39.0	97.6	ug/L	EPA 6020
	Nickel	40.00	42.0	105	ug/L	EPA 6020
	Selenium	40.00	41.5	104	ug/L	EPA 6020
	Silver	20.00	21.5	107	ug/L	EPA 6020
	Thallium	40.00	40.3	101	ug/L	EPA 6020
	Vanadium	40.00	42.5	106	ug/L	EPA 6020
	Zinc	40.00	39.9	99.7	ug/L	EPA 6020
M1B1807-CCVB	Antimony	40.00	42.9	107	ug/L	EPA 6020
	Barium	40.00	43.5	109	ug/L	EPA 6020
	Beryllium	40.00	39.6	98.9	ug/L	EPA 6020
	Cadmium	40.00	43.2	108	ug/L	EPA 6020
	Chromium	40.00	37.8	94.4	ug/L	EPA 6020
	Cobalt	40.00	41.7	104	ug/L	EPA 6020
	Copper	40.00	41.8	105	ug/L	EPA 6020
	Lead	40.00	39.0	97.4	ug/L	EPA 6020
	Nickel	40.00	44.5	111 *	ug/L	EPA 6020
	Selenium	40.00	41.3	103	ug/L	EPA 6020
	Silver	20.00	21.4	107	ug/L	EPA 6020
	Thallium	40.00	38.9	97.2	ug/L	EPA 6020
	Vanadium	40.00	38.6	96.6	ug/L	EPA 6020

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1807-CCVB	Zinc	40.00	39.8	99.5	ug/L	EPA 6020
M1B1807-CCVC	Antimony	40.00	37.4	93.4	ug/L	EPA 6020
	Barium	40.00	43.3	108	ug/L	EPA 6020
	Beryllium	40.00	40.5	101	ug/L	EPA 6020
	Cadmium	40.00	43.8	109	ug/L	EPA 6020
	Chromium	40.00	34.1	85.3 *	ug/L	EPA 6020
	Cobalt	40.00	41.4	103	ug/L	EPA 6020
	Copper	40.00	42.0	105	ug/L	EPA 6020
	Lead	40.00	38.2	95.6	ug/L	EPA 6020
	Nickel	40.00	43.6	109	ug/L	EPA 6020
	Selenium	40.00	42.9	107	ug/L	EPA 6020
	Silver	20.00	20.1	101	ug/L	EPA 6020
	Thallium	40.00	38.9	97.2	ug/L	EPA 6020
	Vanadium	40.00	40.1	100	ug/L	EPA 6020
	Zinc	40.00	40.3	101	ug/L	EPA 6020
M1B1807-CCVD	Antimony	40.00	37.2	93.0	ug/L	EPA 6020
	Barium	40.00	43.7	109	ug/L	EPA 6020
	Beryllium	40.00	41.1	103	ug/L	EPA 6020
	Cadmium	40.00	44.1	110	ug/L	EPA 6020
	Chromium	40.00	34.3	85.6 *	ug/L	EPA 6020
	Cobalt	40.00	41.3	103	ug/L	EPA 6020
	Copper	40.00	42.3	106	ug/L	EPA 6020
	Lead	40.00	38.8	96.9	ug/L	EPA 6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B1807-CCVD	Nickel	40.00	43.8	110	ug/L	EPA 6020
	Selenium	40.00	41.8	105	ug/L	EPA 6020
	Silver	20.00	20.7	103	ug/L	EPA 6020
	Thallium	40.00	39.4	98.5	ug/L	EPA 6020
	Vanadium	40.00	40.4	101	ug/L	EPA 6020
	Zinc	40.00	40.6	102	ug/L	EPA 6020

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B2108

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B2108-ICV1	Antimony	40.00	43.6	109	ug/L	EPA 200.8/6020
	Arsenic	40.00	41.0	102	ug/L	EPA 200.8/6020
	Barium	40.00	40.4	101	ug/L	EPA 200.8/6020
	Beryllium	40.00	40.0	99.9	ug/L	EPA 200.8/6020
	Cadmium	40.00	40.0	100	ug/L	EPA 200.8/6020
	Chromium	40.00	41.5	104	ug/L	EPA 200.8/6020
	Cobalt	40.00	39.8	99.4	ug/L	EPA 200.8/6020
	Lead	40.00	41.6	104	ug/L	EPA 200.8/6020
	Nickel	40.00	40.7	102	ug/L	EPA 200.8/6020
	Selenium	40.00	39.9	99.9	ug/L	EPA 200.8/6020
	Thallium	40.00	41.3	103	ug/L	EPA 200.8/6020
	Zinc	40.00	38.6	96.4	ug/L	EPA 200.8/6020
M1B2108-ICV2	Antimony	40.00	41.0	103	ug/L	EPA 200.8/6020
	Arsenic	40.00	41.0	102	ug/L	EPA 200.8/6020
	Barium	40.00	39.7	99.2	ug/L	EPA 200.8/6020
	Beryllium	40.00	40.1	100	ug/L	EPA 200.8/6020
	Cadmium	40.00	40.1	100	ug/L	EPA 200.8/6020
	Chromium	40.00	36.5	91.3	ug/L	EPA 200.8/6020
	Cobalt	40.00	40.3	101	ug/L	EPA 200.8/6020
	Lead	40.00	42.8	107	ug/L	EPA 200.8/6020
	Nickel	40.00	39.7	99.4	ug/L	EPA 200.8/6020
	Selenium	40.00	41.0	103	ug/L	EPA 200.8/6020
	Silver	20.00	21.8	109	ug/L	EPA 200.8/6020

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B2108

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B2108-ICV2	Thallium	40.00	42.3	106	ug/L	EPA 200.8/6020
	Zinc	40.00	40.0	100	ug/L	EPA 200.8/6020
M1B2108-CCV1	Antimony	40.00	40.3	101	ug/L	EPA 200.8/6020
	Arsenic	40.00	39.6	99.0	ug/L	EPA 200.8/6020
	Barium	40.00	39.9	99.6	ug/L	EPA 200.8/6020
	Beryllium	40.00	37.7	94.2	ug/L	EPA 200.8/6020
	Cadmium	40.00	38.5	96.2	ug/L	EPA 200.8/6020
	Chromium	40.00	41.0	102	ug/L	EPA 200.8/6020
	Cobalt	40.00	41.8	104	ug/L	EPA 200.8/6020
	Lead	40.00	41.9	105	ug/L	EPA 200.8/6020
	Nickel	40.00	40.1	100	ug/L	EPA 200.8/6020
	Selenium	40.00	40.3	101	ug/L	EPA 200.8/6020
	Silver	20.00	21.8	109	ug/L	EPA 200.8/6020
	Thallium	40.00	43.1	108	ug/L	EPA 200.8/6020
	Zinc	40.00	39.2	98.0	ug/L	EPA 200.8/6020
M1B2108-CCV2	Antimony	40.00	39.4	98.4	ug/L	EPA 200.8/6020
	Arsenic	40.00	40.4	101	ug/L	EPA 200.8/6020
	Barium	40.00	39.0	97.4	ug/L	EPA 200.8/6020
	Beryllium	40.00	38.3	95.8	ug/L	EPA 200.8/6020
	Cadmium	40.00	39.3	98.3	ug/L	EPA 200.8/6020
	Chromium	40.00	40.7	102	ug/L	EPA 200.8/6020
	Cobalt	40.00	42.0	105	ug/L	EPA 200.8/6020
	Lead	40.00	42.3	106	ug/L	EPA 200.8/6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

INITIAL AND CONTINUING CALIBRATION CHECK

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Instrument ID: PE ELAN 9000
Calibration: MB10017
Control Limt: +/- 10.00%
Sequence: M1B2108

Lab Sample ID	Analyte	True	Found	%R	Units	Method
M1B2108-CCV2	Nickel	40.00	40.7	102	ug/L	EPA 200.8/6020
	Selenium	40.00	40.4	101	ug/L	EPA 200.8/6020
	Silver	20.00	22.1	110	ug/L	EPA 200.8/6020
	Thallium	40.00	42.8	107	ug/L	EPA 200.8/6020
	Zinc	40.00	38.7	96.7	ug/L	EPA 200.8/6020
M1B2108-CCV3	Antimony	40.00	39.3	98.1	ug/L	EPA 200.8/6020
	Arsenic	40.00	40.8	102	ug/L	EPA 200.8/6020
	Barium	40.00	39.2	98.1	ug/L	EPA 200.8/6020
	Beryllium	40.00	39.1	97.7	ug/L	EPA 200.8/6020
	Cadmium	40.00	40.5	101	ug/L	EPA 200.8/6020
	Chromium	40.00	36.9	92.3	ug/L	EPA 200.8/6020
	Cobalt	40.00	41.8	105	ug/L	EPA 200.8/6020
	Lead	40.00	40.4	101	ug/L	EPA 200.8/6020
	Nickel	40.00	39.1	97.8	ug/L	EPA 200.8/6020
	Selenium	40.00	42.2	105	ug/L	EPA 200.8/6020
	Silver	20.00	21.5	108	ug/L	EPA 200.8/6020
	Thallium	40.00	40.2	101	ug/L	EPA 200.8/6020
	Zinc	40.00	40.1	100	ug/L	EPA 200.8/6020

* Values outside of QC limits

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
SM (20) 2540G

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: Balance #8
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence:
Calibration:

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
1106231-BLK1	% Solids	0.001	0.05	% by Weight		SM (20) 2540G

BLANKS
SW846 7471A

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: Hg
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B0813
Calibration: UNASSIGNED

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B0813-ICB1	Mercury	-0.00212	0.20	ug/L		SW846 7471A
1107038-BLK1	Mercury	-0.00106	0.025	mg/kg wet		SW846 7471A
M1B0813-CCB1	Mercury	-0.00342	0.20	ug/L		SW846 7471A
M1B0813-CCB2	Mercury	-0.00337	0.20	ug/L		SW846 7471A

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: Varian ICP
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1805
Calibration: UNASSIGNED

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1805-ICB1	Tin	0.00126	0.010	mg/L		EPA 6010B
M1B1805-CCB7	Tin	-0.000617	0.010	mg/L		EPA 6010B
1108173-BLK1	Tin	1.39	0.50	mg/kg wet	*	EPA 6010B
M1B1805-CCB8	Tin	-0.00303	0.010	mg/L		EPA 6010B
M1B1805-CCB9	Tin	-0.00372	0.010	mg/L		EPA 6010B
M1B1805-CCBA	Tin	-0.00287	0.010	mg/L		EPA 6010B

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1806
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1806-ICB1	Antimony	0.564	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.115	2.0	ug/L		EPA 200.8/6020
	Barium	0.0150	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.116	1.0	ug/L		EPA 200.8/6020
	Cadmium	-0.137	0.50	ug/L		EPA 200.8/6020
	Chromium	-0.677	2.0	ug/L		EPA 200.8/6020
	Copper	0.0140	1.0	ug/L		EPA 200.8/6020
	Lead	0.0830	1.0	ug/L		EPA 200.8/6020
	Manganese	0.0920	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.236	5.0	ug/L		EPA 200.8/6020
	Selenium	0.840	5.0	ug/L		EPA 200.8/6020
	Silver	0.147	1.0	ug/L		EPA 200.8/6020
	Thallium	0.141	1.0	ug/L		EPA 200.8/6020
M1B1806-CCB1	Antimony	1.30	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.769	2.0	ug/L		EPA 200.8/6020
	Barium	0.0130	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.133	1.0	ug/L		EPA 200.8/6020
	Cadmium	-0.140	0.50	ug/L		EPA 200.8/6020
	Chromium	-2.53	2.0	ug/L	*	EPA 200.8/6020
	Copper	0.0330	1.0	ug/L		EPA 200.8/6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1806
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1806-CCB1	Lead	0.0860	1.0	ug/L		EPA 200.8/6020
	Manganese	0.0470	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.500	5.0	ug/L		EPA 200.8/6020
	Selenium	0.424	5.0	ug/L		EPA 200.8/6020
	Silver	0.159	1.0	ug/L		EPA 200.8/6020
	Thallium	0.299	1.0	ug/L		EPA 200.8/6020

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1807-ICB1	Antimony	0.564	5.0	ug/L		EPA 6020
	Barium	0.0150	1.0	ug/L		EPA 6020
	Beryllium	0.116	1.0	ug/L		EPA 6020
	Cadmium	-0.137	1.0	ug/L		EPA 6020
	Chromium	-0.677	5.0	ug/L		EPA 6020
	Cobalt	0.0860	1.0	ug/L		EPA 6020
	Copper	0.0140	1.0	ug/L		EPA 6020
	Lead	0.0830	1.0	ug/L		EPA 6020
	Nickel	-0.236	1.0	ug/L		EPA 6020
	Selenium	0.840	5.0	ug/L		EPA 6020
	Silver	0.147	1.0	ug/L		EPA 6020
	Thallium	0.141	1.0	ug/L		EPA 6020
	Vanadium	-1.41	5.0	ug/L		EPA 6020
	Zinc	-0.134	10	ug/L		EPA 6020
M1B1807-CCB1	Antimony	1.30	5.0	ug/L		EPA 6020
	Barium	0.0130	1.0	ug/L		EPA 6020
	Beryllium	0.133	1.0	ug/L		EPA 6020
	Cadmium	-0.140	1.0	ug/L		EPA 6020
	Chromium	-2.53	5.0	ug/L		EPA 6020
	Cobalt	0.0890	1.0	ug/L		EPA 6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1807-CCB1	Copper	0.0330	1.0	ug/L		EPA 6020
	Lead	0.0860	1.0	ug/L		EPA 6020
	Nickel	-0.500	1.0	ug/L		EPA 6020
	Selenium	0.424	5.0	ug/L		EPA 6020
	Silver	0.159	1.0	ug/L		EPA 6020
	Thallium	0.299	1.0	ug/L		EPA 6020
	Vanadium	2.04	5.0	ug/L		EPA 6020
	Zinc	-0.0620	10	ug/L		EPA 6020
M1B1807-CCB2	Antimony	-0.165	5.0	ug/L		EPA 6020
	Barium	0.0220	1.0	ug/L		EPA 6020
	Beryllium	0.104	1.0	ug/L		EPA 6020
	Cadmium	-0.140	1.0	ug/L		EPA 6020
	Chromium	-1.69	5.0	ug/L		EPA 6020
	Cobalt	0.0850	1.0	ug/L		EPA 6020
	Copper	0.0160	1.0	ug/L		EPA 6020
	Lead	0.0820	1.0	ug/L		EPA 6020
	Nickel	-0.172	1.0	ug/L		EPA 6020
	Selenium	0.622	5.0	ug/L		EPA 6020
	Silver	0.131	1.0	ug/L		EPA 6020
	Thallium	0.107	1.0	ug/L		EPA 6020

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1807-CCB2	Vanadium	3.21	5.0	ug/L		EPA 6020
	Zinc	-0.133	10	ug/L		EPA 6020
M1B1807-CCB3	Antimony	1.34	5.0	ug/L		EPA 6020
	Barium	0.145	1.0	ug/L		EPA 6020
	Beryllium	0.0860	1.0	ug/L		EPA 6020
	Cadmium	-0.133	1.0	ug/L		EPA 6020
	Chromium	-1.19	5.0	ug/L		EPA 6020
	Cobalt	0.0930	1.0	ug/L		EPA 6020
	Copper	0.0170	1.0	ug/L		EPA 6020
	Lead	0.0690	1.0	ug/L		EPA 6020
	Nickel	-0.311	1.0	ug/L		EPA 6020
	Selenium	0.573	5.0	ug/L		EPA 6020
	Silver	0.145	1.0	ug/L		EPA 6020
	Thallium	0.115	1.0	ug/L		EPA 6020
	Vanadium	0.510	5.0	ug/L		EPA 6020
	Zinc	-0.0810	10	ug/L		EPA 6020
M1B1807-CCBB	Antimony	2.39	5.0	ug/L		EPA 6020
	Barium	0.164	1.0	ug/L		EPA 6020
	Beryllium	0.0880	1.0	ug/L		EPA 6020
	Cadmium	-0.142	1.0	ug/L		EPA 6020

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Baltimore Division
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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1807-CCBB	Chromium	-0.164	5.0	ug/L		EPA 6020
	Cobalt	0.0890	1.0	ug/L		EPA 6020
	Copper	0.195	1.0	ug/L		EPA 6020
	Lead	0.0890	1.0	ug/L		EPA 6020
	Nickel	0.498	1.0	ug/L		EPA 6020
	Selenium	0.595	5.0	ug/L		EPA 6020
	Silver	0.357	1.0	ug/L		EPA 6020
	Thallium	0.114	1.0	ug/L		EPA 6020
	Vanadium	1.26	5.0	ug/L		EPA 6020
	Zinc	0.901	10	ug/L		EPA 6020
1108178-BLK1	Antimony	0.820	5.0	mg/kg wet		EPA 6020
	Barium	0.559	1.0	mg/kg wet		EPA 6020
	Beryllium	0.0824	1.0	mg/kg wet		EPA 6020
	Cadmium	-0.142	1.0	mg/kg wet		EPA 6020
	Chromium	-1.37	5.0	mg/kg wet		EPA 6020
	Cobalt	0.0914	1.0	mg/kg wet		EPA 6020
	Copper	0.116	1.0	mg/kg wet		EPA 6020
	Lead	0.148	1.0	mg/kg wet		EPA 6020
	Nickel	0.401	1.0	mg/kg wet		EPA 6020
	Selenium	1.04	5.0	mg/kg wet		EPA 6020

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BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
1108178-BLK1	Silver	0.186	1.0	mg/kg wet		EPA 6020
	Thallium	0.102	1.0	mg/kg wet		EPA 6020
	Vanadium	3.71	5.0	mg/kg wet		EPA 6020
	Zinc	0.965	10	mg/kg wet		EPA 6020
M1B1807-CCBC	Antimony	1.34	5.0	ug/L		EPA 6020
	Barium	0.168	1.0	ug/L		EPA 6020
	Beryllium	0.0940	1.0	ug/L		EPA 6020
	Cadmium	-0.146	1.0	ug/L		EPA 6020
	Chromium	-2.71	5.0	ug/L		EPA 6020
	Cobalt	0.0870	1.0	ug/L		EPA 6020
	Copper	0.249	1.0	ug/L		EPA 6020
	Lead	0.0760	1.0	ug/L		EPA 6020
	Nickel	-0.842	1.0	ug/L		EPA 6020
	Selenium	0.465	5.0	ug/L		EPA 6020
	Silver	0.164	1.0	ug/L		EPA 6020
	Thallium	0.196	1.0	ug/L		EPA 6020
	Vanadium	2.68	5.0	ug/L		EPA 6020
	Zinc	0.266	10	ug/L		EPA 6020
M1B1807-CCBD	Antimony	1.37	5.0	ug/L		EPA 6020
	Barium	0.151	1.0	ug/L		EPA 6020

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BLANKS
EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B1807
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B1807-CCBD	Beryllium	0.102	1.0	ug/L		EPA 6020
	Cadmium	-0.135	1.0	ug/L		EPA 6020
	Chromium	-2.73	5.0	ug/L		EPA 6020
	Cobalt	0.0890	1.0	ug/L		EPA 6020
	Copper	0.247	1.0	ug/L		EPA 6020
	Lead	0.0760	1.0	ug/L		EPA 6020
	Nickel	-0.817	1.0	ug/L		EPA 6020
	Selenium	0.636	5.0	ug/L		EPA 6020
	Silver	0.165	1.0	ug/L		EPA 6020
	Thallium	0.152	1.0	ug/L		EPA 6020
	Vanadium	2.01	5.0	ug/L		EPA 6020
	Zinc	0.305	10	ug/L		EPA 6020

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B2108
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B2108-ICB1	Antimony	1.86	5.0	ug/L		EPA 200.8/6020
	Arsenic	0.0390	2.0	ug/L		EPA 200.8/6020
	Barium	-0.0390	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.122	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.0800	0.50	ug/L		EPA 200.8/6020
	Chromium	-0.581	2.0	ug/L		EPA 200.8/6020
	Cobalt	0.0180	5.0	ug/L		EPA 200.8/6020
	Lead	-0.0540	1.0	ug/L		EPA 200.8/6020
	Nickel	-0.277	5.0	ug/L		EPA 200.8/6020
	Selenium	0.298	5.0	ug/L		EPA 200.8/6020
	Silver	0.0560	1.0	ug/L		EPA 200.8/6020
	Thallium	0.0160	1.0	ug/L		EPA 200.8/6020
	Zinc	-0.0930	5.0	ug/L		EPA 200.8/6020
M1B2108-CCB1	Antimony	1.84	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.695	2.0	ug/L		EPA 200.8/6020
	Barium	-0.0240	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.132	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.0750	0.50	ug/L		EPA 200.8/6020
	Chromium	-2.08	2.0	ug/L	*	EPA 200.8/6020
	Cobalt	0.0240	5.0	ug/L		EPA 200.8/6020

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B2108
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B2108-CCB1	Lead	-0.0540	1.0	ug/L		EPA 200.8/6020
	Nickel	-1.05	5.0	ug/L		EPA 200.8/6020
	Selenium	-0.0200	5.0	ug/L		EPA 200.8/6020
	Silver	0.0590	1.0	ug/L		EPA 200.8/6020
	Thallium	0.116	1.0	ug/L		EPA 200.8/6020
	Zinc	-0.182	5.0	ug/L		EPA 200.8/6020
1108178-BLK3	Antimony	1.82	5.0	mg/kg wet		EPA 6020
	Barium	0.230	1.0	mg/kg wet		EPA 6020
	Beryllium	0.113	1.0	mg/kg wet		EPA 6020
	Cadmium	0.0816	1.0	mg/kg wet		EPA 6020
	Chromium	-1.92	5.0	mg/kg wet		EPA 6020
	Cobalt	0.0189	1.0	mg/kg wet		EPA 6020
	Copper	0.166	1.0	mg/kg wet		EPA 6020
	Lead	-0.00110	1.0	mg/kg wet		EPA 6020
	Nickel	-1.38	1.0	mg/kg wet	*	EPA 6020
	Selenium	0.199	5.0	mg/kg wet		EPA 6020
	Silver	0.0540	1.0	mg/kg wet		EPA 6020
	Thallium	0.0204	1.0	mg/kg wet		EPA 6020
	Vanadium	1.52	5.0	mg/kg wet		EPA 6020
	Zinc	0.590	10	mg/kg wet		EPA 6020

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BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B2108
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B2108-CCB2	Antimony	1.49	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.544	2.0	ug/L		EPA 200.8/6020
	Barium	-0.0520	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.138	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.0730	0.50	ug/L		EPA 200.8/6020
	Chromium	-2.78	2.0	ug/L	*	EPA 200.8/6020
	Cobalt	0.0130	5.0	ug/L		EPA 200.8/6020
	Lead	-0.0520	1.0	ug/L		EPA 200.8/6020
	Nickel	-1.45	5.0	ug/L		EPA 200.8/6020
	Selenium	0.189	5.0	ug/L		EPA 200.8/6020
	Silver	0.0630	1.0	ug/L		EPA 200.8/6020
	Thallium	0.138	1.0	ug/L		EPA 200.8/6020
	Zinc	-0.159	5.0	ug/L		EPA 200.8/6020
M1B2108-CCB3	Antimony	1.38	5.0	ug/L		EPA 200.8/6020
	Arsenic	-0.470	2.0	ug/L		EPA 200.8/6020
	Barium	-0.0290	5.0	ug/L		EPA 200.8/6020
	Beryllium	0.128	1.0	ug/L		EPA 200.8/6020
	Cadmium	0.0780	0.50	ug/L		EPA 200.8/6020
	Chromium	-2.87	2.0	ug/L	*	EPA 200.8/6020
	Cobalt	0.0150	5.0	ug/L		EPA 200.8/6020

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BLANKS
EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Instrument ID: PE ELAN 9000
Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils
Sequence: M1B2108
Calibration: MB10017

Lab Sample ID	Analyte	Found	MRL	Units	C	Method
M1B2108-CCB3	Lead	-0.0550	1.0	ug/L		EPA 200.8/6020
	Nickel	-1.25	5.0	ug/L		EPA 200.8/6020
	Selenium	0.327	5.0	ug/L		EPA 200.8/6020
	Silver	0.0550	1.0	ug/L		EPA 200.8/6020
	Thallium	0.0770	1.0	ug/L		EPA 200.8/6020
	Zinc	-0.0920	5.0	ug/L		EPA 200.8/6020

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: Varian ICP
Calibration: UNASSIGNED
Sequence: M1B1805

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1805-IFA1	Tin		-0.02		mg/L
M1B1805-IFB1	Tin	1.000	0.94	94.1	mg/L

* Values outside of QC limits

INTERFERENCE CHECK SAMPLE

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10017
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1807-IFA1	Antimony		12.30		ug/L
	Barium		0.33		ug/L
	Beryllium		0.20		ug/L
	Cadmium		0.83		ug/L
	Chromium		-1.36		ug/L
	Cobalt		0.69		ug/L
	Copper		1.41		ug/L

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10017
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1807-IFA1	Lead		0.29		ug/L
	Nickel		194.51		ug/L
	Selenium		1.84		ug/L
	Silver		0.38		ug/L
	Thallium		2.03		ug/L
	Vanadium		-0.85		ug/L
	Zinc		1.98		ug/L
M1B1807-IFB1	Antimony		2.84		ug/L
	Barium		0.25		ug/L
	Beryllium		0.15		ug/L
	Cadmium	100.0	141.13	141 *	ug/L
	Chromium	200.0	263.08	132 *	ug/L
	Cobalt	200.0	251.96	126	ug/L
	Copper	200.0	246.64	123	ug/L
	Lead		0.21		ug/L
	Nickel	200.0	442.33	221 *	ug/L
	Selenium	100.0	136.05	136 *	ug/L

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INTERFERENCE CHECK SAMPLE

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10017
Sequence: M1B1807

Lab Sample ID	Analyte	True	Found	%R	Units
M1B1807-IFB1	Silver	50.00	68.95	138 *	ug/L
	Thallium		0.75		ug/L
	Vanadium	200.0	264.91	132 *	ug/L
	Zinc	100.0	126.31	126	ug/L

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

INTERFERENCE CHECK SAMPLE

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10017
Sequence: M1B2108

Lab Sample ID	Analyte	True	Found	%R	Units
M1B2108-IFA1	Antimony		8.78		ug/L
	Arsenic		0.17		ug/L
	Barium		0.15		ug/L
	Beryllium		0.17		ug/L
	Cadmium		0.65		ug/L
	Chromium		-1.94		ug/L
	Cobalt		0.55		ug/L
	Lead		0.09		ug/L
	Nickel		1.59		ug/L
	Selenium		1.65		ug/L
	Silver		0.23		ug/L
	Thallium		2.46		ug/L
	Zinc		0.94		ug/L
M1B2108-IFB1	Antimony		2.13		ug/L
	Arsenic	100.0	108.34	108	ug/L
	Barium		0.10		ug/L
	Beryllium		0.13		ug/L

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INTERFERENCE CHECK SAMPLE

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020 Me
Instrument ID: PE ELAN 9000
Calibration: MB10017
Sequence: M1B2108

Lab Sample ID	Analyte	True	Found	%R	Units
M1B2108-IFB1	Cadmium	100.0	110.56	111	ug/L
	Chromium	200.0	222.81	111	ug/L
	Cobalt	200.0	215.27	108	ug/L
	Lead		0.04		ug/L
	Nickel	200.0	217.51	109	ug/L
	Selenium	100.0	108.15	108	ug/L
	Silver	50.00	59.86	120	ug/L
	Thallium		0.73		ug/L
	Zinc	100.0	102.38	102	ug/L

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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Lewis B. Gunn III, Project Manager

Microbac Laboratories, Inc.
Baltimore Division
2101 Van Deman Street • Baltimore, MD 21224

Phone: 410-633-1800
Fax: 410-633-6553
www.microbac.com

CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: UNASSIGNED
Laboratory ID: M1B1805-LCV1
Sequence: M1B1805
Standard ID: MB10722

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Tin	0.04000	0.0434	8.5	25.00

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B1806-LCV1
Sequence: M1B1806
Standard ID: MB10816

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Barium	1.000	1.02	1.9	20.00
Beryllium	1.000	1.07	6.6	20.00
Cadmium	1.000	0.914	-8.6	20.00
Chromium	1.000	1.20	20.5 *	20.00
Copper	1.000	1.04	4.2	20.00
Lead	1.000	1.09	9.1	20.00
Manganese	1.000	1.09	8.7	20.00
Nickel	1.000	0.842	-15.8	20.00
Silver	1.000	1.13	12.7	20.00
Thallium	1.000	1.08	7.8	20.00

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B1806-LCV2
Sequence: M1B1806
Standard ID: MB10815

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	5.000	5.12	2.4	20.00
Arsenic	5.000	6.12	22.3 *	20.00
Barium	5.000	4.97	-0.6	20.00
Beryllium	5.000	5.10	2.0	20.00
Cadmium	5.000	5.22	4.4	20.00
Chromium	5.000	4.68	-6.4	20.00
Copper	5.000	5.13	2.6	20.00
Lead	5.000	4.97	-0.7	20.00
Manganese	5.000	5.02	0.3	20.00
Nickel	5.000	4.97	-0.6	20.00
Selenium	5.000	5.57	11.3	20.00
Silver	5.000	4.89	-2.1	20.00
Thallium	5.000	4.84	-3.3	20.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B1807-LCV1
Sequence: M1B1807
Standard ID: MB10816

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1.000	1.28	28.1 *	20.00
Barium	1.000	1.02	1.9	20.00
Beryllium	1.000	1.07	6.6	20.00
Cadmium	1.000	0.914	-8.6	20.00
Chromium	1.000	1.20	20.5 *	20.00
Cobalt	1.000	1.09	8.7	20.00
Copper	1.000	1.04	4.2	20.00
Lead	1.000	1.09	9.1	20.00
Nickel	1.000	0.842	-15.8	20.00
Selenium	1.000	1.82	82.5 *	20.00
Silver	1.000	1.13	12.7	20.00
Thallium	1.000	1.08	7.8	20.00
Vanadium	1.000	-0.800	-180 *	20.00
Zinc	1.000	0.760	-24.0 *	20.00

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B1807-LCV2
Sequence: M1B1807
Standard ID: MB10815

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	5.000	5.12	2.4	20.00
Barium	5.000	4.97	-0.6	20.00
Beryllium	5.000	5.10	2.0	20.00
Cadmium	5.000	5.22	4.4	20.00
Chromium	5.000	4.68	-6.4	20.00
Cobalt	5.000	4.87	-2.6	20.00
Copper	5.000	5.13	2.6	20.00
Lead	5.000	4.97	-0.7	20.00
Nickel	5.000	4.97	-0.6	20.00
Selenium	5.000	5.57	11.3	20.00
Silver	5.000	4.89	-2.1	20.00
Thallium	5.000	4.84	-3.3	20.00
Vanadium	5.000	2.23	-55.4 *	20.00
Zinc	5.000	5.08	1.6	20.00

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B2108-LCV1
Sequence: M1B2108
Standard ID: MB10816

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Barium	1.000	0.956	-4.4	20.00
Beryllium	1.000	1.12	11.5	20.00
Cadmium	1.000	1.06	6.3	20.00
Cobalt	1.000	1.06	5.8	20.00
Lead	1.000	0.956	-4.4	20.00
Selenium	1.000	1.02	2.2	20.00
Silver	1.000	1.01	1.0	20.00
Thallium	1.000	0.967	-3.3	20.00
Zinc	1.000	0.897	-10.3	20.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020]
Calibration: MB10017
Laboratory ID: M1B2108-LCV2
Sequence: M1B2108
Standard ID: MB10815

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	5.000	5.30	6.0	20.00
Arsenic	5.000	5.26	5.2	20.00
Barium	5.000	5.11	2.2	20.00
Beryllium	5.000	4.94	-1.3	20.00
Cadmium	5.000	4.98	-0.5	20.00
Chromium	5.000	4.59	-8.1	20.00
Cobalt	5.000	5.16	3.1	20.00
Lead	5.000	4.99	-0.2	20.00
Nickel	5.000	4.37	-12.7	20.00
Selenium	5.000	4.85	-3.1	20.00
Silver	5.000	4.90	-1.9	20.00
Thallium	5.000	5.01	0.2	20.00
Zinc	5.000	5.26	5.3	20.00

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6010B

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: UNASSIGNED
Laboratory ID: M1B1805-HCV1
Sequence: M1B1805
Standard ID: MB10725

ANALYTE	EXPECTED (mg/L)	FOUND (mg/L)	% DRIFT	QC LIMIT
Tin	20.00	19.8	-1.0	10.00

* Values outside of QC limits

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: MB10017
Laboratory ID: M1B1806-HCV1
Sequence: M1B1806
Standard ID: MB10819

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1000	1090	9.5	10.00
Arsenic	1000	1020	1.9	10.00
Barium	1000	992	-0.8	10.00
Cadmium	1000	1040	4.1	10.00
Chromium	1000	935	-6.5	10.00
Copper	1000	991	-0.9	10.00
Lead	1000	952	-4.8	10.00
Manganese	1000	988	-1.2	10.00
Nickel	1000	998	-0.2	10.00
Selenium	1000	1010	0.6	10.00
Thallium	1000	937	-6.3	10.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: MB10017
Laboratory ID: M1B1807-HCV1
Sequence: M1B1807
Standard ID: MB10819

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1000	1090	9.5	10.00
Barium	1000	992	-0.8	10.00
Beryllium	1000	775	-22.5 *	10.00
Cadmium	1000	1040	4.1	10.00
Chromium	1000	935	-6.5	10.00
Cobalt	1000	931	-6.9	10.00
Copper	1000	991	-0.9	10.00
Lead	1000	952	-4.8	10.00
Nickel	1000	998	-0.2	10.00
Selenium	1000	1010	0.6	10.00
Silver	500.0	257	-48.5 *	10.00
Thallium	1000	937	-6.3	10.00
Vanadium	1000	901	-9.9	10.00
Zinc	1000	962	-3.8	10.00

* Values outside of QC limits

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APG, MD 21010-5422	Project Manager: Heidi Taylor	

HIGH-CONCENTRATION CALIBRATION VERIFICATION

EPA 200.8/6020

Laboratory: Microbac Laboratories, Inc., Baltimore Division
SDG:
Client: Public Health Command
Project: Inorganics-Full Metals -W/WW,6010/6020
Calibration: MB10017
Laboratory ID: M1B2108-HCV1
Sequence: M1B2108
Standard ID: MB10819

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Antimony	1000	1070	7.4	10.00
Arsenic	1000	1010	1.2	10.00
Barium	1000	1030	2.6	10.00
Cadmium	1000	976	-2.4	10.00
Chromium	1000	1030	2.9	10.00
Cobalt	1000	1050	4.9	10.00
Lead	1000	1060	6.0	10.00
Nickel	1000	1010	0.8	10.00
Selenium	1000	1050	5.2	10.00
Thallium	1000	1100	9.7	10.00
Zinc	1000	997	-0.3	10.00

* Values outside of QC limits

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Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Notes and Definitions

Z10	LCV Biased low, sample concentration is greater than 20X the low standard.
V4	ICV recovery was above acceptance limits. The concentration was below the reporting limit.
V1	CCV recovery was above acceptance limits. The concentration was below the reporting limit.
U	Sample concentration is less than the MDL.
R5	Sample Duplicate RPDs were out of acceptance limits. Sample is non-homogeneous; all results reported in QC summary.
R3	Sample Duplicate RPD was out of acceptance limits. The result concentration was within 5 times the reporting limit and the difference was less than the reporting limit.
M1	The matrix spike recovery was out of acceptance limits. The post digestion spike recovery was acceptable.
D	Sample Diluted
B3	Target analyte detected in method blank at or above reporting limit. The analyte concentration was below the reporting limit.
B	Analyte is found in method blank.
#	QC not in acceptance limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc., Baltimore Division

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CERTIFICATE OF ANALYSIS

Public Health Command	Project: Inorganics-Full Metals -W/WW,6010/6020 Met-Soils	Report: 11B0382
Contract #W91ZLK-09-P-1505, Bldg E2100, Rm 201	Project Number: 1848	Reported: 03/01/2011 16:24
APG, MD 21010-5422	Project Manager: Heidi Taylor	

Certifications

Below is a list of certifications maintained by Microbac Laboratories, Inc. All data included in this report has been reviewed for and meets all project specific and quality control requirements of the applicable accreditation, unless otherwise noted. A complete list of individual analytes pursuant to each certification below is available upon request.

- A2LA (Microbiology): 410.02
- A2LA (Environmental): 410.01
- A2LA (ELLAP): 410.01
- CPSC: 1115
- Maryland: 109
- Pennsylvania (NELAC): 68-00339
- USDA: S-53726
- Virginia: 00152

Microbac Laboratories, Inc., Baltimore Division

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Lewis B. Gunn III, Project Manager

INSTALLATION - Camp Moscrip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)
ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	Arsenic Speciation	Pesticides	Arsenic Speciation	Any metals						
EQ GW	31 Jan 11	1300	X		GW	1				1						
MW-1	31 Jan 11	1400	X		GW	1				1						
MW-1D	31 Jan 11	1415	X		GW	1				1						
MW-2	31 Jan 11	1710	X		GW	1				1						
MW-3	31 Jan 11	1615	X		GW	1				1						
EQ Blk soil	1 Feb 11	0945	X		GW	1				1						
735B01-05	1 Feb 11	~~1150~~ 0950	X		~~GW~~ SO	1				1						
735B03-05	2 Feb 11	1110	X		SO	1				1						
735B03-05 D	2 Feb 11	1110	X		SO	1				1						
										9						

9 <- Total Number of Containers

SHIPMENT METHOD - Fed Ex

Date Shipped - 2 Feb 2011 Ron Hurst

Matrix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
Preservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E REV 1 APR 10

USAPHC (PROV)
Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

TERMINOLOGY & ABBREVIATIONS

DF: Dilution Factor

DLS: Directorate of Laboratory Sciences

g: gram

J: The reported result is an estimated value; the result is between the method detection limit (MDL) and the reporting limit.

kg: kilogram

L: Liter

LCS: Laboratory Control Sample

LCSD: Laboratory Control Sample Duplicate

MDL: Method Detection Limit

mg: milligram

MS: Matrix Spike

MSD: Matrix Spike Duplicate

pCi: picocurie

Qual: Data Qualifier

RPD: Relative Percent Difference

(S): Surrogate Standard (Found in Analytical Results and QC Listings)

U: The analyte was not detected and is reported as less than the method reporting limit. Analytes not detected are reported as having a concentration below the reporting limit (as opposed to below the method detection limit (MDL)) due to the relatively high potential for reporting false negatives at the MDL.

ug: microgram

Uncert: Measurement Uncertainty (Reported in Radiochemical Analyses Only)

**Indicates QC failure. For example, recoveries or relative percent difference (RPD) out of range.

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DEPARTMENT OF THE ARMY
US Army Public Health Command (Provisional)
5158 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5403

MCHB-TS-L 04 Mar 2011

MEMORANDUM FOR USAPHC Program 38 (GWSWP) (5158 Blackhawk Road/Mr. Brian Hammond), MCHB-IP-EGW, Bldg 1677, Gunpowder, MD 21010

SUBJECT: DLS Final Analytical Report

1. This is DLS Final Analytical Report for:

Project Site:	Camp Moscrip, PR
SubJono:	0995
DLS Work Order #:	1852
Report Serial #:	6787

2. Please contact us if this report or any of our services did not meet your needs or expectations.

3. Point of contact for additional information is Mr. Ronald J. Swatski or Mr. David F. Morrow, DSN 584-2208 or commercial 410-436-2208.

MR. FREDERIC BELKIN FOR
LTC KEVIN K. PITZER
Laboratory Operations Manager

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USAPHC (PROV)
Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

SAMPLE SUMMARY

Workorder: 1852 Camp Moscrip, PR

Lab ID	Sample ID	Matrix	Date Collected	Date Received
18520001	MW-1	Water (Miscellaneous)	1/31/2011 14:00	2/3/2011 09:45
18520002	MW-1MS	Water (Miscellaneous)	1/31/2011 14:00	2/3/2011 09:45
18520003	MW-1MSD	Water (Miscellaneous)	1/31/2011 14:00	2/3/2011 09:45
18520004	MW-1D	Water (Miscellaneous)	1/31/2011 14:15	2/3/2011 09:45
18520005	MW-3	Water (Miscellaneous)	1/31/2011 16:15	2/2/2011 11:00
18520006	EQ Blk Water	Water (Miscellaneous)	1/31/2011 13:00	2/2/2011 11:00
18520007	EQ Blk Soil	Water (Miscellaneous)	2/1/2011 09:45	2/2/2011 11:00
18520008	EQ Blk Soil MS	Water (Miscellaneous)	2/1/2011 09:45	2/2/2011 11:00
18520009	EQ Blk Soil MSD	Water (Miscellaneous)	2/1/2011 09:45	2/2/2011 11:00
18520010	Trip Blank	Water (Miscellaneous)		2/2/2011 11:00

CERTIFICATE OF ANALYSIS

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Phone: (410)436-2208
Fax: (410)436-4108

PROJECT SUMMARY

Workorder: 1852 Camp Moscrip, PR

Workorder Comments

2,2'-oxybis[1-chloropropane] and bis(2-chloroisopropyl)ether cannot be separated and, as such, the results reported for bis(2-chloroisopropyl)ether represent a combined total for these two compounds.

Sample Comments

Lab ID: 18520001 **Sample ID:** MW-1 **Sample Type:** SAMPLE

APP IX VOC rec'd 02/02/11 1100 Temp 0.5C

APP IX SVOC, LL PAH's rec'd 02/03/11 Temp 3.2C

Lab ID: 18520004 **Sample ID:** MW-1D **Sample Type:** SAMPLE

APP IX VOC rec'd 02/02/11 1100 Temp 0.5C

APP IX SVOC, LL PAH's rec'd 02/03/11 Temp 3.2C

Lab ID: 18520005 **Sample ID:** MW-3 **Sample Type:** SAMPLE

APP IX VOC; APP IX SVOC Temp 0.5C

LL PAHs Temp 1.3C

Lab ID: 18520006 **Sample ID:** EQ Blk Water **Sample Type:** SAMPLE

Temp 0.5C

Lab ID: 18520007 **Sample ID:** EQ Blk Soil **Sample Type:** SAMPLE

Temp APP IX VOC 0.5C

APP IX SVOC, LL PAHs, PES 1.3C

Lab ID: 18520010 **Sample ID:** Trip Blank **Sample Type:** TRPBLK

Temp 0.5C

Lab ID	Client ID	Receiving Comments for Lab Sample ID
18520001	MW-1	Received outside temperature range (1-6)
18520004	MW-1D	Received outside temperature range (1-6)
18520005	MW-3	Received outside temperature range (1-6)
18520006	EQ Blk Water	Received outside temperature range (1-6)
18520007	EQ Blk Soil	Received outside temperature range (1-6)

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Fax: (410)436-4108

The following report(s) comprise the

Contractor Data Report(s) for Analytical Tests

performed at contract laboratories

in support of the US Army Public Health Command.

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Type I Data Package

Prepared for:

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

Project: Camp Moscrip
Water Samples
Collected on 01/31/11-02/01/11

SDG# PUK62

GROUP	SAMPLE NUMBERS
1231845	6199064-6199069

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-08A-TX

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by: Date 2/28/11

Dana M Kauffman
Dana M. Kauffman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Katherine Klinefelter at Ext. 1566.

Total Number of Pages 1455

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SDG# PUK62

7. Semivolatiles by GC/MS (SIM) Data 989

a. Case Narrative-Conformance/Nonconform. Summary 990

b. Quality Control and Calibration Summary Forms 993

c. Sample Data 1021

d. Standards Data 1069

e. Raw QC Data 1139

f. Extraction/Distillation/Digestion Logs 1164

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a. Case Narrative-Conformance/Nonconform. Summary 1167

b. Quality Control and Calibration Summary Forms 1170

c. Sample Data 1276

d. Standards Data 1290

e. Raw QC Data 1426

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Sample Reference List for SDG Number PUK62
with a Data Package Type of I
04694 - U.S. Army IPH
Project: Camp Moscrip

Lab Sample Number	Lab Sample Code	Client Sample Description
6199064	20001	18520001 Camp Moscrip, PR #1852 Hammond Water Field# MW-1 # 11-P-0087
6199065	20004	18520004 Camp Moscrip, PR #1852 Hammond Water Field# MW-1D # 11-P-0087
6199066	20005	18520005 Camp Moscrip, PR #1852 Hammond Water Field# MW-3 # 11-P-0087
6199067	20006	18520006 Camp Moscrip, PR #1852 Hammond Water Field# EQ Blk Water # 11-P-0087
6199068	20007	18520007 Camp Moscrip, PR #1852 Hammond Water Field# EQ Blk Soil # 11-P-0087
6199069	20010	18520010 Camp Moscrip, PR #1852 Hammond Water Field# Trip Blank # 11-P-0087

PUK62 0004

Lancaster Laboratories

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

February 16, 2011

Project: Camp Moscrip

Submittal Date: 02/03/2011
Group Number: 1231845
SDG: PUK62
PO Number: W91ZLK-11-P-0087
Release Number: W23MWP0321S003
State of Sample Origin: NA

Client Sample Description	Lancaster Labs (LLI) #
18520001 Camp Moscrip, PR #1852 Hammond Water	6199064
18520004 Camp Moscrip, PR #1852 Hammond Water	6199065
18520005 Camp Moscrip, PR #1852 Hammond Water	6199066
18520006 Camp Moscrip, PR #1852 Hammond Water	6199067
18520007 Camp Moscrip, PR #1852 Hammond Water	6199068
18520010 Camp Moscrip, PR #1852 Hammond Water	6199069

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO U.S. Army IPH Attn: Heidi Taylor
1 COPY TO Data Package Group

PUK62 8813

Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

2216 Rev. 3/27/06

Lancaster Laboratories

Questions? Contact your Client Services Representative
Katherine A Klinefelter at (717) 656-2300 Ext. 1566

Respectfully Submitted,

Sarah M. Snyder
Senior Specialist

PUR62 6814

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2216 Rev. 3/27/06

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value – The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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Analysis Report

Lancaster Laboratories

Sample Description: 18520001 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199064
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20001 SDG#: PUK62-01BKG

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l		ug/l	ug/l	
02898	Acetone	67-64-1	N.D.		5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.		20	7.0	1
02898	Acrolein	107-02-8	N.D.		25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.		5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.		0.5	0.1	1
02898	Benzene	71-43-2	N.D.		0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.		0.5	0.1	1
02898	Bromoform	75-25-2	N.D.		0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.		0.5	0.1	1
02898	2-Butanone	78-93-3	N.D.		5.0	1.0	1
02898	Carbon Disulfide	75-15-0	4.6		0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.		0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.		0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.		0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.		0.5	0.1	1
02898	Chloroform	67-66-3	N.D.		0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.		0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.		0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.		0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.		0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.		0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.		5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.		0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.		0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.		0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.		0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.		0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.		0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.		0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.		0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.		0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.		0.5	0.1	1
02898	Ethylbenzene	100-41-4	0.3	J	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.		5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.		25	10	1
02898	Methacrylonitrile	126-98-7	N.D.		5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.		0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.		0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.		5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.		0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.		0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.		10	2.0	1
02898	Styrene	100-42-5	N.D.		0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.		0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.		0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.		0.5	0.1	1
02898	Toluene	108-88-3	0.3	J	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.		0.5	0.1	1

PUK62 0016

*=This limit was used in the evaluation of the final result

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2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520001 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199064
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20001 SDG#: PUK62-01BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B 25mL purge**		ug/l	ug/l	ug/l	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
01309	Acenaphthene	83-32-9	N.D.	5	1	1
01309	Acenaphthylene	208-96-8	N.D.	5	1	1
01309	Acetophenone	98-86-2	N.D.	5	2	1
01309	2-Acetylaminofluorene	53-96-3	N.D.	5	2	1
01309	4-Aminobiphenyl	92-67-1	N.D.	5	2	1
01309	Aniline	62-53-3	N.D.	5	1	1
01309	Anthracene	120-12-7	N.D.	5	1	1
01309	Aramite	140-57-8	N.D.	15	5	1
01309	Benzo(a)anthracene	56-55-3	N.D.	5	1	1
01309	Benzo(a)pyrene	50-32-8	N.D.	5	1	1
01309	Benzo(b)fluoranthene	205-99-2	N.D.	5	1	1
01309	Benzo(g,h,i)perylene	191-24-2	N.D.	5	1	1
01309	Benzo(k)fluoranthene	207-08-9	N.D.	5	1	1
01309	Benzyl alcohol	100-51-6	N.D.	15	5	1
01309	4-Bromophenyl-phenylether	101-55-3	N.D.	5	1	1
01309	Butylbenzylphthalate	85-68-7	N.D.	5	2	1
01309	Di-n-butylphthalate	84-74-2	N.D.	5	2	1
01309	4-Chloro-3-methylphenol	59-50-7	N.D.	5	1	1
01309	4-Chloroaniline	106-47-8	N.D.	5	1	1
01309	Chlorobenzilate	510-15-6	N.D.	10	3	1
01309	bis(2-Chloroethoxy)methane	111-91-1	N.D.	5	1	1
01309	bis(2-Chloroethyl)ether	111-44-4	N.D.	5	1	1
01309	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	5	1	1
01309	2-Chloronaphthalene	91-58-7	N.D.	5	2	1
01309	2-Chlorophenol	95-57-8	N.D.	5	1	1
01309	4-Chlorophenyl-phenylether	7005-72-3	N.D.	5	2	1
01309	Chrysene	218-01-9	N.D.	5	1	1
01309	Diallate trans/cis	2303-16-4	N.D.	5	1	1
01309	Dibenz(a,h)anthracene	53-70-3	N.D.	5	1	1
01309	Dibenzofuran	132-64-9	N.D.	5	1	1
01309	1,2-Dichlorobenzene	95-50-1	N.D.	5	1	1
01309	1,3-Dichlorobenzene	541-73-1	N.D.	5	1	1
01309	1,4-Dichlorobenzene	106-46-7	N.D.	5	1	1
01309	3,3'-Dichlorobenzidine	91-94-1	N.D.	5	2	1
01309	2,4-Dichlorophenol	120-83-2	N.D.	5	1	1
01309	2,6-Dichlorophenol	87-65-0	N.D.	5	2	1
01309	Diethylphthalate	84-66-2	N.D.	5	2	1
01309	Dimethoate	60-51-5	N.D.	10	3	1
01309	p-Dimethylaminoazobenzene	60-11-7	N.D.	5	2	1

PUK62 2817

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520001 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199064
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20001 SDG#: PUK62-01BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
01309	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	5	2	1
01309	3,3'-Dimethylbenzidine	119-93-7	N.D.	76	25	1
01309	a,a-Dimethylphenethylamine	122-09-8	N.D.	50	5	1
01309	2,4-Dimethylphenol	105-67-9	N.D.	10	3	1
01309	Dimethylphthalate	131-11-3	N.D.	5	2	1
01309	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	15	5	1
01309	1,3-Dinitrobenzene	99-65-0	N.D.	5	2	1
01309	2,4-Dinitrophenol	51-28-5	N.D.	30	10	1
01309	2,4-Dinitrotoluene	121-14-2	N.D.	5	1	1
01309	2,6-Dinitrotoluene	606-20-2	N.D.	5	1	1
01309	1,4-Dioxane	123-91-1	N.D.	5	1	1
01309	Ethyl methanesulfonate	62-50-0	N.D.	5	2	1
01309	bis(2-Ethylhexyl)phthalate	117-81-7	3 J	5	2	1
01309	Fluoranthene	206-44-0	N.D.	5	1	1
01309	Fluorene	86-73-7	N.D.	5	1	1
01309	Hexachlorobenzene	118-74-1	N.D.	5	1	1
01309	Hexachlorobutadiene	87-68-3	N.D.	5	1	1
01309	Hexachlorocyclopentadiene	77-47-4	N.D.	15	5	1
01309	Hexachloroethane	67-72-1	N.D.	5	1	1
01309	Hexachloropropene	1888-71-7	N.D.	5	2	1
01309	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	5	1	1
01309	Isodrin	465-73-6	N.D.	5	1	1
01309	Isophorone	78-59-1	N.D.	5	1	1
01309	Isosafrole	120-58-1	N.D.	5	2	1
01309	Methapyrilene	91-80-5	N.D.	50	15	1
01309	Methyl methanesulfonate	66-27-3	N.D.	5	1	1
01309	3-Methylcholanthrene	56-49-5	N.D.	5	2	1
01309	2-Methylnaphthalene	91-57-6	N.D.	5	1	1
01309	2-Methylphenol	95-48-7	N.D.	5	1	1
01309	4-Methylphenol	106-44-5	N.D.	5	2	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
01309	Naphthalene	91-20-3	N.D.	5	3	1
01309	1,4-Naphthoquinone	130-15-4	N.D.	30	10	1
01309	1-Naphthylamine	134-32-7	N.D.	15	5	1
01309	2-Naphthylamine	91-59-8	N.D.	15	5	1
01309	2-Nitroaniline	88-74-4	N.D.	5	1	1
01309	3-Nitroaniline	99-09-2	N.D.	5	1	1
01309	4-Nitroaniline	100-01-6	N.D.	5	1	1
01309	Nitrobenzene	98-95-3	N.D.	5	1	1
01309	5-Nitro-o-toluidine	99-55-8	N.D.	5	3	1
01309	2-Nitrophenol	88-75-5	N.D.	5	1	1
01309	4-Nitrophenol	100-02-7	N.D.	30	10	1
01309	4-Nitroquinoline-1-oxide	56-57-5	N.D.	61	20	1
01309	N-Nitrosodiethylamine	55-18-5	N.D.	5	2	1
01309	N-Nitrosodimethylamine	62-75-9	N.D.	5	2	1
01309	N-Nitrosodi-n-butylamine	924-16-3	N.D.	5	2	1
01309	N-Nitroso-di-n-propylamine	621-64-7	N.D.	5	1	1
01309	N-Nitrosodiphenylamine	86-30-6	N.D.	5	2	1

PUK62 0018

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520001 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199064
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20001 SDG#: PUK62-01BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Semivolatiles SW-846 8270C		ug/l	ug/l	ug/l	
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					
01309	N-Nitrosomethylethylamine	10595-95-6	N.D.	5	2	1
01309	N-Nitrosomorpholine	59-89-2	N.D.	5	2	1
01309	N-Nitrosopiperidine	100-75-4	N.D.	5	2	1
01309	N-Nitrosopyrrolidine	930-55-2	N.D.	5	2	1
01309	Di-n-octylphthalate	117-84-0	N.D.	5	2	1
01309	Pentachlorobenzene	608-93-5	N.D.	5	2	1
01309	Pentachloronitrobenzene	82-68-8	N.D.	5	2	1
01309	Pentachlorophenol	87-86-5	N.D.	15	3	1
01309	Phenacetin	62-44-2	N.D.	5	2	1
01309	Phenanthrene	85-01-8	N.D.	5	1	1
01309	Phenol	108-95-2	N.D.	5	1	1
01309	1,4-Phenylenediamine	106-50-3	N.D.	250	76	1
01309	2-Picoline	109-06-8	N.D.	5	2	1
01309	Pronamide	23950-58-5	N.D.	5	1	1
01309	Pyrene	129-00-0	N.D.	5	1	1
01309	Pyridine	110-86-1	N.D.	5	2	1
01309	Safrole	94-59-7	N.D.	5	2	1
01309	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	5	2	1
01309	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	5	2	1
01309	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	5	1	1
01309	Thionazin	297-97-2	N.D.	5	2	1
01309	o-Toluidine	95-53-4	N.D.	5	1	1
01309	1,2,4-Trichlorobenzene	120-82-1	N.D.	5	1	1
01309	2,4,5-Trichlorophenol	95-95-4	N.D.	5	1	1
01309	2,4,6-Trichlorophenol	88-06-2	N.D.	5	1	1
01309	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	5	2	1
01309	1,3,5-Trinitrobenzene	99-35-4	N.D.	15	5	1

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

GC/MS	Semivolatiles SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Acenaphthene	83-32-9	N.D.	0.050	0.010	1
08357	Acenaphthylene	208-96-8	N.D.	0.050	0.010	1
08357	Anthracene	120-12-7	N.D.	0.050	0.010	1
08357	Benzo(a)anthracene	56-55-3	N.D.	0.050	0.010	1
08357	Benzo(a)pyrene	50-32-8	N.D.	0.050	0.010	1
08357	Benzo(b)fluoranthene	205-99-2	N.D.	0.050	0.010	1
08357	Benzo(g,h,i)perylene	191-24-2	N.D.	0.050	0.010	1
08357	Benzo(k)fluoranthene	207-08-9	N.D.	0.050	0.010	1
08357	Chrysene	218-01-9	N.D.	0.050	0.010	1
08357	Dibenz(a,h)anthracene	53-70-3	N.D.	0.050	0.010	1
08357	Fluoranthene	206-44-0	N.D.	0.050	0.010	1

PUK62 2019

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520001 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199064
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20001 SDG#: PUK62-01BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Fluorene	86-73-7	N.D.	0.050	0.010	1
08357	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	0.050	0.010	1
08357	1-Methylnaphthalene	90-12-0	N.D.	0.050	0.010	1
08357	2-Methylnaphthalene	91-57-6	N.D.	0.050	0.010	1
08357	Naphthalene	91-20-3	0.016 J	0.050	0.010	1
08357	Phenanthrene	85-01-8	N.D.	0.050	0.010	1
08357	Pyrene	129-00-0	N.D.	0.050	0.010	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 12:33	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 12:33	Jason M Long	1
01309	SVOC Camp Moscrip List - water	SW-846 8270C	1	I1036WAB026	02/11/2011 15:56	Matthew S Woods	1
08357	SIM PAHs - water	SW-846 8270C SIM	1	I1036WAC026	02/07/2011 23:25	Gregory J Drahovsky	1
10464	BNA Water Extraction (App IX)	SW-846 3510C	1	I1036WAB026	02/07/2011 03:30	Sherry L Morrow	1
10470	BNA Water Extraction (SIM)	SW-846 3510C	1	I1036WAC026	02/07/2011 03:30	Sherry L Morrow	1

PUK62 0020

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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Analysis Report

Lancaster Laboratories

Sample Description: 18520004 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1D # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199065
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20004 SDG#: PUK62-02FD

CAT No.	Analysis Name	CAS Number	As Received Result		As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l		ug/l	ug/l	
02898	Acetone	67-64-1	4.0	J	5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.		20	7.0	1
02898	Acrolein	107-02-8	N.D.		25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.		5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.		0.5	0.1	1
02898	Benzene	71-43-2	N.D.		0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.		0.5	0.1	1
02898	Bromoform	75-25-2	N.D.		0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.		0.5	0.1	1
02898	2-Butanone	78-93-3	N.D.		5.0	1.0	1
02898	Carbon Disulfide	75-15-0	5.2		0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.		0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.		0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.		0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.		0.5	0.1	1
02898	Chloroform	67-66-3	N.D.		0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.		0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.		0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.		0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.		0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.		0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.		5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.		0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.		0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.		0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.		0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.		0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.		0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.		0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.		0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.		0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.		0.5	0.1	1
02898	Ethylbenzene	100-41-4	0.3	J	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.		5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.		25	10	1
02898	Methacrylonitrile	126-98-7	N.D.		5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.		0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.		0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.		5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.		0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.		0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.		10	2.0	1
02898	Styrene	100-42-5	N.D.		0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.		0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.		0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.		0.5	0.1	1
02898	Toluene	108-88-3	0.3	J	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.		0.5	0.1	1

PUK62 0821

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Lancaster Laboratories

Sample Description: 18520004 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1D # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199065
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20004 SDG#: PUK62-02FD

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B 25mL purge**		**ug/l**	**ug/l**	**ug/l**	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
01309	Acenaphthene	83-32-9	N.D.	5	1	1
01309	Acenaphthylene	208-96-8	N.D.	5	1	1
01309	Acetophenone	98-86-2	N.D.	5	2	1
01309	2-Acetylaminofluorene	53-96-3	N.D.	5	2	1
01309	4-Aminobiphenyl	92-67-1	N.D.	5	2	1
01309	Aniline	62-53-3	N.D.	5	1	1
01309	Anthracene	120-12-7	N.D.	5	1	1
01309	Aramite	140-57-8	N.D.	15	5	1
01309	Benzo(a)anthracene	56-55-3	N.D.	5	1	1
01309	Benzo(a)pyrene	50-32-8	N.D.	5	1	1
01309	Benzo(b)fluoranthene	205-99-2	N.D.	5	1	1
01309	Benzo(g,h,i)perylene	191-24-2	N.D.	5	1	1
01309	Benzo(k)fluoranthene	207-08-9	N.D.	5	1	1
01309	Benzyl alcohol	100-51-6	N.D.	15	5	1
01309	4-Bromophenyl-phenylether	101-55-3	N.D.	5	1	1
01309	Butylbenzylphthalate	85-68-7	N.D.	5	2	1
01309	Di-n-butylphthalate	84-74-2	N.D.	5	2	1
01309	4-Chloro-3-methylphenol	59-50-7	N.D.	5	1	1
01309	4-Chloroaniline	106-47-8	N.D.	5	1	1
01309	Chlorobenzilate	510-15-6	N.D.	10	3	1
01309	bis(2-Chloroethoxy)methane	111-91-1	N.D.	5	1	1
01309	bis(2-Chloroethyl)ether	111-44-4	N.D.	5	1	1
01309	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	5	1	1
01309	2-Chloronaphthalene	91-58-7	N.D.	5	2	1
01309	2-Chlorophenol	95-57-8	N.D.	5	1	1
01309	4-Chlorophenyl-phenylether	7005-72-3	N.D.	5	2	1
01309	Chrysene	218-01-9	N.D.	5	1	1
01309	Diallate trans/cis	2303-16-4	N.D.	5	1	1
01309	Dibenz(a,h)anthracene	53-70-3	N.D.	5	1	1
01309	Dibenzofuran	132-64-9	N.D.	5	1	1
01309	1,2-Dichlorobenzene	95-50-1	N.D.	5	1	1
01309	1,3-Dichlorobenzene	541-73-1	N.D.	5	1	1
01309	1,4-Dichlorobenzene	106-46-7	N.D.	5	1	1
01309	3,3'-Dichlorobenzidine	91-94-1	N.D.	5	2	1
01309	2,4-Dichlorophenol	120-83-2	N.D.	5	1	1
01309	2,6-Dichlorophenol	87-65-0	N.D.	5	2	1
01309	Diethylphthalate	84-66-2	N.D.	5	2	1
01309	Dimethoate	60-51-5	N.D.	10	3	1
01309	p-Dimethylaminoazobenzene	60-11-7	N.D.	5	2	1

PUK62 0822

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520004 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1D # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199065
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20004 SDG#: PUK62-02FD

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles SW-846 8270C			ug/l	ug/l	ug/l	
01309	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	5	2	1
01309	3,3'-Dimethylbenzidine	119-93-7	N.D.	73	24	1
01309	a,a-Dimethylphenethylamine	122-09-8	N.D.	49	5	1
01309	2,4-Dimethylphenol	105-67-9	N.D.	10	3	1
01309	Dimethylphthalate	131-11-3	N.D.	5	2	1
01309	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	15	5	1
01309	1,3-Dinitrobenzene	99-65-0	N.D.	5	2	1
01309	2,4-Dinitrophenol	51-28-5	N.D.	29	10	1
01309	2,4-Dinitrotoluene	121-14-2	N.D.	5	1	1
01309	2,6-Dinitrotoluene	606-20-2	N.D.	5	1	1
01309	1,4-Dioxane	123-91-1	N.D.	5	1	1
01309	Ethyl methanesulfonate	62-50-0	N.D.	5	2	1
01309	bis(2-Ethylhexyl)phthalate	117-81-7	5 J	5	2	1
01309	Fluoranthene	206-44-0	N.D.	5	1	1
01309	Fluorene	86-73-7	N.D.	5	1	1
01309	Hexachlorobenzene	118-74-1	N.D.	5	1	1
01309	Hexachlorobutadiene	87-68-3	N.D.	5	1	1
01309	Hexachlorocyclopentadiene	77-47-4	N.D.	15	5	1
01309	Hexachloroethane	67-72-1	N.D.	5	1	1
01309	Hexachloropropene	1888-71-7	N.D.	5	2	1
01309	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	5	1	1
01309	Isodrin	465-73-6	N.D.	5	1	1
01309	Isophorone	78-59-1	N.D.	5	1	1
01309	Isosafrole	120-58-1	N.D.	5	2	1
01309	Methapyrilene	91-80-5	N.D.	49	15	1
01309	Methyl methanesulfonate	66-27-3	N.D.	5	1	1
01309	3-Methylcholanthrene	56-49-5	N.D.	5	2	1
01309	2-Methylnaphthalene	91-57-6	N.D.	5	1	1
01309	2-Methylphenol	95-48-7	N.D.	5	1	1
01309	4-Methylphenol	106-44-5	N.D.	5	2	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
01309	Naphthalene	91-20-3	N.D.	5	1	1
01309	1,4-Naphthoquinone	130-15-4	N.D.	29	10	1
01309	1-Naphthylamine	134-32-7	N.D.	15	5	1
01309	2-Naphthylamine	91-59-8	N.D.	15	5	1
01309	2-Nitroaniline	88-74-4	N.D.	5	1	1
01309	3-Nitroaniline	99-09-2	N.D.	5	1	1
01309	4-Nitroaniline	100-01-6	N.D.	5	1	1
01309	Nitrobenzene	98-95-3	N.D.	5	1	1
01309	5-Nitro-o-toluidine	99-55-8	N.D.	5	3	1
01309	2-Nitrophenol	88-75-5	N.D.	5	1	1
01309	4-Nitrophenol	100-02-7	N.D.	29	10	1
01309	4-Nitroquinoline-1-oxide	56-57-5	N.D.	58	19	1
01309	N-Nitrosodiethylamine	55-18-5	N.D.	5	2	1
01309	N-Nitrosodimethylamine	62-75-9	N.D.	5	2	1
01309	N-Nitrosodi-n-butylamine	924-16-3	N.D.	5	2	1
01309	N-Nitroso-di-n-propylamine	621-64-7	N.D.	5	1	1
01309	N-Nitrosodiphenylamine	86-30-6	N.D.	5	2	1

PUK62 8823

*=This limit was used in the evaluation of the final result

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Lancaster Laboratories

Sample Description: 18520004 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1D # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199065
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20004 SDG#: PUK62-02FD

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					
01309	N-Nitrosomethylethylamine	10595-95-6	N.D.	5	2	1
01309	N-Nitrosomorpholine	59-89-2	N.D.	5	2	1
01309	N-Nitrosopiperidine	100-75-4	N.D.	5	2	1
01309	N-Nitrosopyrrolidine	930-55-2	N.D.	5	2	1
01309	Di-n-octylphthalate	117-84-0	N.D.	5	2	1
01309	Pentachlorobenzene	608-93-5	N.D.	5	2	1
01309	Pentachloronitrobenzene	82-68-8	N.D.	5	2	1
01309	Pentachlorophenol	87-86-5	N.D.	15	3	1
01309	Phenacetin	62-44-2	N.D.	5	2	1
01309	Phenanthrene	85-01-8	N.D.	5	1	1
01309	Phenol	108-95-2	N.D.	5	1	1
01309	1,4-Phenylenediamine	106-50-3	N.D.	240	73	1
01309	2-Picoline	109-06-8	N.D.	5	2	1
01309	Pronamide	23950-58-5	N.D.	5	1	1
01309	Pyrene	129-00-0	N.D.	5	1	1
01309	Pyridine	110-86-1	N.D.	5	2	1
01309	Safrole	94-59-7	N.D.	5	2	1
01309	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	5	2	1
01309	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	5	2	1
01309	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	5	1	1
01309	Thionazin	297-97-2	N.D.	5	2	1
01309	o-Toluidine	95-53-4	N.D.	5	1	1
01309	1,2,4-Trichlorobenzene	120-82-1	N.D.	5	1	1
01309	2,4,5-Trichlorophenol	95-95-4	N.D.	5	1	1
01309	2,4,6-Trichlorophenol	88-06-2	N.D.	5	1	1
01309	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	5	2	1
01309	1,3,5-Trinitrobenzene	99-35-4	N.D.	15	5	1

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Acenaphthene	83-32-9	N.D.	0.051	0.010	1
08357	Acenaphthylene	208-96-8	N.D.	0.051	0.010	1
08357	Anthracene	120-12-7	N.D.	0.051	0.010	1
08357	Benzo(a)anthracene	56-55-3	N.D.	0.051	0.010	1
08357	Benzo(a)pyrene	50-32-8	N.D.	0.051	0.010	1
08357	Benzo(b)fluoranthene	205-99-2	N.D.	0.051	0.010	1
08357	Benzo(g,h,i)perylene	191-24-2	N.D.	0.051	0.010	1
08357	Benzo(k)fluoranthene	207-08-9	N.D.	0.051	0.010	1
08357	Chrysene	218-01-9	N.D.	0.051	0.010	1
08357	Dibenz(a,h)anthracene	53-70-3	N.D.	0.051	0.010	1
08357	Fluoranthene	206-44-0	N.D.	0.051	0.010	1

PUK62 0024

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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Lancaster Laboratories

Sample Description: 18520004 Camp Moscrip, PR #1852 Hammond Water
Field# MW-1D # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199065
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 14:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20004 SDG#: PUK62-02FD

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Fluorene	86-73-7	N.D.	0.051	0.010	1
08357	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	0.051	0.010	1
08357	1-Methylnaphthalene	90-12-0	N.D.	0.051	0.010	1
08357	2-Methylnaphthalene	91-57-6	N.D.	0.051	0.010	1
08357	Naphthalene	91-20-3	0.014 J	0.051	0.010	1
08357	Phenanthrene	85-01-8	N.D.	0.051	0.010	1
08357	Pyrene	129-00-0	N.D.	0.051	0.010	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 14:18	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 14:18	Jason M Long	1
01309	SVOC Camp Moscrip List - water	SW-846 8270C	1	11036WAB026	02/11/2011 17:59	Matthew S Woods	1
08357	SIM PAHs - water	SW-846 8270C SIM	1	11036WAC026	02/08/2011 23:10	Gregory J Drahovsky	1
10464	BNA Water Extraction (App IX)	SW-846 3510C	1	11036WAB026	02/07/2011 03:30	Sherry L Morrow	1
10470	BNA Water Extraction (SIM)	SW-846 3510C	1	11036WAC026	02/07/2011 03:30	Sherry L Morrow	1

PUK62 0825

*=This limit was used in the evaluation of the final result

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Analysis Report

Lancaster Laboratories

Sample Description: 18520005 Camp Moscrip, PR #1852 Hammond Water
Field# MW-3 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199066
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 16:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20005 SDG#: PUK62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	Acetone	67-64-1	N.D.	5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.	20	7.0	1
02898	Acrolein	107-02-8	N.D.	25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.	5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.	0.5	0.1	1
02898	Benzene	71-43-2	N.D.	0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.	0.5	0.1	1
02898	Bromoform	75-25-2	N.D.	0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.	0.5	0.1	1
02898	2-Butanone	78-93-3	N.D.	5.0	1.0	1
02898	Carbon Disulfide	75-15-0	3.8	0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.	0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.	0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.	0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.	0.5	0.1	1
02898	Chloroform	67-66-3	N.D.	0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.	0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.	0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.	0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.	0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.	0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.	5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.	0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.	0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.	0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.	0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.	0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.	0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.	0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.	0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.	0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.	0.5	0.1	1
02898	Ethylbenzene	100-41-4	N.D.	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.	5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.	25	10	1
02898	Methacrylonitrile	126-98-7	N.D.	5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.	0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.	0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.	5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.	0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.	0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.	10	2.0	1
02898	Styrene	100-42-5	N.D.	0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.	0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.	0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.	0.5	0.1	1
02898	Toluene	108-88-3	N.D.	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.	0.5	0.1	1

PUK62 9826

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Lancaster Laboratories

Sample Description: 18520005 Camp Moscrip, PR #1852 Hammond Water
Field# MW-3 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199066
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 16:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20005 SDG#: PUK62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
01309	Acenaphthene	83-32-9	N.D.	5	1	1
01309	Acenaphthylene	208-96-8	N.D.	5	1	1
01309	Acetophenone	98-86-2	N.D.	5	2	1
01309	2-Acetylaminofluorene	53-96-3	N.D.	5	2	1
01309	4-Aminobiphenyl	92-67-1	N.D.	5	2	1
01309	Aniline	62-53-3	N.D.	5	1	1
01309	Anthracene	120-12-7	N.D.	5	1	1
01309	Aramite	140-57-8	N.D.	15	5	1
01309	Benzo(a)anthracene	56-55-3	N.D.	5	1	1
01309	Benzo(a)pyrene	50-32-8	N.D.	5	1	1
01309	Benzo(b)fluoranthene	205-99-2	N.D.	5	1	1
01309	Benzo(g,h,i)perylene	191-24-2	N.D.	5	1	1
01309	Benzo(k)fluoranthene	207-08-9	N.D.	5	1	1
01309	Benzyl alcohol	100-51-6	N.D.	15	5	1
01309	4-Bromophenyl-phenylether	101-55-3	N.D.	5	1	1
01309	Butylbenzylphthalate	85-68-7	N.D.	5	2	1
01309	Di-n-butylphthalate	84-74-2	N.D.	5	2	1
01309	4-Chloro-3-methylphenol	59-50-7	N.D.	5	1	1
01309	4-Chloroaniline	106-47-8	N.D.	5	1	1
01309	Chlorobenzilate	510-15-6	N.D.	10	3	1
01309	bis(2-Chloroethoxy)methane	111-91-1	N.D.	5	1	1
01309	bis(2-Chloroethyl)ether	111-44-4	N.D.	5	1	1
01309	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	5	1	1
01309	2-Chloronaphthalene	91-58-7	N.D.	5	2	1
01309	2-Chlorophenol	95-57-8	N.D.	5	1	1
01309	4-Chlorophenyl-phenylether	7005-72-3	N.D.	5	2	1
01309	Chrysene	218-01-9	N.D.	5	1	1
01309	Diallate trans/cis	2303-16-4	N.D.	5	1	1
01309	Dibenz(a,h)anthracene	53-70-3	N.D.	5	1	1
01309	Dibenzofuran	132-64-9	N.D.	5	1	1
01309	1,2-Dichlorobenzene	95-50-1	N.D.	5	1	1
01309	1,3-Dichlorobenzene	541-73-1	N.D.	5	1	1
01309	1,4-Dichlorobenzene	106-46-7	N.D.	5	1	1
01309	3,3'-Dichlorobenzidine	91-94-1	N.D.	5	2	1
01309	2,4-Dichlorophenol	120-83-2	N.D.	5	1	1
01309	2,6-Dichlorophenol	87-65-0	N.D.	5	2	1
01309	Diethylphthalate	84-66-2	N.D.	5	2	1
01309	Dimethoate	60-51-5	N.D.	10	3	1
01309	p-Dimethylaminoazobenzene	60-11-7	N.D.	5	2	1

PUK62 8827

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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Lancaster Laboratories

Sample Description: 18520005 Camp Moscrip, PR #1852 Hammond Water
Field# MW-3 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199066
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 16:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20005 SDG#: PUK62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Semivolatiles SW-846 8270C		ug/l	ug/l	ug/l	
01309	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	5	2	1
01309	3,3'-Dimethylbenzidine	119-93-7	N.D.	73	24	1
01309	a,a-Dimethylphenethylamine	122-09-8	N.D.	49	5	1
01309	2,4-Dimethylphenol	105-67-9	N.D.	10	3	1
01309	Dimethylphthalate	131-11-3	N.D.	5	2	1
01309	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	15	5	1
01309	1,3-Dinitrobenzene	99-65-0	N.D.	5	2	1
01309	2,4-Dinitrophenol	51-28-5	N.D.	29	10	1
01309	2,4-Dinitrotoluene	121-14-2	N.D.	5	1	1
01309	2,6-Dinitrotoluene	606-20-2	N.D.	5	1	1
01309	1,4-Dioxane	123-91-1	N.D.	5	1	1
01309	Ethyl methanesulfonate	62-50-0	N.D.	5	2	1
01309	bis(2-Ethylhexyl)phthalate	117-81-7	28	5	2	1
01309	Fluoranthene	206-44-0	N.D.	5	1	1
01309	Fluorene	86-73-7	N.D.	5	1	1
01309	Hexachlorobenzene	118-74-1	N.D.	5	1	1
01309	Hexachlorobutadiene	87-68-3	N.D.	5	1	1
01309	Hexachlorocyclopentadiene	77-47-4	N.D.	15	5	1
01309	Hexachloroethane	67-72-1	N.D.	5	1	1
01309	Hexachloropropene	1888-71-7	N.D.	5	2	1
01309	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	5	1	1
01309	Isodrin	465-73-6	N.D.	5	1	1
01309	Isophorone	78-59-1	N.D.	5	1	1
01309	Isosafrole	120-58-1	N.D.	5	2	1
01309	Methapyrilene	91-80-5	N.D.	49	15	1
01309	Methyl methanesulfonate	66-27-3	N.D.	5	1	1
01309	3-Methylcholanthrene	56-49-5	N.D.	5	2	1
01309	2-Methylnaphthalene	91-57-6	N.D.	5	1	1
01309	2-Methylphenol	95-48-7	N.D.	5	1	1
01309	4-Methylphenol	106-44-5	N.D.	5	2	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
01309	Naphthalene	91-20-3	N.D.	5	1	1
01309	1,4-Naphthoquinone	130-15-4	N.D.	29	10	1
01309	1-Naphthylamine	134-32-7	N.D.	15	5	1
01309	2-Naphthylamine	91-59-8	N.D.	15	5	1
01309	2-Nitroaniline	88-74-4	N.D.	5	1	1
01309	3-Nitroaniline	99-09-2	N.D.	5	1	1
01309	4-Nitroaniline	100-01-6	N.D.	5	1	1
01309	Nitrobenzene	98-95-3	N.D.	5	1	1
01309	5-Nitro-o-toluidine	99-55-8	N.D.	5	3	1
01309	2-Nitrophenol	88-75-5	N.D.	5	1	1
01309	4-Nitrophenol	100-02-7	N.D.	29	10	1
01309	4-Nitroquinoline-1-oxide	56-57-5	N.D.	59	20	1
01309	N-Nitrosodiethylamine	55-18-5	N.D.	5	2	1
01309	N-Nitrosodimethylamine	62-75-9	N.D.	5	2	1
01309	N-Nitrosodi-n-butylamine	924-16-3	N.D.	5	2	1
01309	N-Nitroso-di-n-propylamine	621-64-7	N.D.	5	1	1
01309	N-Nitrosodiphenylamine	86-30-6	N.D.	5	2	1

PUK62. 0029

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520005 Camp Moscrip, PR #1852 Hammond Water
Field# MW-3 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199066
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 16:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20005 SDG#: PUK62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					
01309	N-Nitrosomethylethylamine	10595-95-6	N.D.	5	2	1
01309	N-Nitrosomorpholine	59-89-2	N.D.	5	2	1
01309	N-Nitrosopiperidine	100-75-4	N.D.	5	2	1
01309	N-Nitrosopyrrolidine	930-55-2	N.D.	5	2	1
01309	Di-n-octylphthalate	117-84-0	N.D.	5	2	1
01309	Pentachlorobenzene	608-93-5	N.D.	5	2	1
01309	Pentachloronitrobenzene	82-68-8	N.D.	5	2	1
01309	Pentachlorophenol	87-86-5	N.D.	15	3	1
01309	Phenacetin	62-44-2	N.D.	5	2	1
01309	Phenanthrene	85-01-8	N.D.	5	1	1
01309	Phenol	108-95-2	N.D.	5	1	1
01309	1,4-Phenylenediamine	106-50-3	N.D.	240	73	1
01309	2-Picoline	109-06-8	N.D.	5	2	1
01309	Pronamide	23950-58-5	N.D.	5	1	1
01309	Pyrene	129-00-0	N.D.	5	1	1
01309	Pyridine	110-86-1	N.D.	5	2	1
01309	Safrole	94-59-7	N.D.	5	2	1
01309	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	5	2	1
01309	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	5	2	1
01309	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	5	1	1
01309	Thionazin	297-97-2	N.D.	5	2	1
01309	o-Toluidine	95-53-4	N.D.	5	1	1
01309	1,2,4-Trichlorobenzene	120-82-1	N.D.	5	1	1
01309	2,4,5-Trichlorophenol	95-95-4	N.D.	5	1	1
01309	2,4,6-Trichlorophenol	88-06-2	N.D.	5	1	1
01309	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	5	2	1
01309	1,3,5-Trinitrobenzene	99-35-4	N.D.	15	5	1

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

Surrogate recoveries are outside of QC limits for the initial GC/MS semivolatile analysis. The analysis was repeated outside of the required hold time and surrogate recoveries are again outside of QC limits, indicating a matrix effect. The data reported is from the initial extraction of the sample.

GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Acenaphthene	83-32-9	N.D.	0.049	0.0097	1
08357	Acenaphthylene	208-96-8	N.D.	0.049	0.0097	1
08357	Anthracene	120-12-7	N.D.	0.049	0.0097	1
08357	Benzo(a)anthracene	56-55-3	N.D.	0.049	0.0097	1
08357	Benzo(a)pyrene	50-32-8	N.D.	0.049	0.0097	1

PUK62 0829

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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Analysis Report

Lancaster Laboratories

Sample Description: 18520005 Camp Moscrip, PR #1852 Hammond Water
Field# MW-3 # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199066
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 16:15

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20005 SDG#: PUK62-03

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Benzo(b)fluoranthene	205-99-2	N.D.	0.049	0.0097	1
08357	Benzo(g,h,i)perylene	191-24-2	N.D.	0.049	0.0097	1
08357	Benzo(k)fluoranthene	207-08-9	N.D.	0.049	0.0097	1
08357	Chrysene	218-01-9	N.D.	0.049	0.0097	1
08357	Dibenz(a,h)anthracene	53-70-3	N.D.	0.049	0.0097	1
08357	Fluoranthene	206-44-0	N.D.	0.049	0.0097	1
08357	Fluorene	86-73-7	N.D.	0.049	0.0097	1
08357	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	0.049	0.0097	1
08357	1-Methylnaphthalene	90-12-0	N.D.	0.049	0.0097	1
08357	2-Methylnaphthalene	91-57-6	N.D.	0.049	0.0097	1
08357	Naphthalene	91-20-3	0.020 J	0.049	0.0097	1
08357	Phenanthrene	85-01-8	0.011 J	0.049	0.0097	1
08357	Pyrene	129-00-0	0.010 J	0.049	0.0097	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 14:40	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 14:40	Jason M Long	1
01309	SVOC Camp Moscrip List - water	SW-846 8270C	1	11036WAB026	02/11/2011 18:23	Matthew S Woods	1
08357	SIM PAHs - water	SW-846 8270C SIM	1	11036WAC026	02/09/2011 08:45	Joseph M Gambler	1
10464	BNA Water Extraction (App IX)	SW-846 3510C	1	11036WAB026	02/07/2011 03:30	Sherry L Morrow	1
10470	BNA Water Extraction (SIM)	SW-846 3510C	1	11036WAC026	02/07/2011 03:30	Sherry L Morrow	1

PUK62 0000

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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Analysis Report

Lancaster Laboratories

Sample Description: 18520006 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Water # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199067
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 13:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20006 SDG#: PUK62-04EB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	Acetone	67-64-1	N.D.	5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.	20	7.0	1
02898	Acrolein	107-02-8	N.D.	25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.	5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.	0.5	0.1	1
02898	Benzene	71-43-2	N.D.	0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.	0.5	0.1	1
02898	Bromoform	75-25-2	N.D.	0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.	0.5	0.1	1
02898	2-Butanone	78-93-3	N.D.	5.0	1.0	1
02898	Carbon Disulfide	75-15-0	4.9	0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.	0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.	0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.	0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.	0.5	0.1	1
02898	Chloroform	67-66-3	N.D.	0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.	0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.	0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.	0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.	0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.	0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.	5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.	0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.	0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.	0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.	0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.	0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.	0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.	0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.	0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.	0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.	0.5	0.1	1
02898	Ethylbenzene	100-41-4	N.D.	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.	5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.	25	10	1
02898	Methacrylonitrile	126-98-7	N.D.	5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.	0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.	0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.	5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.	0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.	0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.	10	2.0	1
02898	Styrene	100-42-5	N.D.	0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.	0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.	0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.	0.5	0.1	1
02898	Toluene	108-88-3	N.D.	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.	0.5	0.1	1

PUK62 0831

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18520006 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Water # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199067
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 13:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20006 SDG#: PUK62-04EB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B 25mL purge**		**ug/l**	**ug/l**	**ug/l**	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1
GC/MS Semivolatiles	**SW-846 8270C**		**ug/l**	**ug/l**	**ug/l**	
01309	Acenaphthene	83-32-9	N.D.	5	1	1
01309	Acenaphthylene	208-96-8	N.D.	5	1	1
01309	Acetophenone	98-86-2	N.D.	5	2	1
01309	2-Acetylaminofluorene	53-96-3	N.D.	5	2	1
01309	4-Aminobiphenyl	92-67-1	N.D.	5	2	1
01309	Aniline	62-53-3	N.D.	5	1	1
01309	Anthracene	120-12-7	N.D.	5	1	1
01309	Aramite	140-57-8	N.D.	15	5	1
01309	Benzo(a)anthracene	56-55-3	N.D.	5	1	1
01309	Benzo(a)pyrene	50-32-8	N.D.	5	1	1
01309	Benzo(b)fluoranthene	205-99-2	N.D.	5	1	1
01309	Benzo(g,h,i)perylene	191-24-2	N.D.	5	1	1
01309	Benzo(k)fluoranthene	207-08-9	N.D.	5	1	1
01309	Benzyl alcohol	100-51-6	N.D.	15	5	1
01309	4-Bromophenyl-phenylether	101-55-3	N.D.	5	1	1
01309	Butylbenzylphthalate	85-68-7	N.D.	5	2	1
01309	Di-n-butylphthalate	84-74-2	N.D.	5	2	1
01309	4-Chloro-3-methylphenol	59-50-7	N.D.	5	1	1
01309	4-Chloroaniline	106-47-8	N.D.	5	1	1
01309	Chlorobenzilate	510-15-6	N.D.	10	3	1
01309	bis(2-Chloroethoxy)methane	111-91-1	N.D.	5	1	1
01309	bis(2-Chloroethyl)ether	111-44-4	N.D.	5	1	1
01309	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	5	1	1
01309	2-Chloronaphthalene	91-58-7	N.D.	5	2	1
01309	2-Chlorophenol	95-57-8	N.D.	5	1	1
01309	4-Chlorophenyl-phenylether	7005-72-3	N.D.	5	2	1
01309	Chrysene	218-01-9	N.D.	5	1	1
01309	Diallate trans/cis	2303-16-4	N.D.	5	1	1
01309	Dibenz(a,h)anthracene	53-70-3	N.D.	5	1	1
01309	Dibenzofuran	132-64-9	N.D.	5	1	1
01309	1,2-Dichlorobenzene	95-50-1	N.D.	5	1	1
01309	1,3-Dichlorobenzene	541-73-1	N.D.	5	1	1
01309	1,4-Dichlorobenzene	106-46-7	N.D.	5	1	1
01309	3,3'-Dichlorobenzidine	91-94-1	N.D.	5	2	1
01309	2,4-Dichlorophenol	120-83-2	N.D.	5	1	1
01309	2,6-Dichlorophenol	87-65-0	N.D.	5	2	1
01309	Diethylphthalate	84-66-2	N.D.	5	2	1
01309	Dimethoate	60-51-5	N.D.	10	3	1
01309	p-Dimethylaminoazobenzene	60-11-7	N.D.	5	2	1

PUK62 0032

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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Lancaster Laboratories

Sample Description: 18520006 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Water # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199067
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 13:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20006 SDG#: PUK62-04EB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
01309	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	5	2	1
01309	3,3'-Dimethylbenzidine	119-93-7	N.D.	75	25	1
01309	a,a-Dimethylphenethylamine	122-09-8	N.D.	50	5	1
01309	2,4-Dimethylphenol	105-67-9	N.D.	10	3	1
01309	Dimethylphthalate	131-11-3	N.D.	5	2	1
01309	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	15	5	1
01309	1,3-Dinitrobenzene	99-65-0	N.D.	5	2	1
01309	2,4-Dinitrophenol	51-28-5	N.D.	30	10	1
01309	2,4-Dinitrotoluene	121-14-2	N.D.	5	1	1
01309	2,6-Dinitrotoluene	606-20-2	N.D.	5	1	1
01309	1,4-Dioxane	123-91-1	N.D.	5	1	1
01309	Ethyl methanesulfonate	62-50-0	N.D.	5	2	1
01309	bis(2-Ethylhexyl)phthalate	117-81-7	15	5	2	1
01309	Fluoranthene	206-44-0	N.D.	5	1	1
01309	Fluorene	86-73-7	N.D.	5	1	1
01309	Hexachlorobenzene	118-74-1	N.D.	5	1	1
01309	Hexachlorobutadiene	87-68-3	N.D.	5	1	1
01309	Hexachlorocyclopentadiene	77-47-4	N.D.	15	5	1
01309	Hexachloroethane	67-72-1	N.D.	5	1	1
01309	Hexachloropropene	1888-71-7	N.D.	5	2	1
01309	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	5	1	1
01309	Isodrin	465-73-6	N.D.	5	1	1
01309	Isophorone	78-59-1	N.D.	5	1	1
01309	Isosafrole	120-58-1	N.D.	5	2	1
01309	Methapyrilene	91-80-5	N.D.	50	15	1
01309	Methyl methanesulfonate	66-27-3	N.D.	5	1	1
01309	3-Methylcholanthrene	56-49-5	N.D.	5	2	1
01309	2-Methylnaphthalene	91-57-6	N.D.	5	1	1
01309	2-Methylphenol	95-48-7	N.D.	5	1	1
01309	4-Methylphenol	106-44-5	N.D.	5	2	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
01309	Naphthalene	91-20-3	N.D.	5	1	1
01309	1,4-Naphthoquinone	130-15-4	N.D.	30	10	1
01309	1-Naphthylamine	134-32-7	N.D.	15	5	1
01309	2-Naphthylamine	91-59-8	N.D.	15	5	1
01309	2-Nitroaniline	88-74-4	N.D.	5	1	1
01309	3-Nitroaniline	99-09-2	N.D.	5	1	1
01309	4-Nitroaniline	100-01-6	N.D.	5	1	1
01309	Nitrobenzene	98-95-3	N.D.	5	1	1
01309	5-Nitro-o-toluidine	99-55-8	N.D.	5	3	1
01309	2-Nitrophenol	88-75-5	N.D.	5	1	1
01309	4-Nitrophenol	100-02-7	N.D.	30	10	1
01309	4-Nitroquinoline-1-oxide	56-57-5	N.D.	60	20	1
01309	N-Nitrosodiethylamine	55-18-5	N.D.	5	2	1
01309	N-Nitrosodimethylamine	62-75-9	N.D.	5	2	1
01309	N-Nitrosodi-n-butylamine	924-16-3	N.D.	5	2	1
01309	N-Nitroso-di-n-propylamine	621-64-7	N.D.	5	1	1
01309	N-Nitrosodiphenylamine	86-30-6	N.D.	5	2	1

PUK62 8833

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
Lancaster, PA 17605-2425
717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520006 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Water # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199067
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 13:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20006 SDG#: PUK62-04EB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	**SW-846 8270C**		ug/l	ug/l	ug/l	
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					
01309	N-Nitrosomethylethylamine	10595-95-6	N.D.	5	2	1
01309	N-Nitrosomorpholine	59-89-2	N.D.	5	2	1
01309	N-Nitrosopiperidine	100-75-4	N.D.	5	2	1
01309	N-Nitrosopyrrolidine	930-55-2	N.D.	5	2	1
01309	Di-n-octylphthalate	117-84-0	N.D.	5	2	1
01309	Pentachlorobenzene	608-93-5	N.D.	5	2	1
01309	Pentachloronitrobenzene	82-68-8	N.D.	5	2	1
01309	Pentachlorophenol	87-86-5	N.D.	15	3	1
01309	Phenacetin	62-44-2	N.D.	5	2	1
01309	Phenanthrene	85-01-8	N.D.	5	1	1
01309	Phenol	108-95-2	N.D.	5	1	1
01309	1,4-Phenylenediamine	106-50-3	N.D.	250	75	1
01309	2-Picoline	109-06-8	N.D.	5	2	1
01309	Pronamide	23950-58-5	N.D.	5	1	1
01309	Pyrene	129-00-0	N.D.	5	1	1
01309	Pyridine	110-86-1	N.D.	5	2	1
01309	Safrole	94-59-7	N.D.	5	2	1
01309	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	5	2	1
01309	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	5	2	1
01309	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	5	1	1
01309	Thionazin	297-97-2	N.D.	5	2	1
01309	o-Toluidine	95-53-4	N.D.	5	1	1
01309	1,2,4-Trichlorobenzene	120-82-1	N.D.	5	1	1
01309	2,4,5-Trichlorophenol	95-95-4	N.D.	5	1	1
01309	2,4,6-Trichlorophenol	88-06-2	N.D.	5	1	1
01309	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	5	2	1
01309	1,3,5-Trinitrobenzene	99-35-4	N.D.	15	5	1

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

GC/MS Semivolatiles	**SW-846 8270C SIM**		ug/l	ug/l	ug/l	
08357	Acenaphthene	83-32-9	N.D.	0.049	0.0097	1
08357	Acenaphthylene	208-96-8	N.D.	0.049	0.0097	1
08357	Anthracene	120-12-7	N.D.	0.049	0.0097	1
08357	Benzo(a)anthracene	56-55-3	N.D.	0.049	0.0097	1
08357	Benzo(a)pyrene	50-32-8	N.D.	0.049	0.0097	1
08357	Benzo(b)fluoranthene	205-99-2	N.D.	0.049	0.0097	1
08357	Benzo(g,h,i)perylene	191-24-2	N.D.	0.049	0.0097	1
08357	Benzo(k)fluoranthene	207-08-9	N.D.	0.049	0.0097	1
08357	Chrysene	218-01-9	N.D.	0.049	0.0097	1
08357	Dibenz(a,h)anthracene	53-70-3	N.D.	0.049	0.0097	1
08357	Fluoranthene	206-44-0	N.D.	0.049	0.0097	1

PUK62 0034

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520006 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Water # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199067
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011 13:00

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20006 SDG#: PUK62-04EB

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Fluorene	86-73-7	N.D.	0.049	0.0097	1
08357	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	0.049	0.0097	1
08357	1-Methylnaphthalene	90-12-0	N.D.	0.049	0.0097	1
08357	2-Methylnaphthalene	91-57-6	N.D.	0.049	0.0097	1
08357	Naphthalene	91-20-3	0.022 J	0.049	0.0097	1
08357	Phenanthrene	85-01-8	0.012 J	0.049	0.0097	1
08357	Pyrene	129-00-0	N.D.	0.049	0.0097	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 15:02	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 15:02	Jason M Long	1
01309	SVOC Camp Moscrip List - water	SW-846 8270C	1	11036WAB026	02/11/2011 18:48	Matthew S Woods	1
08357	SIM PAHs - water	SW-846 8270C SIM	1	11036WAC026	02/09/2011 00:16	Gregory J Drahovsky	1
10464	BNA Water Extraction (App IX)	SW-846 3510C	1	11036WAB026	02/07/2011 03:30	Sherry L Morrow	1
10470	BNA Water Extraction (SIM)	SW-846 3510C	1	11036WAC026	02/07/2011 03:30	Sherry L Morrow	1

PUK62 9835

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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Analysis Report

Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	Acetone	67-64-1	N.D.	5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.	20	7.0	1
02898	Acrolein	107-02-8	N.D.	25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.	5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.	0.5	0.1	1
02898	Benzene	71-43-2	N.D.	0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.	0.5	0.1	1
02898	Bromoform	75-25-2	N.D.	0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.	0.5	0.1	1
02898	2-Butanone	78-93-3	N.D.	5.0	1.0	1
02898	Carbon Disulfide	75-15-0	2.7	0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.	0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.	0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.	0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.	0.5	0.1	1
02898	Chloroform	67-66-3	N.D.	0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.	0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.	0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.	0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.	0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.	0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.	5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.	0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.	0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.	0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.	0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.	0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.	0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.	0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.	0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.	0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.	0.5	0.1	1
02898	Ethylbenzene	100-41-4	N.D.	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.	5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.	25	10	1
02898	Methacrylonitrile	126-98-7	N.D.	5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.	0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.	0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.	5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.	0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.	0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.	10	2.0	1
02898	Styrene	100-42-5	N.D.	0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.	0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.	0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.	0.5	0.1	1
02898	Toluene	108-88-3	N.D.	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.	0.5	0.1	1

PUK62 0036

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
01309	Acenaphthene	83-32-9	N.D.	5	1	1
01309	Acenaphthylene	208-96-8	N.D.	5	1	1
01309	Acetophenone	98-86-2	N.D.	5	2	1
01309	2-Acetylaminofluorene	53-96-3	N.D.	5	2	1
01309	4-Aminobiphenyl	92-67-1	N.D.	5	2	1
01309	Aniline	62-53-3	N.D.	5	1	1
01309	Anthracene	120-12-7	N.D.	5	1	1
01309	Aramite	140-57-8	N.D.	15	5	1
01309	Benzo(a)anthracene	56-55-3	N.D.	5	1	1
01309	Benzo(a)pyrene	50-32-8	N.D.	5	1	1
01309	Benzo(b)fluoranthene	205-99-2	N.D.	5	1	1
01309	Benzo(g,h,i)perylene	191-24-2	N.D.	5	1	1
01309	Benzo(k)fluoranthene	207-08-9	N.D.	5	1	1
01309	Benzyl alcohol	100-51-6	N.D.	15	5	1
01309	4-Bromophenyl-phenylether	101-55-3	N.D.	5	1	1
01309	Butylbenzylphthalate	85-68-7	N.D.	5	2	1
01309	Di-n-butylphthalate	84-74-2	N.D.	5	2	1
01309	4-Chloro-3-methylphenol	59-50-7	N.D.	5	1	1
01309	4-Chloroaniline	106-47-8	N.D.	5	1	1
01309	Chlorobenzilate	510-15-6	N.D.	10	3	1
01309	bis(2-Chloroethoxy)methane	111-91-1	N.D.	5	1	1
01309	bis(2-Chloroethyl)ether	111-44-4	N.D.	5	1	1
01309	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	5	1	1
01309	2-Chloronaphthalene	91-58-7	N.D.	5	2	1
01309	2-Chlorophenol	95-57-8	N.D.	5	1	1
01309	4-Chlorophenyl-phenylether	7005-72-3	N.D.	5	2	1
01309	Chrysene	218-01-9	N.D.	5	1	1
01309	Diallate trans/cis	2303-16-4	N.D.	5	1	1
01309	Dibenz(a,h)anthracene	53-70-3	N.D.	5	1	1
01309	Dibenzofuran	132-64-9	N.D.	5	1	1
01309	1,2-Dichlorobenzene	95-50-1	N.D.	5	1	1
01309	1,3-Dichlorobenzene	541-73-1	N.D.	5	1	1
01309	1,4-Dichlorobenzene	106-46-7	N.D.	5	1	1
01309	3,3'-Dichlorobenzidine	91-94-1	N.D.	5	2	1
01309	2,4-Dichlorophenol	120-83-2	N.D.	5	1	1
01309	2,6-Dichlorophenol	87-65-0	N.D.	5	2	1
01309	Diethylphthalate	84-66-2	N.D.	5	2	1
01309	Dimethoate	60-51-5	N.D.	10	3	1
01309	p-Dimethylaminoazobenzene	60-11-7	N.D.	5	2	1

PUK62 0037

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
PO Box 12425
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717-656-2300 Fax: 717-656-2681

Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/l	ug/l	ug/l	
01309	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	5	2	1
01309	3,3'-Dimethylbenzidine	119-93-7	N.D.	73	24	1
01309	a,a-Dimethylphenethylamine	122-09-8	N.D.	48	5	1
01309	2,4-Dimethylphenol	105-67-9	N.D.	10	3	1
01309	Dimethylphthalate	131-11-3	N.D.	5	2	1
01309	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	15	5	1
01309	1,3-Dinitrobenzene	99-65-0	N.D.	5	2	1
01309	2,4-Dinitrophenol	51-28-5	N.D.	29	10	1
01309	2,4-Dinitrotoluene	121-14-2	N.D.	5	1	1
01309	2,6-Dinitrotoluene	606-20-2	N.D.	5	1	1
01309	1,4-Dioxane	123-91-1	N.D.	5	1	1
01309	Ethyl methanesulfonate	62-50-0	N.D.	5	2	1
01309	bis(2-Ethylhexyl)phthalate	117-81-7	N.D.	5	2	1
01309	Fluoranthene	206-44-0	N.D.	5	1	1
01309	Fluorene	86-73-7	N.D.	5	1	1
01309	Hexachlorobenzene	118-74-1	N.D.	5	1	1
01309	Hexachlorobutadiene	87-68-3	N.D.	5	1	1
01309	Hexachlorocyclopentadiene	77-47-4	N.D.	15	5	1
01309	Hexachloroethane	67-72-1	N.D.	5	1	1
01309	Hexachloropropene	1888-71-7	N.D.	5	2	1
01309	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	5	1	1
01309	Isodrin	465-73-6	N.D.	5	1	1
01309	Isophorone	78-59-1	N.D.	5	1	1
01309	Isosafrole	120-58-1	N.D.	5	2	1
01309	Methapyrilene	91-80-5	N.D.	48	15	1
01309	Methyl methanesulfonate	66-27-3	N.D.	5	1	1
01309	3-Methylcholanthrene	56-49-5	N.D.	5	2	1
01309	2-Methylnaphthalene	91-57-6	N.D.	5	1	1
01309	2-Methylphenol	95-48-7	N.D.	5	1	1
01309	4-Methylphenol	106-44-5	N.D.	5	2	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
01309	Naphthalene	91-20-3	N.D.	5	1	1
01309	1,4-Naphthoquinone	130-15-4	N.D.	29	10	1
01309	1-Naphthylamine	134-32-7	N.D.	15	5	1
01309	2-Naphthylamine	91-59-8	N.D.	15	5	1
01309	2-Nitroaniline	88-74-4	N.D.	5	1	1
01309	3-Nitroaniline	99-09-2	N.D.	5	1	1
01309	4-Nitroaniline	100-01-6	N.D.	5	1	1
01309	Nitrobenzene	98-95-3	N.D.	5	1	1
01309	5-Nitro-o-toluidine	99-55-8	N.D.	5	3	1
01309	2-Nitrophenol	88-75-5	N.D.	5	1	1
01309	4-Nitrophenol	100-02-7	N.D.	29	10	1
01309	4-Nitroquinoline-1-oxide	56-57-5	N.D.	58	19	1
01309	N-Nitrosodiethylamine	55-18-5	N.D.	5	2	1
01309	N-Nitrosodimethylamine	62-75-9	N.D.	5	2	1
01309	N-Nitrosodi-n-butylamine	924-16-3	N.D.	5	2	1
01309	N-Nitroso-di-n-propylamine	621-64-7	N.D.	5	1	1
01309	N-Nitrosodiphenylamine	86-30-6	N.D.	5	2	1

PUK62 0028

*=This limit was used in the evaluation of the final result

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Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS	Semivolatiles SW-846 8270C		ug/l	ug/l	ug/l	
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					
01309	N-Nitrosomethylethylamine	10595-95-6	N.D.	5	2	1
01309	N-Nitrosomorpholine	59-89-2	N.D.	5	2	1
01309	N-Nitrosopiperidine	100-75-4	N.D.	5	2	1
01309	N-Nitrosopyrrolidine	930-55-2	N.D.	5	2	1
01309	Di-n-octylphthalate	117-84-0	N.D.	5	2	1
01309	Pentachlorobenzene	608-93-5	N.D.	5	2	1
01309	Pentachloronitrobenzene	82-68-8	N.D.	5	2	1
01309	Pentachlorophenol	87-86-5	N.D.	15	3	1
01309	Phenacetin	62-44-2	N.D.	5	2	1
01309	Phenanthrene	85-01-8	N.D.	5	1	1
01309	Phenol	108-95-2	N.D.	5	1	1
01309	1,4-Phenylenediamine	106-50-3	N.D.	240	73	1
01309	2-Picoline	109-06-8	N.D.	5	2	1
01309	Pronamide	23950-58-5	N.D.	5	1	1
01309	Pyrene	129-00-0	N.D.	5	1	1
01309	Pyridine	110-86-1	N.D.	5	2	1
01309	Safrole	94-59-7	N.D.	5	2	1
01309	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	5	2	1
01309	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	5	2	1
01309	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	5	1	1
01309	Thionazin	297-97-2	N.D.	5	2	1
01309	o-Toluidine	95-53-4	N.D.	5	1	1
01309	1,2,4-Trichlorobenzene	120-82-1	N.D.	5	1	1
01309	2,4,5-Trichlorophenol	95-95-4	N.D.	5	1	1
01309	2,4,6-Trichlorophenol	88-06-2	N.D.	5	1	1
01309	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	5	2	1
01309	1,3,5-Trinitrobenzene	99-35-4	N.D.	15	5	1

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

GC/MS	Semivolatiles SW-846 8270C SIM		ug/l	ug/l	ug/l	
08357	Acenaphthene	83-32-9	N.D.	0.048	0.0096	1
08357	Acenaphthylene	208-96-8	N.D.	0.048	0.0096	1
08357	Anthracene	120-12-7	N.D.	0.048	0.0096	1
08357	Benzo(a)anthracene	56-55-3	N.D.	0.048	0.0096	1
08357	Benzo(a)pyrene	50-32-8	N.D.	0.048	0.0096	1
08357	Benzo(b)fluoranthene	205-99-2	N.D.	0.048	0.0096	1
08357	Benzo(g,h,i)perylene	191-24-2	N.D.	0.048	0.0096	1
08357	Benzo(k)fluoranthene	207-08-9	N.D.	0.048	0.0096	1
08357	Chrysene	218-01-9	N.D.	0.048	0.0096	1
08357	Dibenz(a,h)anthracene	53-70-3	N.D.	0.048	0.0096	1
08357	Fluoranthene	206-44-0	N.D.	0.048	0.0096	1

PUK62 8839

*=This limit was used in the evaluation of the final result

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Analysis Report

Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	**SW-846 8270C SIM**		ug/l	ug/l	ug/l	
08357	Fluorene	86-73-7	N.D.	0.048	0.0096	1
08357	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	0.048	0.0096	1
08357	1-Methylnaphthalene	90-12-0	N.D.	0.048	0.0096	1
08357	2-Methylnaphthalene	91-57-6	N.D.	0.048	0.0096	1
08357	Naphthalene	91-20-3	0.024 J	0.048	0.0096	1
08357	Phenanthrene	85-01-8	N.D.	0.048	0.0096	1
08357	Pyrene	129-00-0	N.D.	0.048	0.0096	1
Pesticides/PCBs	**SW-846 8081A**		ug/l	ug/l	ug/l	
00177	Aldrin	309-00-2	N.D.	0.0096	0.0019	1
00177	Alpha BHC	319-84-6	N.D.	0.0096	0.0029	1
00177	Beta BHC	319-85-7	N.D.	0.0096	0.0028	1
00177	Gamma BHC - Lindane	58-89-9	N.D.	0.0096	0.0019	1
00177	Chlordane	57-74-9	N.D.	0.48	0.11	1
00177	p,p-DDD	72-54-8	N.D.	0.019	0.0048	1
00177	p,p-DDE	72-55-9	N.D.	0.019	0.0048	1
00177	p,p-DDT	50-29-3	N.D.	0.019	0.0048	1
00177	Delta BHC	319-86-8	N.D.	0.0096	0.0028	1
00177	Dieldrin	60-57-1	N.D.	0.019	0.0051	1
00177	Endosulfan I	959-98-8	N.D.	0.0096	0.0041	1
00177	Endosulfan II	33213-65-9	N.D.	0.019	0.014	1
00177	Endosulfan Sulfate	1031-07-8	N.D.	0.019	0.0056	1
00177	Endrin	72-20-8	N.D.	0.019	0.0078	1
00177	Endrin Aldehyde	7421-93-4	N.D.	0.096	0.019	1
00177	Heptachlor	76-44-8	N.D.	0.0096	0.0025	1
00177	Heptachlor Epoxide	1024-57-3	N.D.	0.0096	0.0022	1
00177	Kepone	143-50-0	N.D.	0.19	0.067	1
00177	Methoxychlor	72-43-5	N.D.	0.096	0.029	1
00177	Toxaphene	8001-35-2	N.D.	2.9	0.96	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 15:23	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 15:23	Jason M Long	1
01309	SVOC Camp Moscrip List - water	SW-846 8270C	1	11036WAB026	02/11/2011 19:12	Matthew S Woods	1
08357	SIM PAHs - water	SW-846 8270C SIM	1	11036WAC026	02/09/2011 00:49	Gregory J Drahovsky	1
10464	BNA Water Extraction (App IX)	SW-846 3510C	1	11036WAB026	02/07/2011 03:30	Sherry L Morrow	1

PUK62 9848

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18520007 Camp Moscrip, PR #1852 Hammond Water
Field# EQ Blk Soil # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199068
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 02/01/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20007 SDG#: PUK62-05BKG

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10470	BNA Water Extraction (SIM)	SW-846 3510C	1	11036WAC026	02/07/2011 03:30	Sherry L Morrow	1
00177	App IX OC Pesticides - water	SW-846 8081A	1	110370003A	02/09/2011 21:20	Jamie L Brillhart	1
11118	Pesticide Screen Waters Ext	SW-846 3510C	1	110370003A	02/07/2011 17:05	JoElla L Rice	1

PUK62 0041

Lancaster Laboratories, Inc.
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*=This limit was used in the evaluation of the final result

2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18520010 Camp Moscrip, PR #1852 Hammond Water
Field# Trip Blank # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199069
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20010 SDG#: PUK62-06TB*

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	Acetone	67-64-1	10	5.0	3.0	1
02898	Acetonitrile	75-05-8	N.D.	20	7.0	1
02898	Acrolein	107-02-8	N.D.	25	5.0	1
02898	Acrylonitrile	107-13-1	N.D.	5.0	1.0	1
02898	Allyl Chloride	107-05-1	N.D.	0.5	0.1	1
02898	Benzene	71-43-2	N.D.	0.5	0.1	1
02898	Bromodichloromethane	75-27-4	N.D.	0.5	0.1	1
02898	Bromoform	75-25-2	N.D.	0.5	0.1	1
02898	Bromomethane	74-83-9	N.D.	0.5	0.1	1
02898	2-Butanone	78-93-3	1.2 J	5.0	1.0	1
02898	Carbon Disulfide	75-15-0	2.2	0.5	0.4	1
02898	Carbon Tetrachloride	56-23-5	N.D.	0.5	0.1	1
02898	2-Chloro-1,3-Butadiene	126-99-8	N.D.	0.5	0.1	1
02898	Chlorobenzene	108-90-7	N.D.	0.5	0.1	1
02898	Chloroethane	75-00-3	N.D.	0.5	0.1	1
02898	Chloroform	67-66-3	N.D.	0.5	0.1	1
02898	Chloromethane	74-87-3	N.D.	0.5	0.2	1
02898	1,2-Dibromo-3-chloropropane	96-12-8	N.D.	0.5	0.2	1
02898	Dibromochloromethane	124-48-1	N.D.	0.5	0.1	1
02898	1,2-Dibromoethane	106-93-4	N.D.	0.5	0.1	1
02898	Dibromomethane	74-95-3	N.D.	0.5	0.1	1
02898	trans-1,4-Dichloro-2-butene	110-57-6	N.D.	5.0	1.0	1
02898	Dichlorodifluoromethane	75-71-8	N.D.	0.5	0.1	1
02898	1,1-Dichloroethane	75-34-3	N.D.	0.5	0.1	1
02898	1,2-Dichloroethane	107-06-2	N.D.	0.5	0.1	1
02898	1,1-Dichloroethene	75-35-4	N.D.	0.5	0.1	1
02898	cis-1,2-Dichloroethene	156-59-2	N.D.	0.5	0.1	1
02898	trans-1,2-Dichloroethene	156-60-5	N.D.	0.5	0.1	1
02898	1,2-Dichloropropane	78-87-5	N.D.	0.5	0.1	1
02898	cis-1,3-Dichloropropene	10061-01-5	N.D.	0.5	0.1	1
02898	trans-1,3-Dichloropropene	10061-02-6	N.D.	0.5	0.1	1
02898	Ethyl Methacrylate	97-63-2	N.D.	0.5	0.1	1
02898	Ethylbenzene	100-41-4	N.D.	0.5	0.1	1
02898	2-Hexanone	591-78-6	N.D.	5.0	1.0	1
02898	Isobutyl Alcohol	78-83-1	N.D.	25	10	1
02898	Methacrylonitrile	126-98-7	N.D.	5.0	1.0	1
02898	Methyl Iodide	74-88-4	N.D.	0.5	0.1	1
02898	Methyl Methacrylate	80-62-6	N.D.	0.5	0.1	1
02898	4-Methyl-2-Pentanone	108-10-1	N.D.	5.0	1.0	1
02898	Methylene Chloride	75-09-2	N.D.	0.5	0.2	1
02898	Pentachloroethane	76-01-7	N.D.	0.5	0.2	1
02898	Propionitrile	107-12-0	N.D.	10	2.0	1
02898	Styrene	100-42-5	N.D.	0.5	0.1	1
02898	1,1,1,2-Tetrachloroethane	630-20-6	N.D.	0.5	0.1	1
02898	1,1,2,2-Tetrachloroethane	79-34-5	N.D.	0.5	0.1	1
02898	Tetrachloroethene	127-18-4	N.D.	0.5	0.1	1
02898	Toluene	108-88-3	N.D.	0.5	0.1	1
02898	1,1,1-Trichloroethane	71-55-6	N.D.	0.5	0.1	1

PUK62 8842

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18520010 Camp Moscrip, PR #1852 Hammond Water
Field# Trip Blank # 11-P-0087
Pick-Up Order# 001 Delivery Order# 01 Water

LLI Sample # WW 6199069
LLI Group # 1231845
Account # 04694

Project Name: Camp Moscrip

Collected: 01/31/2011

Submitted: 02/03/2011 09:45
Reported: 02/16/2011 10:46

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

20010 SDG#: PUK62-06TB*

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B 25mL purge		ug/l	ug/l	ug/l	
02898	1,1,2-Trichloroethane	79-00-5	N.D.	0.5	0.1	1
02898	Trichloroethene	79-01-6	N.D.	0.5	0.1	1
02898	Trichlorofluoromethane	75-69-4	N.D.	0.5	0.1	1
02898	1,2,3-Trichloropropane	96-18-4	N.D.	1.0	0.3	1
02898	Vinyl Acetate	108-05-4	N.D.	0.5	0.2	1
02898	Vinyl Chloride	75-01-4	N.D.	0.5	0.1	1
02898	Xylene (Total)	1330-20-7	N.D.	0.5	0.1	1

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
02898	VOCs Camp Moscrip List - water	SW-846 8260B 25mL purge	1	G110401AA	02/09/2011 15:45	Jason M Long	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	G110401AA	02/09/2011 15:45	Jason M Long	1

PUK62: 8843

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Volatiles by GC/MS Data

PUN62. 0044

Case Narrative Conformance/Nonconformance Summary

PUK62 2845

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Volatiles
Fraction: Volatiles by GC/MS

VOCs Camp Moscrip List - water

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199064	Field# MW-1	X		
6199065	Field# MW-1D	X		Field Duplicate Sample
6199066	Field# MW-3	X		
6199067	Field# EQ Blk Water	X		Equipment Blank
6199068	Field# EQ Blk Soil		X	
6199069	Field# Trip Blank	X		Trip Blank

See QC Reference List for Associated Batch QC Samples

SAMPLE PREPARATION:

No problems were encountered with the preparation of the samples.

ANALYSIS:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA Methods for organic compounds do no require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

The percent recovery exceeds the maximum recovery limit for Allyl Chloride in LCSG71. Since a positive bias is observed and the compound is not detected in the associated samples, no further action is needed.

PUK62 0846

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Volatiles
Fraction: Volatiles by GC/MS

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2/25/2011 by Jessica Kelgore
(Date)

PUK62 8847

Quality Control and Calibration Summary Forms

PUK62: 9948:

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401A / VBLKG71 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Dichlorodifluoromethane	02/09/11	N.D.	ug/l	0.1	0.5
Chloromethane	02/09/11	N.D.	ug/l	0.2	0.5
Vinyl Chloride	02/09/11	N.D.	ug/l	0.1	0.5
Bromomethane	02/09/11	N.D.	ug/l	0.1	0.5
Chloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Trichlorofluoromethane	02/09/11	N.D.	ug/l	0.1	0.5
Acrolein	02/09/11	N.D.	ug/l	5.0	25
1,1-Dichloroethene	02/09/11	N.D.	ug/l	0.1	0.5
Acetone	02/09/11	N.D.	ug/l	3.0	5.0
Methyl Iodide	02/09/11	N.D.	ug/l	0.1	0.5
Carbon Disulfide	02/09/11	N.D.	ug/l	0.4	0.5
Acetonitrile	02/09/11	N.D.	ug/l	7.0	20
Allyl Chloride	02/09/11	N.D.	ug/l	0.1	0.5
Methylene Chloride	02/09/11	N.D.	ug/l	0.2	0.5
Acrylonitrile	02/09/11	N.D.	ug/l	1.0	5.0
trans-1,2-Dichloroethene	02/09/11	N.D.	ug/l	0.1	0.5
1,1-Dichloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Vinyl Acetate	02/09/11	N.D.	ug/l	0.2	0.5
2-Chloro-1,3-Butadiene	02/09/11	N.D.	ug/l	0.1	0.5
2-Butanone	02/09/11	N.D.	ug/l	1.0	5.0
cis-1,2-Dichloroethene	02/09/11	N.D.	ug/l	0.1	0.5
Propionitrile	02/09/11	N.D.	ug/l	2.0	10
Methacrylonitrile	02/09/11	N.D.	ug/l	1.0	5.0
Chloroform	02/09/11	N.D.	ug/l	0.1	0.5
1,1,1-Trichloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Carbon Tetrachloride	02/09/11	N.D.	ug/l	0.1	0.5
Isobutyl Alcohol	02/09/11	N.D.	ug/l	10	25
Benzene	02/09/11	N.D.	ug/l	0.1	0.5
1,2-Dichloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Trichloroethene	02/09/11	N.D.	ug/l	0.1	0.5
1,2-Dichloropropane	02/09/11	N.D.	ug/l	0.1	0.5
Dibromomethane	02/09/11	N.D.	ug/l	0.1	0.5
Methyl Methacrylate	02/09/11	N.D.	ug/l	0.1	0.5
Bromodichloromethane	02/09/11	N.D.	ug/l	0.1	0.5
cis-1,3-Dichloropropene	02/09/11	N.D.	ug/l	0.1	0.5
4-Methyl-2-Pentanone	02/09/11	N.D.	ug/l	1.0	5.0
Toluene	02/09/11	N.D.	ug/l	0.1	0.5
trans-1,3-Dichloropropene	02/09/11	N.D.	ug/l	0.1	0.5
Ethyl Methacrylate	02/09/11	N.D.	ug/l	0.1	0.5
1,1,2-Trichloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Tetrachloroethene	02/09/11	N.D.	ug/l	0.1	0.5
2-Hexanone	02/09/11	N.D.	ug/l	1.0	5.0
Dibromochloromethane	02/09/11	N.D.	ug/l	0.1	0.5
1,2-Dibromoethane	02/09/11	N.D.	ug/l	0.1	0.5
Chlorobenzene	02/09/11	N.D.	ug/l	0.1	0.5

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401A / VBLKG71 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
1,1,1,2-Tetrachloroethane	02/09/11	N.D.	ug/l	0.1	0.5
Ethylbenzene	02/09/11	N.D.	ug/l	0.1	0.5
Xylene (Total)	02/09/11	N.D.	ug/l	0.1	0.5
Styrene	02/09/11	N.D.	ug/l	0.1	0.5
Bromoform	02/09/11	N.D.	ug/l	0.1	0.5
1,1,2,2-Tetrachloroethane	02/09/11	N.D.	ug/l	0.1	0.5
trans-1,4-Dichloro-2-butene	02/09/11	N.D.	ug/l	1.0	5.0
1,2,3-Trichloropropane	02/09/11	N.D.	ug/l	0.3	1.0
Pentachloroethane	02/09/11	N.D.	ug/l	0.2	0.5
1,2-Dibromo-3-chloropropane	02/09/11	N.D.	ug/l	0.2	0.5

PUK62 8858

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401AA	Dibromofluoromethane		1,2-Dichloroethane-d4		Toluene-d8		4-Bromofluorobenzene	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
6199064	103	77 - 114	100	74 - 113	105	77 - 110	99	78 - 110
6199064 MSD	103	77 - 114	102	74 - 113	106	77 - 110	99	78 - 110
6199064 MS	104	77 - 114	101	74 - 113	106	77 - 110	100	78 - 110
6199064MS1	102	77 - 114	100	74 - 113	106	77 - 110	100	78 - 110
6199064MSD1	102	77 - 114	99	74 - 113	106	77 - 110	99	78 - 110
6199065	103	77 - 114	98	74 - 113	105	77 - 110	99	78 - 110
6199066	103	77 - 114	103	74 - 113	103	77 - 110	99	78 - 110
6199067	102	77 - 114	99	74 - 113	104	77 - 110	99	78 - 110
6199068	103	77 - 114	101	74 - 113	105	77 - 110	99	78 - 110
6199069	102	77 - 114	100	74 - 113	103	77 - 110	99	78 - 110
LCSG71	102	77 - 114	101	74 - 113	106	77 - 110	100	78 - 110
LCS1G71	101	77 - 114	98	74 - 113	106	77 - 110	99	78 - 110
VBLKG71	101	77 - 114	99	74 - 113	106	77 - 110	98	78 - 110

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/l)
4-Bromofluorobenzene	10
Toluene-d8	10
1,2-Dichloroethane-d4	10
Dibromofluoromethane	10

PUK62 0051

2/23/2011 11:36:46 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401AA Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Dichlorodifluoromethane	5	N.D.	2.7	3.0	55	59	40-136	7	30
Chloromethane	5	N.D.	1.9	1.9	38 *	38 *	55-152	1	30
Vinyl Chloride	5	N.D.	4.8	5.2	96	103	57-150	7	30
Bromomethane	5	N.D.	4.0	4.1	80	82	66-137	3	30
Chloroethane	5	N.D.	5.0	5.2	100	103	70-139	3	30
Trichlorofluoromethane	5	N.D.	5.0	5.2	100	103	81-149	3	30
Acrolein	37.5	N.D.	30	29	81	78	29-149	4	30
1,1-Dichloroethene	5	N.D.	5.4	5.4	107	108	88-137	1	30
Acetone	37.5	N.D.	40	41	105	110	57-163	4	30
Methyl Iodide	5	N.D.	5.3	5.4	106	107	79-129	1	30
Carbon Disulfide	5	4.6	12	15	149 *	207 *	82-147	22	30
Acetonitrile	37.5	N.D.	50	54	134	144	56-164	7	30
Allyl Chloride	5	N.D.	7.3	7.6	145 *	151 *	67-139	4	30
Methylene Chloride	5	N.D.	5.0	5.0	99	99	84-122	0	30
Acrylonitrile	25	N.D.	27	27	106	108	56-161	1	30
trans-1,2-Dichloroethene	5	N.D.	5.2	5.3	103	105	88-127	2	30
1,1-Dichloroethane	5	N.D.	5.1	5.2	102	105	89-128	3	30
Vinyl Acetate	12.5	N.D.	14	14	112	113	57-159	1	30
2-Chloro-1,3-Butadiene	5	N.D.	5.4	5.5	108	109	71-159	1	30
2-Butanone	37.5	N.D.	41	41	109	109	58-168	1	30
cis-1,2-Dichloroethene	5	N.D.	4.9	4.9	98	98	82-129	0	30
Propionitrile	37.5	N.D.	39	40	104	106	63-147	2	30
Methacrylonitrile	37.5	N.D.	35	37	95	98	58-155	4	30
Chloroform	5	N.D.	5.0	5.0	100	101	86-136	1	30
1,1,1-Trichloroethane	5	N.D.	5.2	5.2	104	104	81-152	1	30
Carbon Tetrachloride	5	N.D.	5.3	5.2	106	105	86-152	1	30
Isobutyl Alcohol	125	N.D.	110	120	88	93	65-155	6	30
Benzene	5	N.D.	4.9	4.9	99	99	87-126	0	30
1,2-Dichloroethane	5	N.D.	5.1	5.2	103	104	83-143	1	30
Trichloroethene	5	N.D.	4.9	4.9	97	97	85-131	0	30
1,2-Dichloropropane	5	N.D.	5.0	5.0	99	100	83-126	1	30
Dibromomethane	5	N.D.	4.9	4.9	98	98	83-126	0	30
Methyl Methacrylate	5	N.D.	4.7	4.8	93	95	48-152	2	30
Bromodichloromethane	5	N.D.	5.2	5.2	104	103	82-133	1	30
cis-1,3-Dichloropropene	5	N.D.	4.7	4.6	94	92	63-127	1	30
4-Methyl-2-Pentanone	25	N.D.	25	25	99	100	69-133	2	30
Toluene	5	0.3	5.8	5.9	109	111	83-127	1	30
trans-1,3-Dichloropropene	5	N.D.	5.0	4.8	99	96	71-128	3	30
Ethyl Methacrylate	5	N.D.	4.9	5.1	98	101	58-133	3	30
1,1,2-Trichloroethane	5	N.D.	5.3	5.2	105	104	85-129	1	30
Tetrachloroethene	5	N.D.	5.1	5.1	102	102	86-129	1	30
2-Hexanone	25	N.D.	28	28	110	111	63-145	1	30
Dibromochloromethane	5	N.D.	5.8	5.7	116	113	79-125	2	30
1,2-Dibromoethane	5	N.D.	5.3	5.3	107	106	80-120	1	30
Chlorobenzene	5	N.D.	5.2	5.3	105	106	87-120	1	30

PUK62 10852

2/23/2011 11:09:53 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401AA Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
1,1,1,2-Tetrachloroethane	5	N.D.	5.2	5.2	104	104	87-126	1	30
Ethylbenzene	5	0.3	5.8	5.8	110	110	80-140	0	30
Xylene (Total)	15	N.D.	16	16	108	109	84-125	1	30
Styrene	5	N.D.	4.0	4.2	81	84	39-162	4	30
Bromoform	5	N.D.	6.1	5.7	123	114	65-126	7	30
1,1,2,2-Tetrachloroethane	5	N.D.	5.5	5.4	109	107	70-125	2	30
trans-1,4-Dichloro-2-butene	25	N.D.	3.8	3.4	15	14	11-172	11	30
1,2,3-Trichloropropane	5	N.D.	5.3	5.3	106	105	76-120	0	30
Pentachloroethane	5	N.D.	6.0	6.0	120	121	78-127	1	30
1,2-Dibromo-3-chloropropane	5	N.D.	5.2	4.9	103	98	55-156	5	30

PUK62 0053

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401AA Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Dichlorodifluoromethane	5	3.8		76		39-120		
Chloromethane	5	4.3		86		55-135		
Vinyl Chloride	5	4.4		88		55-126		
Bromomethane	5	4.3		87		66-124		
Chloroethane	5	4.5		90		67-124		
Trichlorofluoromethane	5	4.4		88		71-126		
Acrolein	37.5	39		105		32-129		
1,1-Dichloroethene	5	4.8		96		80-123		
Acetone	37.5	39		104		74-137		
Methyl Iodide	5	5.0		101		71-120		
Carbon Disulfide	5	5.6		113		73-133		
Acetonitrile	37.5	54		145		64-162		
Allyl Chloride	5	6.7		135 *		74-121		
Methylene Chloride	5	4.8		96		80-120		
Acrylonitrile	25	27		109		76-135		
trans-1,2-Dichloroethene	5	4.7		94		80-120		
1,1-Dichloroethane	5	4.8		95		80-120		
Vinyl Acetate	12.5	13		104		57-157		
2-Chloro-1,3-Butadiene	5	5.2		103		80-127		
2-Butanone	37.5	41		109		71-149		
cis-1,2-Dichloroethene	5	4.7		94		80-120		
Propionitrile	37.5	37		98		76-133		
Methacrylonitrile	37.5	39		104		75-134		
Chloroform	5	4.7		95		80-120		
1,1,1-Trichloroethane	5	4.7		93		80-121		
Carbon Tetrachloride	5	4.7		94		80-129		
Isobutyl Alcohol	125	120		96		78-142		
Benzene	5	4.5		90		80-120		
1,2-Dichloroethane	5	4.9		99		80-127		
Trichloroethene	5	4.5		90		80-120		
1,2-Dichloropropane	5	4.7		94		80-120		
Dibromomethane	5	4.9		97		80-120		
Methyl Methacrylate	5	5.3		107		58-139		
Bromodichloromethane	5	4.8		97		80-120		
cis-1,3-Dichloropropene	5	4.6		92		74-120		
4-Methyl-2-Pentanone	25	25		98		70-123		
Toluene	5	5.1		102		80-120		
trans-1,3-Dichloropropene	5	5.1		103		80-120		
Ethyl Methacrylate	5	5.5		109		72-120		
1,1,2-Trichloroethane	5	5.2		104		80-120		
Tetrachloroethene	5	4.9		98		80-120		
2-Hexanone	25	27		110		75-124		
Dibromochloromethane	5	5.3		105		80-120		
1,2-Dibromoethane	5	5.2		105		80-120		

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Volatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Volatiles by GC/MS

G110401AA Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chlorobenzene	5	5.0		101		80-120		
1,1,1,2-Tetrachloroethane	5	5.1		103		80-120		
Ethylbenzene	5	5.1		102		80-120		
Xylene (Total)	15	15		103		80-120		
Styrene	5	5.3		106		80-120		
Bromoform	5	5.3		106		70-128		
1,1,2,2-Tetrachloroethane	5	5.2		105		80-125		
trans-1,4-Dichloro-2-butene	25	20		78		14-166		
1,2,3-Trichloropropane	5	5.2		104		80-120		
Pentachloroethane	5	5.7		114		80-120		
1,2-Dibromo-3-chloropropane	5	5.0		101		70-133		

PUK62 0055

Semivolatiles by GC/MS Data

PUR62: 0468

Case Narrative Conformance/Nonconformance Summary

PUK62 8461

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Semivolatiles
Fraction: Semivolatiles by GC/MS

SVOC Camp Moscrip List - water

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199064	Field# MW-1	X		
6199065	Field# MW-1D	X		Field Duplicate Sample
6199066	Field# MW-3	X		
6199067	Field# EQ Blk Water	X		Equipment Blank
6199068	Field# EQ Blk Soil	X		Equipment Blank

See QC Reference List for Associated Batch QC Samples.

SAMPLE PREPARATION:

No problems were encountered with the preparation of the samples.

ANALYSIS:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA methods for organic compounds do not require action by the laboratory based on out-of-specification MS/MSD results.

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for aramite and a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

PUK62 0462

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Semivolatiles
Fraction: Semivolatiles by GC/MS

The recovery of 7,12-dimethylbenz(a)anthracene is above QC limits for the LCS associated with batch 11036WAB026. Since this compound was not detected in the associated samples, no further action was taken.

The recoveries of a,a-dimethylphenethylamine, methapyrilene and aramite are outside QC limits for the LCS associated with batch 11036WAB026.

The recovery of 1,4-phenylenediamine is outside QC limits for the LCS2 and LCSD2 associated with batch 11036WAB026.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2-28-11 by Grace Salm
(Date)

PUK62 0463

Quality Control and Calibration Summary Forms

PUM62 8464

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026	Phenol-d6		2-Fluorophenol		2,4,6-Tribromophenol		Nitrobenzene-d5		2-Fluorobiphenyl		Terphenyl-d14	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
036WBLCS	47	10 - 74	60	10 - 98	98	34 - 145	96	52 - 120	97	63 - 114	89	34 - 118
036WBLCSD2	48	10 - 74	63	10 - 98	106	34 - 145	91	52 - 120	95	63 - 114	86	34 - 118
6199064	41	10 - 74	55	10 - 98	100	34 - 145	82	52 - 120	87	63 - 114	78	34 - 118
6199064 MSD	55	10 - 74	65	10 - 98	101	34 - 145	92	52 - 120	92	63 - 114	90	34 - 118
6199064 MS	54	10 - 74	66	10 - 98	101	34 - 145	94	52 - 120	95	63 - 114	93	34 - 118
6199065	35	10 - 74	47	10 - 98	95	34 - 145	79	52 - 120	80	63 - 114	70	34 - 118
6199066	12	10 - 74	3 *	10 - 98	7 *	34 - 145	90	52 - 120	92	63 - 114	86	34 - 118
6199067	39	10 - 74	56	10 - 98	93	34 - 145	88	52 - 120	88	63 - 114	87	34 - 118
6199068	43	10 - 74	60	10 - 98	98	34 - 145	90	52 - 120	91	63 - 114	92	34 - 118
SBLKWB036	40	10 - 74	53	10 - 98	98	34 - 145	85	52 - 120	88	63 - 114	81	34 - 118

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/l)
Terphenyl-d14	100
2-Fluorobiphenyl	100
Nitrobenzene-d5	100
2,4,6-Tribromophenol	200
2-Fluorophenol	200
Phenol-d6	200

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
1,4-Dioxane	49.0196	N.D.	23.85	25.24	49	51	27-83	6	30
N-Nitrosodimethylamine	49.0196	N.D.	28.82	34.31	59	69	32-102	17	30
Pyridine	49.0196	N.D.	22.15	27.15	45	55	18-83	20	30
2-Picoline	49.0196	N.D.	34.69	36.42	71	73	60-95	5	30
N-Nitrosomethylethylamine	49.0196	N.D.	44.09	44.66	90	90	66-106	1	30
Methyl methanesulfonate	49.0196	N.D.	30.75	31.21	63	63	48-66	1	30
N-Nitrosodiethylamine	49.0196	N.D.	48.33	47.93	99	97	80-102	1	30
Ethyl methanesulfonate	49.0196	N.D.	46.24	46.65	94	94	79-107	1	30
Phenol	49.0196	N.D.	31.05	30.38	63	61	10-83	2	30
Aniline	49.0196	N.D.	45.01	43.79	92	88	35-113	3	30
bis(2-Chloroethyl)ether	49.0196	N.D.	48.02	47.37	98	95	75-109	1	30
2-Chlorophenol	49.0196	N.D.	47.34	46.89	97	94	27-146	1	30
1,3-Dichlorobenzene	49.0196	N.D.	42.93	44.41	88	89	64-116	3	30
1,4-Dichlorobenzene	49.0196	N.D.	43.23	44.81	88	90	69-116	4	30
Benzyl alcohol	49.0196	N.D.	43.41	44.04	89	89	65-96	1	30
1,2-Dichlorobenzene	49.0196	N.D.	44.01	45.60	90	92	71-107	4	30
2-Methylphenol	49.0196	N.D.	46.37	47.82	95	96	10-146	3	30
bis(2-Chloroisopropyl)ether	49.0196	N.D.	48.63	49.98	99	101	63-131	3	30
N-Nitrosopyrrolidine	49.0196	N.D.	45.61	47.22	93	95	66-104	3	30
4-Methylphenol	49.0196	N.D.	45.52	45.83	93	92	10-147	1	30
N-Nitroso-di-n-propylamine	49.0196	N.D.	49.53	49.23	101	99	72-119	1	30
Acetophenone	49.0196	N.D.	47.08	48.47	96	98	73-110	3	30
N-Nitrosomorpholine	49.0196	N.D.	46.72	47.24	95	95	64-103	1	30
o-Toluidine	49.0196	N.D.	38.73	34.65	79	70	22-116	11	30
Hexachloroethane	49.0196	N.D.	43.62	46.61	89	94	54-119	7	30
Nitrobenzene	49.0196	N.D.	49.22	48.18	100	97	67-124	2	30
N-Nitrosopiperidine	49.0196	N.D.	49.70	49.42	101	100	76-108	1	30
Isophorone	49.0196	N.D.	49.62	49.21	101	99	73-114	1	30
2-Nitrophenol	49.0196	N.D.	49.65	47.95	101	97	67-123	3	30
2,4-Dimethylphenol	49.0196	N.D.	50.59	50.35	103	101	20-145	0	30
O,O,O-Triethylphosphorothioate	49.0196	N.D.	50.45	49.67	103	100	86-111	2	30
bis(2-Chloroethoxy)methane	49.0196	N.D.	48.37	47.99	99	97	79-115	1	30
a,a-Dimethylphenethylamine	49.0196	N.D.	10.31	14.42	21 *	29 *	70-130	33 *	30
2,4-Dichlorophenol	49.0196	N.D.	48.85	48.57	100	98	30-154	1	30
1,2,4-Trichlorobenzene	49.0196	N.D.	47.07	48.18	96	97	69-118	2	30
Naphthalene	49.0196	N.D.	47.83	48.20	98	97	73-113	1	30
4-Chloroaniline	49.0196	N.D.	40.13	32.80	82	66	42-124	20	30
2,6-Dichlorophenol	49.0196	N.D.	50.71	48.52	103	98	47-140	4	30
Hexachloropropene	49.0196	N.D.	46.84	47.63	96	96	49-135	2	30
Hexachlorobutadiene	49.0196	N.D.	46.79	47.82	95	96	68-123	2	30
N-Nitrosodi-n-butylamine	49.0196	N.D.	44.20	44.88	90	90	76-98	2	30
1,4-Phenylenediamine	980.3921	N.D.	N.D.	N.D.	0 *	0 *	70-130	0	30
4-Chloro-3-methylphenol	49.0196	N.D.	49.85	48.47	102	98	19-155	3	30
Safrole	49.0196	N.D.	51.03	50.99	104	103	75-112	0	30

PUK62 8466

Results are being reported on an as received basis.

2/25/2011 11:07:21 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
2-Methylnaphthalene	49.0196	N.D.	46.89	45.56	96	92	80-111	3	30
Hexachlorocyclopentadiene	98.03921	N.D.	49.27	48.92	50	49	10-130	1	30
1,2,4,5-Tetrachlorobenzene	49.0196	N.D.	47.16	46.92	96	94	81-115	1	30
2,4,6-Trichlorophenol	49.0196	N.D.	49.23	47.98	100	97	37-147	3	30
2,4,5-Trichlorophenol	49.0196	N.D.	46.92	48.13	96	97	32-144	3	30
Isosafrole	49.0196	N.D.	48.82	50.77	100	102	74-104	4	30
2-Chloronaphthalene	49.0196	N.D.	39.57	38.97	81	78	49-141	2	30
2-Nitroaniline	49.0196	N.D.	62.37	56.35	127 *	113	76-121	10	30
1,4-Naphthoquinone	49.0196	N.D.	10.03	10.54	20 *	21 *	70-130	5	30
Dimethylphthalate	49.0196	N.D.	46.82	46.17	96	93	51-132	1	30
1,3-Dinitrobenzene	49.0196	N.D.	50.31	49.56	103	100	78-118	2	30
2,6-Dinitrotoluene	49.0196	N.D.	47.63	46.09	97	93	75-122	3	30
Acenaphthylene	49.0196	N.D.	49.02	48.07	100	97	75-124	2	30
3-Nitroaniline	49.0196	N.D.	48.19	45.80	98	92	66-122	5	30
Acenaphthene	49.0196	N.D.	48.27	47.34	98	95	78-107	2	30
2,4-Dinitrophenol	98.03921	N.D.	82.02	82.03	84	83	20-168	0	30
4-Nitrophenol	49.0196	N.D.	30.57	31.07	62	63	10-109	2	30
Pentachlorobenzene	49.0196	N.D.	50.25	49.57	103	100	82-112	1	30
2,4-Dinitrotoluene	49.0196	N.D.	47.72	47.85	97	96	70-124	0	30
Dibenzofuran	49.0196	N.D.	48.77	47.93	99	97	71-116	2	30
1-Naphthylamine	98.03921	N.D.	80.99	74.47	83	75	25-116	8	30
2,3,4,6-Tetrachlorophenol	49.0196	N.D.	50.15	49.49	102	100	44-147	1	30
2-Naphthylamine	98.03921	N.D.	57.91	48.66	59	49	10-107	17	30
Diethylphthalate	49.0196	N.D.	47.64	47.39	97	95	74-118	1	30
Thionazin	49.0196	N.D.	51.65	51.55	105	104	72-117	0	30
Fluorene	49.0196	N.D.	49.65	48.90	101	98	71-123	2	30
4-Chlorophenyl-phenylether	49.0196	N.D.	48.84	49.66	100	100	73-117	2	30
5-Nitro-o-toluidine	49.0196	N.D.	42.02	40.98	86	83	41-117	2	30
4-Nitroaniline	49.0196	N.D.	69.25	66.10	141 *	133 *	57-104	5	30
4,6-Dinitro-2-methylphenol	49.0196	N.D.	51.13	50.46	104	102	42-137	1	30
N-Nitrosodiphenylamine	49.0196	N.D.	50.16	48.26	102	97	74-122	4	30
Tetraethyldithiopyrophosphate	49.0196	N.D.	52.09	50.35	106	101	77-120	3	30
1,3,5-Trinitrobenzene	49.0196	N.D.	35.61	38.04	73	77	30-132	7	30
Phenacetin	49.0196	N.D.	50.06	48.07	102	97	76-120	4	30
4-Bromophenyl-phenylether	49.0196	N.D.	47.91	47.26	98	95	79-118	1	30
Diallate trans/cis	49.0196	N.D.	50.09	48.80	102	98	82-121	3	30
Hexachlorobenzene	49.0196	N.D.	50.94	48.06	104	97	77-122	6	30
Dimethoate	49.0196	N.D.	45.03	40.56	92	82	10-112	10	30
Pentachlorophenol	49.0196	N.D.	46.18	43.97	94	89	23-133	5	30
4-Aminobiphenyl	49.0196	N.D.	30.51	24.46	62	49	10-91	22	30
Pentachloronitrobenzene	49.0196	N.D.	48.09	51.51	98	104	82-116	7	30
Pronamide	49.0196	N.D.	49.72	47.33	101	95	83-124	5	30
Phenanthrene	49.0196	N.D.	48.71	47.51	99	96	72-121	3	30
Anthracene	49.0196	N.D.	49.72	48.42	101	98	78-114	3	30

PUK62: 8467

Results are being reported on an as received basis.

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Di-n-butylphthalate	49.0196	N.D.	49.30	48.43	101	98	79-118	2	30
4-Nitroquinoline-1-oxide	490.196	N.D.	N.D.	N.D.	0 *	0 *	20-135	0	30
Methapyrilene	196.0784	N.D.	43.27	57.10	22 *	29 *	70-130	28	30
Isodrin	49.0196	N.D.	33.36	47.12	68	95	66-129	34 *	30
Fluoranthene	49.0196	N.D.	49.85	48.65	102	98	73-110	2	30
Pyrene	49.0196	N.D.	51.49	48.87	105	98	77-117	5	30
Aramite	49.0196	N.D.	30.80	22.05	63 *	44 *	70-130	33 *	30
p-Dimethylaminoazobenzene	49.0196	N.D.	41.70	37.20	85	75	64-135	11	30
Chlorobenzilate	49.0196	N.D.	52.01	51.96	106	105	85-132	0	30
Butylbenzylphthalate	49.0196	N.D.	53.01	50.36	108	101	68-122	5	30
3,3'-Dimethylbenzidine	98.03921	N.D.	40.27	27.20	41	27	14-78	39 *	30
2-Acetylaminofluorene	49.0196	N.D.	48.60	46.04	99	93	76-120	5	30
bis(2-Ethylhexyl)phthalate	49.0196	2.82	64.28	68.59	125 *	132 *	72-122	6	30
3,3'-Dichlorobenzidine	49.0196	N.D.	43.40	38.92	89	78	42-117	11	30
Benzo(a)anthracene	49.0196	N.D.	49.55	48.17	101	97	76-114	3	30
Chrysene	49.0196	N.D.	48.25	46.95	98	95	78-116	3	30
Di-n-octylphthalate	49.0196	N.D.	64.07	62.32	131	126	58-137	3	30
7,12-Dimethylbenz[a]anthracene	49.0196	N.D.	58.33	56.13	119	113	65-121	4	30
Benzo(b)fluoranthene	49.0196	N.D.	55.55	53.88	113	109	65-125	3	30
Benzo(k)fluoranthene	49.0196	N.D.	60.38	58.70	123 *	118	71-121	3	30
Benzo(a)pyrene	49.0196	N.D.	56.96	54.88	116	111	75-120	4	30
3-Methylcholanthrene	49.0196	N.D.	46.37	39.10	95	79	74-124	17	30
Indeno(1,2,3-cd)pyrene	49.0196	N.D.	52.62	51.98	107	105	69-120	1	30
Dibenz(a,h)anthracene	49.0196	N.D.	52.34	50.91	107	103	73-133	3	30
Benzo(g,h,i)perylene	49.0196	N.D.	51.13	49.63	104	100	72-122	3	30

PUK62 0458

Results are being reported on an as received basis.

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
1,4-Dioxane	50	24.51		49		32-78		
N-Nitrosodimethylamine	50	31.47		63		34-101		
Pyridine	50	26.35		53		15-91		
2-Picoline	50	34.78		70		59-98		
N-Nitrosomethylethylamine	50	44.33		89		72-102		
Methyl methanesulfonate	50	30.16		60		14-127		
N-Nitrosodiethylamine	50	49.35		99		75-106		
Ethyl methanesulfonate	50	47.77		96		76-107		
Phenol	50	24.52		49		21-67		
Aniline	50	38.53		77		49-101		
bis(2-Chloroethyl)ether	50	47.33		95		77-108		
2-Chlorophenol	50	45.16		90		77-108		
1,3-Dichlorobenzene	50	41.12		82		50-119		
1,4-Dichlorobenzene	50	41.41		83		53-119		
Benzyl alcohol	50	40.01		80		66-97		
1,2-Dichlorobenzene	50	42.13		84		55-118		
2-Methylphenol	50	45.06		90		64-101		
bis(2-Chloroisopropyl)ether	50	47.51		95		62-127		
N-Nitrosopyrrolidine	50	45.40		91		68-104		
4-Methylphenol	50	43.09		86		61-103		
N-Nitroso-di-n-propylamine	50	48.73		97		69-110		
Acetophenone	50	46.41		93		75-109		
N-Nitrosomorpholine	50	44.67		89		68-102		
o-Toluidine	50	35.29		71		42-110		
Hexachloroethane	50	40.75		81		52-113		
Nitrobenzene	50	49.21		98		75-109		
N-Nitrosopiperidine	50	50.38		101		78-108		
Isophorone	50	49.02		98		74-117		
2-Nitrophenol	50	48.16		96		86-120		
2,4-Dimethylphenol	50	49.76		100		72-110		
O,O,O-Triethylphosphorothioate	50	50.46		101		81-107		
bis(2-Chloroethoxy)methane	50	49.70		99		74-124		
a,a-Dimethylphenethylamine	50	6.50		13 *		70-130		
2,4-Dichlorophenol	50	49.19		98		80-109		
1,2,4-Trichlorobenzene	50	45.10		90		71-112		
Naphthalene	50	46.95		94		77-107		
4-Chloroaniline	50	38.21		76		42-124		
2,6-Dichlorophenol	50	52.06		104		80-116		
Hexachloropropene	50	48.66		97		61-116		
Hexachlorobutadiene	50	43.62		87		57-124		
N-Nitrosodi-n-butylamine	50	44.82		90		64-105		
1,4-Phenylenediamine	1000	120.65	127.92	12 *	13 *	70-130	6	30
4-Chloro-3-methylphenol	50	49.73		99		70-123		
Safrole	50	51.65		103		81-109		

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
2-Methylnaphthalene	50	45.60		91		78-107		
Hexachlorocyclopentadiene	100	79.32		79		36-118		
1,2,4,5-Tetrachlorobenzene	50	46.56		93		82-111		
2,4,6-Trichlorophenol	50	51.21		102		81-113		
2,4,5-Trichlorophenol	50	48.69		97		79-107		
Isosafrole	50	52.50		105		54-146		
2-Chloronaphthalene	50	44.01		88		54-132		
2-Nitroaniline	50	49.23		98		83-116		
1,4-Naphthoquinone	50	45.51		91		70-130		
Dimethylphthalate	50	47.56		95		39-126		
1,3-Dinitrobenzene	50	50.01		100		86-117		
2,6-Dinitrotoluene	50	48.17		96		85-115		
Acenaphthylene	50	49.39		99		80-122		
3-Nitroaniline	50	47.67		95		74-113		
Acenaphthene	50	48.39		97		82-110		
2,4-Dinitrophenol	100	88.91		89		52-131		
4-Nitrophenol	50	29.29		59		16-78		
Pentachlorobenzene	50	51.24		102		80-113		
2,4-Dinitrotoluene	50	47.90		96		81-115		
Dibenzofuran	50	48.59		97		83-108		
1-Naphthylamine	100	78.44		78		38-111		
2,3,4,6-Tetrachlorophenol	50	50.70		101		79-121		
2-Naphthylamine	100	54.98		55		23-107		
Diethylphthalate	50	48.35		97		75-119		
Thionazin	50	51.38		103		77-113		
Fluorene	50	48.85		98		82-113		
4-Chlorophenyl-phenylether	50	48.04		96		82-111		
5-Nitro-o-toluidine	50	44.24		88		41-111		
4-Nitroaniline	50	46.75		94		59-100		
4,6-Dinitro-2-methylphenol	50	49.94		100		78-119		
N-Nitrosodiphenylamine	50	48.09		96		67-136		
Tetraethyldithiopyrophosphate	50	51.77		104		81-113		
1,3,5-Trinitrobenzene	50	43.72		87		47-114		
Phenacetin	50	49.86		100		78-115		
4-Bromophenyl-phenylether	50	46.73		93		82-117		
Diallate trans/cis	50	49.43		99		84-119		
Hexachlorobenzene	50	47.78		96		81-118		
Dimethoate	50	47.22		94		10-116		
Pentachlorophenol	50	46.99		94		53-110		
4-Aminobiphenyl	50	31.31		63		19-125		
Pentachloronitrobenzene	50	51.80		104		79-115		
Pronamide	50	50.20		100		86-116		
Phenanthrene	50	46.63		93		83-112		
Anthracene	50	48.04		96		81-111		

PUK62 0478

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: Semivolatiles by GC/MS

11036WAB026 Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Di-n-butylphthalate	50	48.84		98		85-115		
4-Nitroquinoline-1-oxide	500	463.61		93		62-161		
Methapyrilene	200	44.04		22 *		70-130		
Isodrin	50	55.59		111		79-125		
Fluoranthene	50	48.07		96		86-116		
Pyrene	50	48.21		96		80-115		
Aramite	50	27.28		55 *		70-130		
p-Dimethylaminoazobenzene	50	51.96		104		72-115		
Chlorobenzilate	50	54.94		110		71-147		
Butylbenzylphthalate	50	49.87		100		77-115		
3,3'-Dimethylbenzidine	100	42.56		43		25-114		
2-Acetylaminofluorene	50	50.48		101		75-120		
bis(2-Ethylhexyl)phthalate	50	48.29		97		78-117		
3,3'-Dichlorobenzidine	50	39.09		78		49-111		
Benzo(a)anthracene	50	48.42		97		80-110		
Chrysene	50	48.39		97		82-112		
Di-n-octylphthalate	50	55.42		111		68-128		
7,12-Dimethylbenz[a]anthracene	50	54.32		109 *		54-105		
Benzo(b)fluoranthene	50	51.98		104		66-125		
Benzo(k)fluoranthene	50	52.39		105		72-122		
Benzo(a)pyrene	50	53.10		106		74-120		
3-Methylcholanthrene	50	57.46		115		56-130		
Indeno(1,2,3-cd)pyrene	50	53.44		107		69-121		
Dibenz(a,h)anthracene	50	52.74		105		74-131		
Benzo(g,h,i)perylene	50	53.02		106		71-125		

PUK62 8471

Semivolatiles by GC/MS Data (SIM)

PUMGZ 8989

Case Narrative Conformance/Nonconformance Summary

P0K62 0990.

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Semivolatiles
Fraction: PAH by GC/MS-SIM

SIM PAHs - water

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199064	Field# MW-1	X		
6199065	Field# MW-1D	X		Field Duplicate Sample
6199066	Field# MW-3	X		
6199067	Field# EQ Blk Water	X		Equipment Blank
6199068	Field# EQ Blk Soil	X		

See QC Reference List for Associated Batch QC Samples.

SAMPLE PREPARATION:

No problems were encountered with the preparation of the samples.

ANALYSIS:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA methods for organic compounds do not require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

The retention time for perylene-d12 in CCV file ib0191 02/07a/11 (instrument HP10976) is outside of specifications due to the trimming of the column during routine maintenance.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

PUK62: 6991

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

GC/MS Semivolatiles
Fraction: PAH by GC/MS-SIM

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved _____ by
(Date)

PUK62 0992

Quality Control and Calibration Summary Forms

PUK62 0993

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: PAH by GC/MS-SIM

11036WAC026	Nitrobenzene-d5		2-Fluorobiphenyl		Terphenyl-d14	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
036WCLCS	109	64 - 147	106	68 - 132	120	53 - 129
6199064	121	64 - 147	104	68 - 132	111	53 - 129
6199064 MSD	102	64 - 147	100	68 - 132	112	53 - 129
6199064 MS	116	64 - 147	102	68 - 132	129	53 - 129
6199065	101	64 - 147	100	68 - 132	111	53 - 129
6199066	116	64 - 147	106	68 - 132	127	53 - 129
6199067	108	64 - 147	104	68 - 132	123	53 - 129
6199068	107	64 - 147	104	68 - 132	129	53 - 129
SBLKWC036	116	64 - 147	105	68 - 132	117	53 - 129

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/l)
Terphenyl-d14	1
2-Fluorobiphenyl	1
Nitrobenzene-d5	1

PUK62 6994

2/24/2011 4:19:49 PM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: PAH by GC/MS-SIM

11036WAC026 Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Naphthalene	1.013171	0.02	0.96	0.92	93	93	52-131	4	30
2-Methylnaphthalene	1.013171	N.D.	0.89	0.85	88	88	62-99	5	30
1-Methylnaphthalene	1.013171	N.D.	0.96	0.92	95	95	83-106	5	30
Acenaphthylene	1.013171	N.D.	0.98	0.89	96	92	49-132	9	30
Acenaphthene	1.013171	N.D.	0.97	0.9	96	93	55-124	8	30
Fluorene	1.013171	N.D.	1.04	0.96	102	100	72-117	7	30
Phenanthrene	1.013171	N.D.	1.04	0.96	103	99	77-112	8	30
Anthracene	1.013171	N.D.	1.07	0.98	106	101	50-134	9	30
Fluoranthene	1.013171	N.D.	1.09	0.82	108	85	73-115	28	30
Pyrene	1.013171	N.D.	1.2	0.98	119	102	65-126	20	30
Benzo(a)anthracene	1.013171	N.D.	1.14	1.08	113	112	68-113	6	30
Chrysene	1.013171	N.D.	1.17	1.02	116	105	74-117	14	30
Benzo(b)fluoranthene	1.013171	N.D.	1.03	0.91	101	95	54-137	12	30
Benzo(k)fluoranthene	1.013171	N.D.	1.14	0.99	112	102	57-130	14	30
Benzo(a)pyrene	1.013171	N.D.	1.02	0.96	101	99	55-130	6	30
Indeno(1,2,3-cd)pyrene	1.013171	N.D.	0.78	0.95	77	99	39-146	20	30
Dibenz(a,h)anthracene	1.013171	N.D.	0.8	0.96	79	100	46-139	18	30
Benzo(g,h,i)perylene	1.013171	N.D.	0.74	1.02	73	105	43-139	31 *	30

PUK62 8995

Results are being reported on an as received basis.

2/24/2011 4:19:34 PM

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK62
Matrix: LIQUID

Fraction: PAH by GC/MS-SIM

11036WAC026 Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Naphthalene	1	0.95		95		72-109		
2-Methylnaphthalene	1	0.88		88		75-115		
1-Methylnaphthalene	1	0.95		95		71-117		
Acenaphthylene	1	0.94		94		70-110		
Acenaphthene	1	0.95		95		74-109		
Fluorene	1	1.0		100		75-114		
Phenanthrene	1	1.0		102		76-111		
Anthracene	1	0.98		98		66-111		
Fluoranthene	1	1.0		101		75-116		
Pyrene	1	1.1		108		69-118		
Benzo(a)anthracene	1	1.1		108		72-114		
Chrysene	1	1.1		108		76-116		
Benzo(b)fluoranthene	1	0.98		98		69-123		
Benzo(k)fluoranthene	1	1.0		103		59-130		
Benzo(a)pyrene	1	0.97		97		60-127		
Indeno(1,2,3-cd)pyrene	1	1.0		100		69-124		
Dibenz(a,h)anthracene	1	1.0		100		55-134		
Benzo(g,h,i)perylene	1	1.1		106		57-131		

PUK62: 8996

2/24/2011 4:19:22 PM

Organochlorine Pesticides Data

PUK62: 1166

Case Narrative Conformance/Nonconformance Summary

P0K62 1167

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

Pesticide Residue Analysis
Fraction: Organochlorine Pesticides

App IX OC Pesticides - water

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199068	Field# EQ Blk Soil		X	

See QC Reference List for Associated Batch QC Samples

SAMPLE PREPARATION:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the preparation of the samples.

ANALYSIS:

The Dieldrin recovery in the Initial Calibration Verification standard is outside the 15% criteria on Column A. Dieldrin is reported from Column B.

The gamma-BHC recovery in the Initial Calibration Verification standard is outside the 15% criteria on Column B. Report gamma-BHC from Column A.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA Methods for organic compounds do no require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

All QC is within specification.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value

PUK62: 1168

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK62

Pesticide Residue Analysis
Fraction: Organochlorine Pesticides

D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2/24/ (Date) by

Elizabeth A. Smith
Specialist

PUK62 1169

Quality Control and Calibration Summary Forms

PUM62 1178

Lancaster Laboratories

Quality Control Summary
Method Blank
Pesticide Residue Analysis
SDG: PUK62
Matrix: LIQUID

Fraction: Organochlorine Pesticides

110370003 / PBLK03037 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Alpha BHC	02/09/11	N.D.	ug/l	0.0030	0.010
Gamma BHC - Lindane	02/09/11	N.D.	ug/l	0.0020	0.010
Beta BHC	02/09/11	N.D.	ug/l	0.0029	0.010
Delta BHC	02/09/11	N.D.	ug/l	0.0029	0.010
Heptachlor	02/09/11	N.D.	ug/l	0.0026	0.010
Aldrin	02/09/11	N.D.	ug/l	0.0020	0.010
Heptachlor Epoxide	02/09/11	N.D.	ug/l	0.0023	0.010
p,p-DDE	02/09/11	N.D.	ug/l	0.0050	0.020
Endosulfan I	02/09/11	N.D.	ug/l	0.0043	0.010
Dieldrin	02/09/11	N.D.	ug/l	0.0053	0.020
Endrin	02/09/11	N.D.	ug/l	0.0081	0.020
p,p-DDD	02/09/11	N.D.	ug/l	0.0050	0.020
Endosulfan II	02/09/11	N.D.	ug/l	0.015	0.020
p,p-DDT	02/09/11	N.D.	ug/l	0.0050	0.020
Methoxychlor	02/09/11	N.D.	ug/l	0.030	0.10
Endosulfan Sulfate	02/09/11	N.D.	ug/l	0.0058	0.020
Kepone	02/09/11	N.D.	ug/l	0.070	0.20
Chlordane	02/09/11	N.D.	ug/l	0.12	0.50
Endrin Aldehyde	02/09/11	N.D.	ug/l	0.020	0.10
Toxaphene	02/09/11	N.D.	ug/l	1.0	3.0

PUK62 1174

Lancaster Laboratories

Quality Control Summary
Surrogates
Pesticide Residue Analysis
SDG: PUK62
Matrix: LIQUID

Fraction: Organochlorine Pesticides

110370003A	Tetrachloro-m-xylene		Decachlorobiphenyl	
Sample	% Recovery	Limits	% Recovery	Limits
6199068	100	52 - 141	81	40 - 144
6199068 MSD	113	52 - 141	116	40 - 144
6199068 MS	105	52 - 141	106	40 - 144
LCS03037	99	52 - 141	94	40 - 144
PBLK03037	102	52 - 141	119	40 - 144

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/l)
Decachlorobiphenyl	0.313
Tetrachloro-m-xylene	0.312

PUK62 1172

2/23/2011 5:09:00 PM

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
Pesticide Residue Analysis
SDG: PUK62
Matrix: LIQUID

Fraction: Organochlorine Pesticides

110370003A Compound	Spike Added ug/l	LCS Conc ug/l	LCSD Conc ug/l	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Alpha BHC	0.098	0.094		96		59-146		
Gamma BHC - Lindane	0.099	0.092		93		68-128		
Beta BHC	0.097	0.093		96		73-147		
Delta BHC	0.097	0.097		100		76-148		
Heptachlor	0.098	0.091		93		57-126		
Aldrin	0.099	0.095		96		54-159		
Heptachlor Epoxide	0.098	0.099		101		73-156		
p,p-DDE	0.19	0.24		126		66-130		
Endosulfan I	0.099	0.094		95		68-128		
Dieldrin	0.2	0.23		115		76-132		
Endrin	0.2	0.21		105		52-132		
p,p-DDD	0.2	0.26		130		71-139		
Endosulfan II	0.2	0.22		110		59-144		
p,p-DDT	0.2	0.19		95		53-126		
Methoxychlor	1	1.1		110		52-133		
Endosulfan Sulfate	0.2	0.24		120		71-142		
Endrin Aldehyde	0.2	0.25		125		68-139		

PUK62 1173

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
Pesticide Residue Analysis
SDG: PUK62
Matrix: LIQUID

Fraction: Organochlorine Pesticides

110370003A Compound	Spike Added ug/l	Unspiked Conc ug/l	MS Conc ug/l	MSD Conc ug/l	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Alpha BHC	0.094				98	98	57-148	0	30
Gamma BHC - Lindane	0.094				91	95	42-137	3	30
Beta BHC	0.093				97	99	76-139	2	30
Delta BHC	0.093				97	97	80-137	0	30
Heptachlor	0.094				97	102	54-135	5	30
Aldrin	0.094				98	101	60-149	3	30
Heptachlor Epoxide	0.093				98	97	43-143	1	30
p,p-DDE	0.19				89	84	66-151	6	30
Endosulfan I	0.094				94	98	24-164	4	30
Dieldrin	0.19				111	111	68-139	0	30
Endrin	0.19				105	111	60-145	5	30
p,p-DDD	0.19				126	132	45-172	4	30
Endosulfan II	0.19				105	105	75-133	0	30
p,p-DDT	0.19				53	53	51-132	0	30
Methoxychlor	1				100	72	44-147	33 *	30
Endosulfan Sulfate	0.19				121	126	78-143	4	30
Endrin Aldehyde	0.19				126	121	62-140	4	20

PUK62 1174

USAPHC

UNITED STATES ARMY PUBLIC HEALTH COMMAND (Provisional)

CHAIN OF CUSTODY RECORD

PAGE ____ OF ____

INSTALLATION - Camp Moscrip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)

H	4c	4c	4c							

ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	App IX VOCs	App IX SVOCs	LL PAHs	Pesticides						
MW-1	31 Jan 11	1400	X			3	3									
MW-1 MS	31 Jan 11	1400	X			4	4									
MW-1 MSD	31 Jan 11	1400	X			4	4									
MW-1 D	31 Jan 11	1415	X			3	3									
MW-3	31 Jan 11	1615	X			5	3	2								
EQ Blk Soil	1 Feb	0945	X			3	3									
EQ B/K Water	31 Jan	1300	X			7	3	2	2							
Trip Blank						2	2									
						31	25	4	2							
						31	<- Total Number of Containers									

HIPMENT METHOD - Fed Ex

Date Shipped- 1 Feb 2011

elinquished By:	Date & Time	Accepted By:	Date & Time	Comment/Remarks
Ben Hammond	1 Feb 1600	Fed Ex		
		Tammy Helel	2/2/11 1100	cooler # 2 temp = 0.5°C

trix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
eservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E, Oct 05 (MCHB-TS-LID)

Replaces CHPPM Form 235-R-E, Jan 05, which is obsolete

USAPHC

UNITED STATES ARMY PUBLIC HEALTH COMMAND (Provisional)

CHAIN OF CUSTODY RECORD

PAGE 1 OF 1

INSTALLATION - Camp Moserip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)

4c	4c									

ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	App IX SVOCs	Low Level PAHs									
MW-1	31 Jan 11	1400	X		GW	4	2	2									
MW-1 MS	↓	1400	X		↓	4	2	2									
MW-1 MSD	↓	1400	X		↓	4	2	2									
MW-1D	↓	1415	X		↓	4	2	2									
							8	8									
						16	<- Total Number of Containers										

BF 17

RPK

SHIPMENT METHOD - Fed Ex

Date Shipped - 1 Feb 2011

Relinquished By:	Date & Time	Accepted By:	Date & Time	Comment/Remarks
[illegible]	1600	Fed Ex		
		[illegible] LI	2/3/11 945	Cooler # 2 temp = 3.2°C

Matrix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
Preservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E, Oct 05 (MCHB-TS-LID)

Replaces CHPPM Form 235-R-E, Jan 05, which is obsolete

USAPHC

UNITED STATES ARMY PUBLIC HEALTH COMMAND (Provisional)

CHAIN OF CUSTODY RECORD

PAGE ____ OF ____

INSTALLATION - Camp Moscrip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)

ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	App IX Codes (H)	App IX Sw (4C)	LC Paths (4C)	Pesticides (4C)							
EQ Blank Soil	1 Feb 11	0945				6		2	2	2							
EQ Blank Soil MS&MSD	1 Feb 11	0945				2				2							
MW03	31 Jan 11	1615				2			2								
						10	<- Total Number of Containers										

BFB

SHIPMENT METHOD - Fed Ex Date Shipped- ____

Relinquished By:	Date & Time	Accepted By:	Date & Time	Comment/Remarks
[illegible]	1 Feb 1600	Fed Ex		
		Tammy Nelson	2/2/11 1100	Cooler #1 temp = 1.3°C

Matrix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
Preservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E, Oct 05 (MCHB-TS-LID) Replaces CHPPM Form 235-R-E, Jan 05, which is obsolete

USAPHC (PROV)
Directorate of Laboratory Sciences
5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403
Phone: (410)436-2208
Fax: (410)436-4108

TERMINOLOGY & ABBREVIATIONS

DF: Dilution Factor

DLS: Directorate of Laboratory Sciences

g: gram

J: The reported result is an estimated value; the result is between the method detection limit (MDL) and the reporting limit.

kg: kilogram

L: Liter

LCS: Laboratory Control Sample

LCSD: Laboratory Control Sample Duplicate

MDL: Method Detection Limit

mg: milligram

MS: Matrix Spike

MSD: Matrix Spike Duplicate

pCi: picocurie

Qual: Data Qualifier

RPD: Relative Percent Difference

(S): Surrogate Standard (Found in Analytical Results and QC Listings)

U: The analyte was not detected and is reported as less than the method reporting limit. Analytes not detected are reported as having a concentration below the reporting limit (as opposed to below the method detection limit (MDL)) due to the relatively high potential for reporting false negatives at the MDL.

ug: microgram

Uncert: Measurement Uncertainty (Reported in Radiochemical Analyses Only)

**Indicates QC failure. For example, recoveries or relative percent difference (RPD) out of range.

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DEPARTMENT OF THE ARMY
US Army Public Health Command (Provisional)
5158 Blackhawk Road
Aberdeen Proving Ground, Maryland 21010-5403

MCHB-TS-L 04 Mar 2011

MEMORANDUM FOR USAPHC Program 38 (GWSWP) (5158 Blackhawk Road/Mr. Brian Hammond), MCHB-IP-EGW, Bldg 1677, Gunpowder, MD 21010

SUBJECT: DLS Final Analytical Report

1. This is DLS Final Analytical Report for:

Project Site:	Camp Moscrip, PR
SubJono:	0995
DLS Work Order #:	1857
Report Serial #:	6789

2. Please contact us if this report or any of our services did not meet your needs or expectations.

3. Point of contact for additional information is Mr. Ronald J. Swatski or Mr. David F. Morrow, DSN 584-2208 or commercial 410-436-2208.

MR. FREDERIC BELKIN FOR
LTC KEVIN K. PITZER
Laboratory Operations Manager

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Phone: (410)436-2208
Fax: (410)436-4108

SAMPLE SUMMARY

Workorder: 1857 Camp Moscrip, PR

Lab ID	Sample ID	Matrix	Date Collected	Date Received
18570001	73SB01-05	Soil/Sludge/Sediment	2/2/2011 09:45	2/3/2011 09:45
18570002	73SB01-05D	Soil/Sludge/Sediment	2/2/2011 09:45	2/3/2011 09:45
18570003	73SB01-05 MS	Soil/Sludge/Sediment	2/2/2011 09:45	2/3/2011 09:45
18570004	73SB01-05 MSD	Soil/Sludge/Sediment	2/2/2011 09:45	2/3/2011 09:45

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Fax: (410)436-4108

PROJECT SUMMARY

Workorder: 1857 Camp Moscrip, PR

Workorder Comments

2,2'-oxybis[1-chloropropane] and bis(2-chloroisopropyl)ether cannot be separated and, as such, the results reported for bis(2-chloroisopropyl)ether represent a combined total for these two compounds.

Sample Comments

Lab ID: 18570001 **Sample ID:** 73SB01-05 **Sample Type:** SAMPLE

Temp 1.4C

Lab ID: 18570002 **Sample ID:** 73SB01-05D **Sample Type:** SAMPLE

Temp 1.4C

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The following report(s) comprise the

Contractor Data Report(s) for Analytical Tests

performed at contract laboratories

in support of the US Army Public Health Command.

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2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

Type I Data Package

Prepared for:

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

Project: Camp Moscrip
Soil Samples
Collected on 02/02/11

SDG# PUK63

GROUP	SAMPLE NUMBERS
1231846	6199070-6199071

PA Cert. # 36-00037
NY Cert. # 10670
NJ Cert. # PA011
NC Cert. # 521
TX Cert. # T104704194-08A-TX

Through our technical processes and second person review of data, we have established that our data/deliverables are in compliance with the methods and project requirements unless otherwise noted or previously resolved with the client.

Authorized by: **Date** 2/28/11

Dana M Kaufman
Dana M. Kaufman
Manager

Any questions or concerns you might have regarding this data package should be directed to your client representative, Katherine Klinefelter at Ext. 1566.

Total Number of Pages 1169

Lancaster Laboratories
2425 New Holland Pike, PO Box 12425, Lancaster, PA 17605-2425 • 717-656-2300 Fax: 717-656-2681 • www.lancasterlabs.com

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SDG# PUK63

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Sample Reference List for SDG Number PUK63
with a Data Package Type of I
04694 - U.S. Army IPH
Project: Camp Moscrip

Lab Sample Number	Lab Sample Code	Client Sample Description
6199070	70001	18570001 Camp Moscrip, PR #1857 Hammond Soil Field# 73SB01-05 # 11-P-0087
6199071	70002	18570002 Camp Moscrip, PR #1857 Hammond Soil Field# 73SB01-05D # 11-P-0087

PUK63 0001

Lancaster Laboratories

ANALYTICAL RESULTS

Prepared by:

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17605-2425

Prepared for:

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

February 15, 2011

Project: Camp Moscrip

Submittal Date: 02/03/2011
Group Number: 1231846
SDG: PUK63
PO Number: W91ZLK-11-P-0087
Release Number: W23MWP0321S003
State of Sample Origin: NA

Client Sample Description	Lancaster Labs (LLI) #
18570001 Camp Moscrip, PR #1857 Hammond Soil	6199070
18570002 Camp Moscrip, PR #1857 Hammond Soil	6199071

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC COPY TO U.S. Army IPH Attn: Heidi Taylor
1 COPY TO Data Package Group

Questions? Contact your Client Services Representative
Katherine A Klinefelter at (717) 656-2300 Ext. 1566

Respectfully Submitted,

Sarah M. Snyder
Senior Specialist

PUK63 0000

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2216 Rev. 3/27/06

Explanation of Symbols and Abbreviations

The following defines common symbols and abbreviations used in reporting technical data:

RL	Reporting Limit	**BMQL**	Below Minimum Quantitation Level
N.D.	none detected	**MPN**	Most Probable Number
TNTC	Too Numerous To Count	**CP Units**	cobalt-chloroplatinate units
IU	International Units	**NTU**	nephelometric turbidity units
umhos/cm	micromhos/cm	**ng**	nanogram(s)
C	degrees Celsius	**F**	degrees Fahrenheit
meq	milliequivalents	**lb.**	pound(s)
g	gram(s)	**kg**	kilogram(s)
ug	microgram(s)	**mg**	milligram(s)
ml	milliliter(s)	**l**	liter(s)
m3	cubic meter(s)	**ul**	microliter(s)

< less than - The number following the sign is the limit of quantitation, the smallest amount of analyte which can be reliably determined using this specific test.

> greater than

J estimated value -- The result is ≥ the Method Detection Limit (MDL) and < the Limit of Quantitation (LOQ).

ppm parts per million - One ppm is equivalent to one milligram per kilogram (mg/kg), or one gram per million grams. For aqueous liquids, ppm is usually taken to be equivalent to milligrams per liter (mg/l), because one liter of water has a weight very close to a kilogram. For gases or vapors, one ppm is equivalent to one microliter of gas per liter of gas.

ppb parts per billion

Dry weight basis Results printed under this heading have been adjusted for moisture content. This increases the analyte weight concentration to approximate the value present in a similar sample without moisture. All other results are reported on an as-received basis.

U.S. EPA CLP Data Qualifiers:

Organic Qualifiers

A	TIC is a possible aldol-condensation product
B	Analyte was also detected in the blank
C	Pesticide result confirmed by GC/MS
D	Compound quantitated on a diluted sample
E	Concentration exceeds the calibration range of the instrument
N	Presumptive evidence of a compound (TICs only)
P	Concentration difference between primary and confirmation columns >25%
U	Compound was not detected
X,Y,Z	Defined in case narrative

Inorganic Qualifiers

B	Value is <CRDL, but ≥IDL
E	Estimated due to interference
M	Duplicate injection precision not met
N	Spike sample not within control limits
S	Method of standard additions (MSA) used for calculation
U	Compound was not detected
W	Post digestion spike out of control limits
*****	Duplicate analysis not within control limits
+	Correlation coefficient for MSA <0.995

Analytical test results meet all requirements of NELAC unless otherwise noted under the individual analysis.

Measurement uncertainty values, as applicable, are available upon request.

Tests results relate only to the sample tested. Clients should be aware that a critical step in a chemical or microbiological analysis is the collection of the sample. Unless the sample analyzed is truly representative of the bulk of material involved, the test results will be meaningless. If you have questions regarding the proper techniques of collecting samples, please contact us. We cannot be held responsible for sample integrity, however, unless sampling has been performed by a member of our staff. This report shall not be reproduced except in full, without the written approval of the laboratory.

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PUR63 9889

Analysis Report

Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70001 SDG#: PUK63-01BKG

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B		ug/kg		ug/kg	ug/kg	
10949	Acetone	67-64-1	98		23	8	0.9
10949	Acetonitrile	75-05-8	N.D.		120	29	0.9
10949	Acrolein	107-02-8	N.D.		120	23	0.9
10949	Acrylonitrile	107-13-1	N.D.		23	5	0.9
10949	Allyl Chloride	107-05-1	N.D.		6	1	0.9
10949	Benzene	71-43-2	N.D.		6	0.6	0.9
10949	Bromodichloromethane	75-27-4	N.D.		6	1	0.9
10949	Bromoform	75-25-2	N.D.		6	1	0.9
10949	Bromomethane	74-83-9	N.D.		6	2	0.9
10949	2-Butanone	78-93-3	N.D.		12	5	0.9
10949	Carbon Disulfide	75-15-0	N.D.		6	1	0.9
10949	Carbon Tetrachloride	56-23-5	N.D.		6	1	0.9
10949	2-Chloro-1,3-butadiene	126-99-8	N.D.		6	1	0.9
10949	Chlorobenzene	108-90-7	N.D.		6	1	0.9
10949	Chloroethane	75-00-3	N.D.		6	2	0.9
10949	Chloroform	67-66-3	N.D.		6	1	0.9
10949	Chloromethane	74-87-3	3	J	6	2	0.9
10949	1,2-Dibromo-3-chloropropane	96-12-8	N.D.		6	2	0.9
10949	Dibromochloromethane	124-48-1	N.D.		6	1	0.9
10949	1,2-Dibromoethane	106-93-4	N.D.		6	1	0.9
10949	Dibromomethane	74-95-3	N.D.		6	1	0.9
10949	trans-1,4-Dichloro-2-butene	110-57-6	N.D.		59	12	0.9
10949	Dichlorodifluoromethane	75-71-8	N.D.		6	2	0.9
10949	1,1-Dichloroethane	75-34-3	N.D.		6	1	0.9
10949	1,2-Dichloroethane	107-06-2	N.D.		6	1	0.9
10949	1,1-Dichloroethene	75-35-4	N.D.		6	1	0.9
10949	cis-1,2-Dichloroethene	156-59-2	N.D.		6	1	0.9
10949	trans-1,2-Dichloroethene	156-60-5	N.D.		6	1	0.9
10949	1,2-Dichloropropane	78-87-5	N.D.		6	1	0.9
10949	cis-1,3-Dichloropropene	10061-01-5	N.D.		6	1	0.9
10949	trans-1,3-Dichloropropene	10061-02-6	N.D.		6	1	0.9
10949	Ethyl Methacrylate	97-63-2	N.D.		6	1	0.9
10949	Ethylbenzene	100-41-4	N.D.		6	1	0.9
10949	2-Hexanone	591-78-6	N.D.		12	4	0.9
10949	Isobutyl Alcohol	78-83-1	N.D.		290	120	0.9
10949	Methacrylonitrile	126-98-7	N.D.		59	6	0.9
10949	Methyl Iodide	74-88-4	N.D.		6	4	0.9
10949	Methyl Methacrylate	80-62-6	N.D.		6	1	0.9
10949	4-Methyl-2-pentanone	108-10-1	N.D.		12	4	0.9
10949	Methylene Chloride	75-09-2	N.D.		6	2	0.9
10949	Pentachloroethane	76-01-7	N.D.		6	1	0.9
10949	Propionitrile	107-12-0	N.D.		120	35	0.9
10949	Styrene	100-42-5	N.D.		6	1	0.9
10949	1,1,1,2-Tetrachloroethane	630-20-6	N.D.		6	1	0.9
10949	1,1,2,2-Tetrachloroethane	79-34-5	N.D.		6	1	0.9
10949	Tetrachloroethene	127-18-4	N.D.		6	1	0.9
10949	Toluene	108-88-3	N.D.		6	1	0.9
10949	1,1,1-Trichloroethane	71-55-6	N.D.		6	1	0.9
10949	1,1,2-Trichloroethane	79-00-5	N.D.		6	1	0.9
10949	Trichloroethene	79-01-6	N.D.		6	1	0.9

PUK63 0018

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70001 SDG#: PUK63-01BKG

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10949	Trichlorofluoromethane	75-69-4	N.D.	6	2	0.9
10949	1,2,3-Trichloropropane	96-18-4	N.D.	6	1	0.9
10949	Vinyl Acetate	108-05-4	N.D.	12	2	0.9
10949	Vinyl Chloride	75-01-4	N.D.	6	1	0.9
10949	Xylene (Total)	1330-20-7	N.D.	6	1	0.9
GC/MS Semivolatiles	**SW-846 8270C**		**ug/kg**	**ug/kg**	**ug/kg**	
10723	Acenaphthene	83-32-9	N.D.	220	43	1
10723	Acenaphthylene	208-96-8	N.D.	220	43	1
10723	Acetophenone	98-86-2	N.D.	220	87	1
10723	2-Acetylaminofluorene	53-96-3	N.D.	220	87	1
10723	4-Aminobiphenyl	92-67-1	N.D.	650	220	1
10723	Aniline	62-53-3	N.D.	650	220	1
10723	Anthracene	120-12-7	N.D.	220	43	1
10723	Aramite	140-57-8	N.D.	2,200	87	1
10723	Benzo(a)anthracene	56-55-3	N.D.	220	43	1
10723	Benzo(a)pyrene	50-32-8	N.D.	220	43	1
10723	Benzo(b)fluoranthene	205-99-2	N.D.	220	43	1
10723	Benzo(g,h,i)perylene	191-24-2	N.D.	220	43	1
10723	Benzo(k)fluoranthene	207-08-9	N.D.	220	43	1
10723	Benzyl alcohol	100-51-6	N.D.	650	220	1
10723	4-Bromophenyl-phenylether	101-55-3	N.D.	220	43	1
10723	Butylbenzylphthalate	85-68-7	N.D.	220	87	1
10723	Di-n-butylphthalate	84-74-2	N.D.	220	87	1
10723	4-Chloro-3-methylphenol	59-50-7	N.D.	220	87	1
10723	4-Chloroaniline	106-47-8	N.D.	220	87	1
10723	Chlorobenzilate	510-15-6	N.D.	220	43	1
10723	bis(2-Chloroethoxy)methane	111-91-1	N.D.	220	43	1
10723	bis(2-Chloroethyl)ether	111-44-4	N.D.	220	43	1
10723	bis(2-Chloroisopropyl)ether	39638-32-9	N.D.	220	43	1
10723	2-Chloronaphthalene	91-58-7	N.D.	220	43	1
10723	2-Chlorophenol	95-57-8	N.D.	220	43	1
10723	4-Chlorophenyl-phenylether	7005-72-3	N.D.	220	43	1
10723	Chrysene	218-01-9	N.D.	220	43	1
10723	Diallate TRANS/CIS	2303-16-4	N.D.	220	43	1
10723	Dibenz(a,h)anthracene	53-70-3	N.D.	220	43	1
10723	Dibenzofuran	132-64-9	N.D.	220	43	1
10723	1,2-Dichlorobenzene	95-50-1	N.D.	220	43	1
10723	1,3-Dichlorobenzene	541-73-1	N.D.	220	43	1
10723	1,4-Dichlorobenzene	106-46-7	N.D.	220	43	1
10723	3,3'-Dichlorobenzidine	91-94-1	N.D.	430	130	1
10723	2,4-Dichlorophenol	120-83-2	N.D.	220	43	1
10723	2,6-Dichlorophenol	87-65-0	N.D.	220	87	1
10723	Diethylphthalate	84-66-2	N.D.	220	87	1
10723	Dimethoate	60-51-5	N.D.	650	220	1
10723	p-Dimethylaminoazobenzene	60-11-7	N.D.	220	87	1
10723	7,12-Dimethylbenz[a]anthracene	57-97-6	N.D.	220	43	1
10723	3,3'-Dimethylbenzidine	119-93-7	N.D.	1,300	430	1
10723	a,a-Dimethylphenethylamine	122-09-8	N.D.	2,200	130	1

PUK63 0811

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70001 SDG#: PUK63-01BKG

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS	Semivolatiles SW-846 8270C		ug/kg	ug/kg	ug/kg	
10723	2,4-Dimethylphenol	105-67-9	N.D.	220	87	1
10723	Dimethylphthalate	131-11-3	N.D.	220	87	1
10723	4,6-Dinitro-2-methylphenol	534-52-1	N.D.	650	220	1
10723	1,3-Dinitrobenzene	99-65-0	N.D.	220	87	1
10723	2,4-Dinitrophenol	51-28-5	N.D.	1,300	430	1
10723	2,4-Dinitrotoluene	121-14-2	N.D.	220	87	1
10723	2,6-Dinitrotoluene	606-20-2	N.D.	220	43	1
10723	1,4-Dioxane	123-91-1	N.D.	430	130	1
10723	Ethyl methanesulfonate	62-50-0	N.D.	220	87	1
10723	bis(2-Ethylhexyl)phthalate	117-81-7	N.D.	430	87	1
10723	Fluoranthene	206-44-0	N.D.	220	43	1
10723	Fluorene	86-73-7	N.D.	220	43	1
10723	Hexachlorobenzene	118-74-1	N.D.	220	43	1
10723	Hexachlorobutadiene	87-68-3	N.D.	220	87	1
10723	Hexachlorocyclopentadiene	77-47-4	N.D.	650	220	1
10723	Hexachloroethane	67-72-1	N.D.	220	43	1
10723	Hexachloropropene	1888-71-7	N.D.	430	130	1
10723	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.	220	43	1
10723	Isodrin	465-73-6	N.D.	220	43	1
10723	Isophorone	78-59-1	N.D.	220	43	1
10723	Isosafrole	120-58-1	N.D.	220	87	1
10723	Methapyrilene	91-80-5	N.D.	6,500	2,200	1
10723	Methyl methanesulfonate	66-27-3	N.D.	220	43	1
10723	3-Methylcholanthrene	56-49-5	N.D.	220	87	1
10723	2-Methylnaphthalene	91-57-6	N.D.	220	43	1
10723	2-Methylphenol	95-48-7	N.D.	220	87	1
10723	4-Methylphenol	106-44-5	N.D.	220	87	1
	3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.					
10723	Naphthalene	91-20-3	N.D.	220	43	1
10723	1,4-Naphthoquinone	130-15-4	N.D.	4,300	1,100	1
10723	1-Naphthylamine	134-32-7	N.D.	650	220	1
10723	2-Naphthylamine	91-59-8	N.D.	650	220	1
10723	2-Nitroaniline	88-74-4	N.D.	220	43	1
10723	3-Nitroaniline	99-09-2	N.D.	220	87	1
10723	4-Nitroaniline	100-01-6	N.D.	220	87	1
10723	Nitrobenzene	98-95-3	N.D.	220	43	1
10723	5-Nitro-o-toluidine	99-55-8	N.D.	650	220	1
10723	2-Nitrophenol	88-75-5	N.D.	220	43	1
10723	4-Nitrophenol	100-02-7	N.D.	650	220	1
10723	4-Nitroquinoline-1-oxide	56-57-5	N.D.	1,300	430	1
10723	N-Nitrosodiethylamine	55-18-5	N.D.	220	87	1
10723	N-Nitrosodimethylamine	62-75-9	N.D.	220	87	1
10723	N-Nitrosodi-n-butylamine	924-16-3	N.D.	220	87	1
10723	N-Nitroso-di-n-propylamine	621-64-7	N.D.	220	43	1
10723	N-Nitrosodiphenylamine	86-30-6	N.D.	220	43	1
	N-nitrosodiphenylamine decomposes in the GC inlet forming diphenylamine. The result reported for N-nitrosodiphenylamine represents the combined total of both compounds.					

PUK63 0012

*=This limit was used in the evaluation of the final result

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Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
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Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

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U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
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70001 SDG#: PUK63-01BKG

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	SW-846 8270C		ug/kg	ug/kg	ug/kg	
10723	N-Nitrosomethylethylamine	10595-95-6	N.D.	220	87	1
10723	N-Nitrosomorpholine	59-89-2	N.D.	220	87	1
10723	N-Nitrosopiperidine	100-75-4	N.D.	220	87	1
10723	N-Nitrosopyrrolidine	930-55-2	N.D.	220	87	1
10723	Di-n-octylphthalate	117-84-0	N.D.	220	87	1
10723	Pentachlorobenzene	608-93-5	N.D.	220	87	1
10723	Pentachloronitrobenzene	82-68-8	N.D.	220	87	1
10723	Pentachlorophenol	87-86-5	N.D.	650	220	1
10723	Phenacetin	62-44-2	N.D.	220	87	1
10723	Phenanthrene	85-01-8	N.D.	220	43	1
10723	Phenol	108-95-2	N.D.	220	43	1
10723	1,4-Phenylenediamine	106-50-3	N.D.	43,000	15,000	1
10723	2-Picoline	109-06-8	N.D.	430	130	1
10723	Pronamide	23950-58-5	N.D.	220	43	1
10723	Pyrene	129-00-0	N.D.	220	43	1
10723	Pyridine	110-86-1	N.D.	220	87	1
10723	Safrole	94-59-7	N.D.	220	87	1
10723	1,2,4,5-Tetrachlorobenzene	95-94-3	N.D.	220	87	1
10723	2,3,4,6-Tetrachlorophenol	58-90-2	N.D.	220	87	1
10723	Tetraethyldithiopyrophosphate	3689-24-5	N.D.	220	87	1
10723	Thionazin	297-97-2	N.D.	220	87	1
10723	o-Toluidine	95-53-4	N.D.	870	260	1
10723	1,2,4-Trichlorobenzene	120-82-1	N.D.	220	43	1
10723	2,4,5-Trichlorophenol	95-95-4	N.D.	220	87	1
10723	2,4,6-Trichlorophenol	88-06-2	N.D.	220	43	1
10723	O,O,O-Triethylphosphorothioate	126-68-1	N.D.	220	87	1
10723	1,3,5-Trinitrobenzene	99-35-4	N.D.	650	220	1

The LCS and/or LCSD recoveries are outside the stated QC window but within the marginal exceedance allowance of +/- 4 standard deviations as defined in the NELAC Standards. The following analytes are accepted based on this allowance:
n-nitrosodiphenylamine

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

GC/MS Semivolatiles	SW-846 8270C SIM		ug/kg	ug/kg	ug/kg	
10722	Acenaphthene	83-32-9	N.D.	22	8.7	10
10722	Acenaphthylene	208-96-8	N.D.	22	4.3	10
10722	Anthracene	120-12-7	N.D.	22	4.3	10
10722	Benzo(a)anthracene	56-55-3	N.D.	22	8.7	10
10722	Benzo(a)pyrene	50-32-8	N.D.	22	8.7	10
10722	Benzo(b)fluoranthene	205-99-2	N.D.	22	8.7	10
10722	Benzo(g,h,i)perylene	191-24-2	N.D.	22	8.7	10
10722	Benzo(k)fluoranthene	207-08-9	N.D.	22	8.7	10

PUK63 0013

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
2425 New Holland Pike
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Analysis Report

Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70001 SDG#: PUK63-01BKG

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Semivolatiles	**SW-846 8270C SIM**		ug/kg		ug/kg	ug/kg	
10722	Chrysene	218-01-9	N.D.		22	4.3	10
10722	Dibenz(a,h)anthracene	53-70-3	N.D.		22	8.7	10
10722	Fluoranthene	206-44-0	N.D.		22	8.7	10
10722	Fluorene	86-73-7	N.D.		22	8.7	10
10722	Indeno(1,2,3-cd)pyrene	193-39-5	N.D.		22	8.7	10
10722	1-Methylnaphthalene	90-12-0	N.D.		22	8.7	10
10722	2-Methylnaphthalene	91-57-6	N.D.		22	8.7	10
10722	Naphthalene	91-20-3	N.D.		22	8.7	10
10722	Phenanthrene	85-01-8	N.D.		22	8.7	10
10722	Pyrene	129-00-0	N.D.		22	8.7	10
Reporting limits were raised due to interference from the sample matrix.							
Pesticides/PCBs	**SW-846 8081A**		ug/kg		ug/kg	ug/kg	
10738	Aldrin	309-00-2	N.D.		1.1	0.22	1
10738	Alpha BHC	319-84-6	N.D.		1.1	0.22	1
10738	Beta BHC	319-85-7	N.D.		2.5	1.2	1
10738	Gamma BHC - Lindane	58-89-9	N.D.		1.1	0.22	1
10738	Chlordane	57-74-9	N.D.		22	5.2	1
10738	p,p-DDD	72-54-8	N.D.		2.2	0.43	1
10738	p,p-DDE	72-55-9	N.D.		2.2	0.43	1
10738	p,p-DDT	50-29-3	N.D.		2.2	0.43	1
10738	Delta BHC	319-86-8	N.D.		1.1	0.59	1
10738	Dieldrin	60-57-1	N.D.		2.2	0.43	1
10738	Endosulfan I	959-98-8	N.D.		1.1	0.29	1
10738	Endosulfan II	33213-65-9	1.0	J	2.2	0.43	1
10738	Endosulfan Sulfate	1031-07-8	N.D.		2.2	0.43	1
10738	Endrin	72-20-8	N.D.		2.2	0.43	1
10738	Endrin Aldehyde	7421-93-4	N.D.		2.2	0.43	1
10738	Heptachlor	76-44-8	N.D.		1.1	0.22	1
10738	Heptachlor Epoxide	1024-57-3	N.D.		1.1	0.22	1
10738	Kepone	143-50-0	N.D.		9.1	3.0	1
10738	Methoxychlor	72-43-5	N.D.		11	2.2	1
10738	Toxaphene	8001-35-2	N.D.		43	14	1
Wet Chemistry	**SM20 2540 G**		%		%	%	
00111	Moisture	n.a.	23.1		0.50	0.50	1
"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.							

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

PUK63 0014

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Lancaster Laboratories

Sample Description: 18570001 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05 # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199070
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70001 SDG#: PUK63-01BKG

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10949	VOCs Camp Moscrip List - soil	SW-846 8260B	1	X110391AA	02/08/2011 14:32	Emily R Styer	0.9
08389	GC/MS - LL Encore Prep	SW-846 5035	1	201103523643	02/03/2011 20:14	Lois E Hiltz	n.a.
08389	GC/MS - LL Encore Prep	SW-846 5035	2	201103523643	02/03/2011 20:13	Lois E Hiltz	n.a.
08389	GC/MS - LL Encore Prep	SW-846 5035	3	201103523643	02/03/2011 20:19	Lois E Hiltz	n.a.
08389	GC/MS - LL Encore Prep	SW-846 5035	4	201103523643	02/03/2011 20:18	Lois E Hiltz	n.a.
07578	GC/MS-HL Encore Prep-NC	SW-846 5035	1	201103523643	02/03/2011 20:12	Lois E Hiltz	n.a.
10723	SVOCs Camp Moscrip List - soil	SW-846 8270C	1	11036SLA026	02/11/2011 06:41	Linda M Hartenstine	1
10722	SIM PAHs - soil	SW-846 8270C SIM	1	11040SLB026	02/11/2011 04:28	Gregory J Drahovsky	10
10813	BNA Soil Microwave APP IX	SW-846 3546	1	11036SLA026	02/07/2011 10:25	Kerrie A Freeburn	1
10810	BNA Soil Microwave SIM PAH	SW-846 3546	1	11040SLB026	02/09/2011 18:30	Sally L Appleyard	1
10738	App IX OC Pesticides - soil	SW-846 8081A	1	110360005A	02/07/2011 17:32	Jamie L Brillhart	1
10738	App IX OC Pesticides - soil	SW-846 8081A	1	110360005A	02/07/2011 19:47	Jamie L Brillhart	1
10496	PPL Pest. Microwave Extraction	SW-846 3546	1	110360005A	02/06/2011 15:15	Wanda F Oswald	1
00111	Moisture	SM20 2540 G	1	11040820001B	02/09/2011 16:06	Scott W Freisher	1

PUK63 0015

*=This limit was used in the evaluation of the final result

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2425 New Holland Pike
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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18570002 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05D # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199071
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70002 SDG#: PUK63-02FD*

CAT No.	Analysis Name	CAS Number	Dry Result		Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	SW-846 8260B		ug/kg		ug/kg	ug/kg	
10949	Acetone	67-64-1	350		23	8	0.9
10949	Acetonitrile	75-05-8	N.D.		110	28	0.9
10949	Acrolein	107-02-8	N.D.		110	23	0.9
10949	Acrylonitrile	107-13-1	N.D.		23	5	0.9
10949	Allyl Chloride	107-05-1	N.D.		6	1	0.9
10949	Benzene	71-43-2	N.D.		6	0.6	0.9
10949	Bromodichloromethane	75-27-4	N.D.		6	1	0.9
10949	Bromoform	75-25-2	N.D.		6	1	0.9
10949	Bromomethane	74-83-9	N.D.		6	2	0.9
10949	2-Butanone	78-93-3	15		11	5	0.9
10949	Carbon Disulfide	75-15-0	1	J	6	1	0.9
10949	Carbon Tetrachloride	56-23-5	N.D.		6	1	0.9
10949	2-Chloro-1,3-butadiene	126-99-8	N.D.		6	1	0.9
10949	Chlorobenzene	108-90-7	N.D.		6	1	0.9
10949	Chloroethane	75-00-3	N.D.		6	2	0.9
10949	Chloroform	67-66-3	N.D.		6	1	0.9
10949	Chloromethane	74-87-3	5	J	6	2	0.9
10949	1,2-Dibromo-3-chloropropane	96-12-8	N.D.		6	2	0.9
10949	Dibromochloromethane	124-48-1	N.D.		6	1	0.9
10949	1,2-Dibromoethane	106-93-4	N.D.		6	1	0.9
10949	Dibromomethane	74-95-3	N.D.		6	1	0.9
10949	trans-1,4-Dichloro-2-butene	110-57-6	N.D.		57	11	0.9
10949	Dichlorodifluoromethane	75-71-8	N.D.		6	2	0.9
10949	1,1-Dichloroethane	75-34-3	N.D.		6	1	0.9
10949	1,2-Dichloroethane	107-06-2	N.D.		6	1	0.9
10949	1,1-Dichloroethene	75-35-4	N.D.		6	1	0.9
10949	cis-1,2-Dichloroethene	156-59-2	N.D.		6	1	0.9
10949	trans-1,2-Dichloroethene	156-60-5	N.D.		6	1	0.9
10949	1,2-Dichloropropane	78-87-5	N.D.		6	1	0.9
10949	cis-1,3-Dichloropropene	10061-01-5	N.D.		6	1	0.9
10949	trans-1,3-Dichloropropene	10061-02-6	N.D.		6	1	0.9
10949	Ethyl Methacrylate	97-63-2	N.D.		6	1	0.9
10949	Ethylbenzene	100-41-4	N.D.		6	1	0.9
10949	2-Hexanone	591-78-6	N.D.		11	3	0.9
10949	Isobutyl Alcohol	78-83-1	N.D.		280	110	0.9
10949	Methacrylonitrile	126-98-7	N.D.		57	6	0.9
10949	Methyl Iodide	74-88-4	15		6	3	0.9
10949	Methyl Methacrylate	80-62-6	N.D.		6	1	0.9
10949	4-Methyl-2-pentanone	108-10-1	N.D.		11	3	0.9
10949	Methylene Chloride	75-09-2	N.D.		6	2	0.9
10949	Pentachloroethane	76-01-7	N.D.		6	1	0.9
10949	Propionitrile	107-12-0	N.D.		110	34	0.9
10949	Styrene	100-42-5	N.D.		6	1	0.9
10949	1,1,1,2-Tetrachloroethane	630-20-6	N.D.		6	1	0.9
10949	1,1,2,2-Tetrachloroethane	79-34-5	N.D.		6	1	0.9
10949	Tetrachloroethene	127-18-4	N.D.		6	1	0.9
10949	Toluene	108-88-3	N.D.		6	1	0.9
10949	1,1,1-Trichloroethane	71-55-6	N.D.		6	1	0.9
10949	1,1,2-Trichloroethane	79-00-5	N.D.		6	1	0.9
10949	Trichloroethene	79-01-6	N.D.		6	1	0.9

PUK63 0016

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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Analysis Report

Lancaster Laboratories

Sample Description: 18570002 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05D # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199071
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70002 SDG#: PUK63-02FD*

CAT No.	Analysis Name	CAS Number	Dry Result	Dry Limit of Quantitation*	Dry Method Detection Limit	Dilution Factor
GC/MS Volatiles	**SW-846 8260B**		**ug/kg**	**ug/kg**	**ug/kg**	
10949	Trichlorofluoromethane	75-69-4	N.D.	6	2	0.9
10949	1,2,3-Trichloropropane	96-18-4	N.D.	6	1	0.9
10949	Vinyl Acetate	108-05-4	N.D.	11	2	0.9
10949	Vinyl Chloride	75-01-4	N.D.	6	1	0.9
10949	Xylene (Total)	1330-20-7	N.D.	6	1	0.9
Pesticides/PCBs	**SW-846 8081A**		**ug/kg**	**ug/kg**	**ug/kg**	
10738	Aldrin	309-00-2	N.D.	1.0	0.21	1
10738	Alpha BHC	319-84-6	N.D.	1.0	0.21	1
10738	Beta BHC	319-85-7	N.D.	2.4	1.2	1
10738	Gamma BHC - Lindane	58-89-9	N.D.	1.0	0.21	1
10738	Chlordane	57-74-9	N.D.	21	5.1	1
10738	p,p-DDD	72-54-8	0.85 J	2.1	0.42	1
10738	p,p-DDE	72-55-9	N.D.	2.1	0.42	1
10738	p,p-DDT	50-29-3	N.D.	2.1	0.42	1
10738	Delta BHC	319-86-8	N.D.	1.0	0.57	1
10738	Dieldrin	60-57-1	N.D.	2.1	0.42	1
10738	Endosulfan I	959-98-8	N.D.	1.0	0.28	1
10738	Endosulfan II	33213-65-9	2.2	2.1	0.42	1
10738	Endosulfan Sulfate	1031-07-8	N.D.	2.1	0.42	1
10738	Endrin	72-20-8	N.D.	2.1	0.42	1
10738	Endrin Aldehyde	7421-93-4	N.D.	2.1	0.42	1
10738	Heptachlor	76-44-8	N.D.	1.0	0.21	1
10738	Heptachlor Epoxide	1024-57-3	N.D.	1.0	0.21	1
10738	Kepone	143-50-0	N.D.	8.8	2.9	1
10738	Methoxychlor	72-43-5	N.D.	10	2.1	1
10738	Toxaphene	8001-35-2	N.D.	42	14	1
Wet Chemistry	**SM20 2540 G**		**%**	**%**	**%**	
00111	Moisture	n.a.	20.8	0.50	0.50	1

"Moisture" represents the loss in weight of the sample after oven drying at 103 - 105 degrees Celsius. The moisture result reported above is on an as-received basis.

General Sample Comments

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10949	VOCs Camp Moscrip List - soil	SW-846 8260B	1	X110391AA	02/08/2011 15:41	Emily R Styer	0.9
08389	GC/MS - LL Encore Prep	SW-846 5035	1	201103523643	02/03/2011 20:16	Lois E Hiltz	n.a.
08389	GC/MS - LL Encore Prep	SW-846 5035	2	201103523643	02/03/2011 20:17	Lois E Hiltz	n.a.

PUK63 0017

*=This limit was used in the evaluation of the final result

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2216 Rev. 3/27/06

Analysis Report

Lancaster Laboratories

Sample Description: 18570002 Camp Moscrip, PR #1857 Hammond Soil
Field# 73SB01-05D # 11-P-0087
Pick-Up Order# 002 Delivery Order# 01 Soil

LLI Sample # SW 6199071
LLI Group # 1231846
Account # 04694

Project Name: Camp Moscrip

Collected: 02/02/2011 09:45

Submitted: 02/03/2011 09:45
Reported: 02/15/2011 10:26

U.S. Army IPH
325 Brooks Road
VPAY SOMARDS
Rome NY 13441-4527

70002 SDG#: PUK63-02FD*

Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
07578	GC/MS-HL Encore Prep-NC	SW-846 5035	1	201103523643	02/03/2011 20:15	Lois E Hiltz	n.a.
07578	GC/MS-HL Encore Prep-NC	SW-846 5035	2	201103523643	02/03/2011 20:18	Lois E Hiltz	n.a.
10738	App IX OC Pesticides - soil	SW-846 8081A	1	110360005A	02/07/2011 17:45	Jamie L Brillhart	1
10738	App IX OC Pesticides - soil	SW-846 8081A	1	110360005A	02/07/2011 20:01	Jamie L Brillhart	1
10496	PPL Pest. Microwave Extraction	SW-846 3546	1	110360005A	02/06/2011 15:15	Wanda F Oswald	1
00111	Moisture	SM20 2540 G	1	11040820001B	02/09/2011 16:06	Scott W Freisher	1

PUK63 0010

*=This limit was used in the evaluation of the final result

Lancaster Laboratories, Inc.
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2216 Rev. 3/27/06

Volatiles by GC/MS Data

PDK63 8819

Case Narrative Conformance/Nonconformance Summary

PUK63 0020

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Volatiles
Fraction: Volatiles by GC/MS

VOCs Camp Moscrip List - soil

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199070	Field# 73SB01-05		X	
6199071	Field# 73SB01-05D		X	Field Duplicate Sample

See QC Reference List for Associated Batch QC Samples

SAMPLE PREPARATION:

The following samples are outside the weight requirement: 6199070 and 6199071.

No problems were encountered with the preparation of the samples.

ANALYSIS:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA Methods for organic compounds do not require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

DATA INTERPRETATION :

No further interpretation is necessary for the data submitted.

PUK63 0021

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Volatiles
Fraction: Volatiles by GC/MS

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2-28-11 by Grace Salm
(Date)

PUK63 0822

Quality Control and Calibration Summary Forms

PUX63. 0823

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391A / VBLKX38 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Dichlorodifluoromethane	02/08/11	N.D.	ug/kg	2	5
Chloromethane	02/08/11	N.D.	ug/kg	2	5
Vinyl Chloride	02/08/11	N.D.	ug/kg	1	5
Bromomethane	02/08/11	N.D.	ug/kg	2	5
Chloroethane	02/08/11	N.D.	ug/kg	2	5
Trichlorofluoromethane	02/08/11	N.D.	ug/kg	2	5
Acrolein	02/08/11	N.D.	ug/kg	20	100
1,1-Dichloroethene	02/08/11	N.D.	ug/kg	1	5
Acetone	02/08/11	N.D.	ug/kg	7	20
Allyl Chloride	02/08/11	N.D.	ug/kg	1	5
Carbon Disulfide	02/08/11	N.D.	ug/kg	1	5
Methyl Iodide	02/08/11	N.D.	ug/kg	3	5
1,1,1-Trichloroethane	02/08/11	N.D.	ug/kg	1	5
1,1-Dichloroethane	02/08/11	N.D.	ug/kg	1	5
1,2-Dichloroethane	02/08/11	N.D.	ug/kg	1	5
1,2-Dichloropropane	02/08/11	N.D.	ug/kg	1	5
2-Butanone	02/08/11	N.D.	ug/kg	4	10
2-Chloro-1,3-butadiene	02/08/11	N.D.	ug/kg	1	5
4-Methyl-2-pentanone	02/08/11	N.D.	ug/kg	3	10
Acrylonitrile	02/08/11	N.D.	ug/kg	4	20
Benzene	02/08/11	N.D.	ug/kg	0.5	5
Bromodichloromethane	02/08/11	N.D.	ug/kg	1	5
Carbon Tetrachloride	02/08/11	N.D.	ug/kg	1	5
Chloroform	02/08/11	N.D.	ug/kg	1	5
cis-1,2-Dichloroethene	02/08/11	N.D.	ug/kg	1	5
cis-1,3-Dichloropropene	02/08/11	N.D.	ug/kg	1	5
Dibromomethane	02/08/11	N.D.	ug/kg	1	5
Isobutyl Alcohol	02/08/11	N.D.	ug/kg	100	250
Methacrylonitrile	02/08/11	N.D.	ug/kg	5	50
Methyl Methacrylate	02/08/11	N.D.	ug/kg	1	5
Methylene Chloride	02/08/11	N.D.	ug/kg	2	5
Propionitrile	02/08/11	N.D.	ug/kg	30	100
Toluene	02/08/11	N.D.	ug/kg	1	5
trans-1,2-Dichloroethene	02/08/11	N.D.	ug/kg	1	5
Trichloroethene	02/08/11	N.D.	ug/kg	1	5
Vinyl Acetate	02/08/11	N.D.	ug/kg	2	10
1,1,1,2-Tetrachloroethane	02/08/11	N.D.	ug/kg	1	5
1,1,2,2-Tetrachloroethane	02/08/11	N.D.	ug/kg	1	5
1,1,2-Trichloroethane	02/08/11	N.D.	ug/kg	1	5
1,2,3-Trichloropropane	02/08/11	N.D.	ug/kg	1	5
1,2-Dibromo-3-chloropropane	02/08/11	N.D.	ug/kg	2	5
1,2-Dibromoethane	02/08/11	N.D.	ug/kg	1	5
2-Hexanone	02/08/11	N.D.	ug/kg	3	10
Bromoform	02/08/11	N.D.	ug/kg	1	5
Chlorobenzene	02/08/11	N.D.	ug/kg	1	5

PUK63 0024

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391A / VBLKX38 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Dibromochloromethane	02/08/11	N.D.	ug/kg	1	5
Ethyl Methacrylate	02/08/11	N.D.	ug/kg	1	5
Ethylbenzene	02/08/11	N.D.	ug/kg	1	5
Pentachloroethane	02/08/11	N.D.	ug/kg	1	5
Styrene	02/08/11	N.D.	ug/kg	1	5
Tetrachloroethene	02/08/11	N.D.	ug/kg	1	5
trans-1,3-Dichloropropene	02/08/11	N.D.	ug/kg	1	5
trans-1,4-Dichloro-2-butene	02/08/11	N.D.	ug/kg	10	50
Xylene (Total)	02/08/11	N.D.	ug/kg	1	5
Acetonitrile	02/08/11	N.D.	ug/kg	25	100

PUK63 0825

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391AA	Dibromofluoromethane		1,2-Dichloroethane-d4		Toluene-d8		4-Bromofluorobenzene	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
6199070	100	71 - 114	108	70 - 109	98	70 - 123	90	70 - 111
6199070 MSD	99	71 - 114	103	70 - 109	117	70 - 123	84	70 - 111
6199070 MS	99	71 - 114	104	70 - 109	121	70 - 123	79	70 - 111
6199071	98	71 - 114	98	70 - 109	102	70 - 123	86	70 - 111
LCSX38	98	71 - 114	104	70 - 109	105	70 - 123	98	70 - 111
LCS1X38	98	71 - 114	103	70 - 109	93	70 - 123	92	70 - 111
LCD1X38	99	71 - 114	104	70 - 109	97	70 - 123	97	70 - 111
VBLKX38	100	71 - 114	101	70 - 109	97	70 - 123	96	70 - 111

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/kg)
4-Bromofluorobenzene	50
Toluene-d8	50
1,2-Dichloroethane-d4	50
Dibromofluoromethane	50

PUK63 0826

2/25/2011 8:04:58 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391AA Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Dichlorodifluoromethane	17.954	N.D.	17.12	16.97	95	95	26-151	1	30
Chloromethane	17.954	2.09	23.12	24.29	117	124	51-163	5	30
Vinyl Chloride	17.954	N.D.	19.14	19.98	107	112	50-154	4	30
Bromomethane	17.954	N.D.	15.80	16.82	88	94	42-168	6	30
Chloroethane	17.954	N.D.	15.66	16.32	87	91	39-152	4	30
Trichlorofluoromethane	17.954	N.D.	17.52	17.58	98	98	47-163	0	30
Acrolein	134.655	N.D.	164.44	133.86	122	100	10-165	20	30
1,1-Dichloroethene	17.954	N.D.	19.88	18.79	111	105	61-149	6	30
Acetone	134.655	75.48	402.13	365.48	243 *	217 *	15-210	10	30
Allyl Chloride	17.954	N.D.	18.09	17.72	101	99	55-154	2	30
Carbon Disulfide	17.954	N.D.	21.68	20.85	121	117	48-146	4	30
Methyl Iodide	17.954	N.D.	26.25	26.01	146 *	146 *	52-139	1	30
1,1,1-Trichloroethane	17.954	N.D.	17.42	16.70	97	93	64-142	4	30
1,1-Dichloroethane	17.954	N.D.	18.44	17.79	103	100	63-142	4	30
1,2-Dichloroethane	17.954	N.D.	16.89	15.94	94	89	68-131	6	30
1,2-Dichloropropane	17.954	N.D.	17.83	17.01	99	95	62-135	5	30
2-Butanone	134.655	N.D.	153.07	136.34	114	102	37-163	12	30
2-Chloro-1,3-butadiene	17.954	N.D.	11.18	6.65	62	37 *	51-152	51 *	30
4-Methyl-2-pentanone	89.77	N.D.	91.37	86.07	102	96	46-139	6	30
Acrylonitrile	89.77	N.D.	97.84	88.51	109	99	48-139	10	30
Benzene	17.954	N.D.	18.59	17.72	104	99	55-143	5	30
Bromodichloromethane	17.954	N.D.	15.78	14.88	88	83	53-136	6	30
Carbon Tetrachloride	17.954	N.D.	17.04	15.96	95	89	45-153	7	30
Chloroform	17.954	N.D.	18.13	17.29	101	97	61-142	5	30
cis-1,2-Dichloroethene	17.954	N.D.	19.13	18.23	107	102	60-136	5	30
cis-1,3-Dichloropropene	17.954	N.D.	14.67	14.08	82	79	51-131	4	30
Dibromomethane	17.954	N.D.	16.69	15.81	93	89	57-130	5	30
Isobutyl Alcohol	448.85	N.D.	572.66	473.78	128	106	44-158	19	30
Methacrylonitrile	134.655	N.D.	141.26	126.92	105	95	54-142	11	30
Methyl Methacrylate	17.954	N.D.	14.86	12.92	83	72	42-134	14	30
Methylene Chloride	17.954	N.D.	18.96	18.10	106	101	61-141	5	30
Propionitrile	134.655	N.D.	155.05	141.54	115	106	44-169	9	30
Toluene	17.954	N.D.	22.54	20.29	126	114	50-146	10	30
trans-1,2-Dichloroethene	17.954	N.D.	19.37	18.77	108	105	59-142	3	30
Trichloroethene	17.954	N.D.	17.73	16.68	99	93	53-144	6	30
1,1,1,2-Tetrachloroethane	17.954	N.D.	19.82	18.07	110	101	52-130	9	30
1,1,2,2-Tetrachloroethane	17.954	N.D.	27.91	22.10	155 *	124	40-152	23	30
1,1,2-Trichloroethane	17.954	N.D.	20.33	18.88	113	106	54-139	7	30
1,2,3-Trichloropropane	17.954	N.D.	28.46	22.83	159 *	128	45-154	22	30
1,2-Dibromo-3-chloropropane	17.954	N.D.	18.71	16.09	104	90	30-139	15	30
1,2-Dibromoethane	17.954	N.D.	19.54	17.87	109	100	54-129	9	30
2-Hexanone	89.77	N.D.	114.48	97.32	128	109	32-160	16	30
Bromoform	17.954	N.D.	13.88	12.87	77	72	38-124	8	30
Chlorobenzene	17.954	N.D.	19.49	17.74	109	99	49-135	9	30

Results are being reported on an as received basis.

PUK63: 0027

2/25/2011 7:53:58 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391AA Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Dibromochloromethane	17.954	N.D.	18.07	16.26	101	91	51-128	11	30
Ethyl Methacrylate	17.954	N.D.	18.59	15.40	104	86	35-134	19	30
Ethylbenzene	17.954	N.D.	19.75	17.49	110	98	44-141	12	30
Pentachloroethane	17.954	N.D.	27.71	21.45	154 *	120	35-145	25	30
Styrene	17.954	N.D.	3.60	.92	20 *	5 *	35-134	118 *	30
Tetrachloroethene	17.954	N.D.	20.84	17.76	116	99	42-149	16	30
trans-1,3-Dichloropropene	17.954	N.D.	18.52	15.74	103	88	49-129	16	30
trans-1,4-Dichloro-2-butene	89.77	N.D.	126.66	98.31	141	110	31-144	25	30
Xylene (Total)	53.862	N.D.	58.53	52.08	109	97	44-136	12	30

Results are being reported on an as received basis.

PUK63 0020

2/25/2011 7:53:58 AM

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391AA Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Dichlorodifluoromethane	20	16.61		83		20-120		
Chloromethane	20	19.27		96		54-132		
Vinyl Chloride	20	19.09		95		53-120		
Bromomethane	20	14.41		72		32-162		
Chloroethane	20	15.44		77		37-154		
Trichlorofluoromethane	20	17.25		86		58-133		
Acrolein	150	168.66		112		52-139		
1,1-Dichloroethene	20	18.57		93		73-123		
Acetone	150	172.90		115		32-209		
Allyl Chloride	20	17.44		87		69-137		
Carbon Disulfide	20	19.28		96		67-122		
Methyl Iodide	20	18.54		93		72-120		
1,1,1-Trichloroethane	20	16.58		83		71-125		
1,1-Dichloroethane	20	18.06		90		80-120		
1,2-Dichloroethane	20	17.74		89		71-129		
1,2-Dichloropropane	20	18.89		94		80-120		
2-Butanone	150	135.96		91		46-153		
2-Chloro-1,3-butadiene	20	17.08		85		72-126		
4-Methyl-2-pentanone	100	94.33		94		61-134		
Acrylonitrile	100	101.73		102		60-133		
Benzene	20	18.62		93		80-120		
Bromodichloromethane	20	17.46		87		78-120		
Carbon Tetrachloride	20	16.51		83		69-122		
Chloroform	20	18.32		92		80-120		
cis-1,2-Dichloroethene	20	18.91		95		80-120		
cis-1,3-Dichloropropene	20	16.72		84		80-120		
Dibromomethane	20	18.58		93		80-120		
Isobutyl Alcohol	500	517.71		104		69-123		
Methacrylonitrile	150	147.47		98		72-128		
Methyl Methacrylate	20	17.56		88		66-120		
Methylene Chloride	20	18.46		92		76-124		
Propionitrile	150	155.81		104		69-136		
Toluene	20	19.72		99		80-120		
trans-1,2-Dichloroethene	20	18.74		94		79-120		
Trichloroethene	20	18.19		91		80-120		
Vinyl Acetate	100	83.99	83.80	84	84	56-137	0	30
1,1,1,2-Tetrachloroethane	20	19.14		96		80-120		
1,1,2,2-Tetrachloroethane	20	20.68		103		71-123		
1,1,2-Trichloroethane	20	19.78		99		80-120		
1,2,3-Trichloropropane	20	19.40		97		71-123		
1,2-Dibromo-3-chloropropane	20	18.98		95		58-120		
1,2-Dibromoethane	20	19.67		98		80-120		
2-Hexanone	100	98.71		99		45-155		
Bromoform	20	17.48		87		70-120		

PUK63 #829

2/25/2011 7:53:51 AM

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Volatiles
SDG: PUK63
Matrix: SOLID

Fraction: Volatiles by GC/MS

X110391AA Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Chlorobenzene	20	19.92		100		80-120		
Dibromochloromethane	20	18.36		92		77-120		
Ethyl Methacrylate	20	19.13		96		70-120		
Ethylbenzene	20	19.80		99		80-120		
Pentachloroethane	20	19.07		95		71-120		
Styrene	20	19.04		95		76-120		
Tetrachloroethene	20	19.23		96		77-120		
trans-1,3-Dichloropropene	20	18.09		90		77-120		
trans-1,4-Dichloro-2-butene	100	99.25		99		61-126		
Xylene (Total)	60	60.37		101		80-120		
Acetonitrile	150	135.11	133.65	90	89	48-149	1	30

PUK63 0030

Semivolatiles by GC/MS Data

PUR63 8346

Case Narrative Conformance/Nonconformance Summary

PUR63 8347

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Semivolatiles
Fraction: Semivolatiles by GC/MS

SVOCs Camp Moscrip List - soil

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199070	Field# 73SB01-05		X	

See QC Reference List for Associated Batch QC Samples.

SAMPLE PREPARATION:

No problems were encountered with the preparation of the samples.

ANALYSIS:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

The QC windows for 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are advisory due to the erratic performance of the compounds. The quantitated values of 1,4-phenylenediamine, 1,4-naphthoquinone, and methapyrilene are estimated.

The QC limits for a,a-dimethylphenethylamine are advisory only until sufficient data points can be obtained to calculate statistical limits.

Please note that US EPA Methods for organic compounds do no require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

PUK63 0348

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Semivolatiles
Fraction: Semivolatiles by GC/MS

The LCS and/or LCSD recoveries are outside the stated QC window but within the marginal exceedance allowance of +/- 4 standard deviations as defined in the NELAC Standards. The following analytes are accepted based on this allowance: n-nitrosodiphenylamine

LCS recoveries are outside QC limits for a,a-dimethylphenethylamine and methapyrilene.

LCS and LCSD recoveries are outside QC limits for 1,4-phenylenediamine.

The relative percent difference (RPD) for 1,4-phenylenediamine between the LCS and LCSD is greater than 30%.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2/27/11 by Grace Salm
(Date)

PUK63 0349

Quality Control and Calibration Summary Forms

PUN63 0358

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA02 / SBLKLA036 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
1,4-Dioxane	02/11/11	N.D.	ug/kg	100	330
N-Nitrosodimethylamine	02/11/11	N.D.	ug/kg	67	170
Pyridine	02/11/11	N.D.	ug/kg	67	170
2-Picoline	02/11/11	N.D.	ug/kg	100	330
N-Nitrosomethylethylamine	02/11/11	N.D.	ug/kg	67	170
Methyl methanesulfonate	02/11/11	N.D.	ug/kg	33	170
N-Nitrosodiethylamine	02/11/11	N.D.	ug/kg	67	170
Ethyl methanesulfonate	02/11/11	N.D.	ug/kg	67	170
Phenol	02/11/11	N.D.	ug/kg	33	170
Aniline	02/11/11	N.D.	ug/kg	170	500
bis(2-Chloroethyl)ether	02/11/11	N.D.	ug/kg	33	170
2-Chlorophenol	02/11/11	N.D.	ug/kg	33	170
1,3-Dichlorobenzene	02/11/11	N.D.	ug/kg	33	170
1,4-Dichlorobenzene	02/11/11	N.D.	ug/kg	33	170
Benzyl alcohol	02/11/11	N.D.	ug/kg	170	500
1,2-Dichlorobenzene	02/11/11	N.D.	ug/kg	33	170
2-Methylphenol	02/11/11	N.D.	ug/kg	67	170
bis(2-Chloroisopropyl)ether	02/11/11	N.D.	ug/kg	33	170
N-Nitrosopyrrolidine	02/11/11	N.D.	ug/kg	67	170
4-Methylphenol	02/11/11	N.D.	ug/kg	67	170
N-Nitroso-di-n-propylamine	02/11/11	N.D.	ug/kg	33	170
Acetophenone	02/11/11	N.D.	ug/kg	67	170
N-Nitrosomorpholine	02/11/11	N.D.	ug/kg	67	170
o-Toluidine	02/11/11	N.D.	ug/kg	200	670
Hexachloroethane	02/11/11	N.D.	ug/kg	33	170
Nitrobenzene	02/11/11	N.D.	ug/kg	33	170
N-Nitrosopiperidine	02/11/11	N.D.	ug/kg	67	170
Isophorone	02/11/11	N.D.	ug/kg	33	170
2-Nitrophenol	02/11/11	N.D.	ug/kg	33	170
2,4-Dimethylphenol	02/11/11	N.D.	ug/kg	67	170
O,O,O-Triethylphosphorothioate	02/11/11	N.D.	ug/kg	67	170
bis(2-Chloroethoxy)methane	02/11/11	N.D.	ug/kg	33	170
a,a-Dimethylphenethylamine	02/11/11	N.D.	ug/kg	100	1700
2,4-Dichlorophenol	02/11/11	N.D.	ug/kg	33	170
1,2,4-Trichlorobenzene	02/11/11	N.D.	ug/kg	33	170
Naphthalene	02/11/11	N.D.	ug/kg	33	170
4-Chloroaniline	02/11/11	N.D.	ug/kg	67	170
2,6-Dichlorophenol	02/11/11	N.D.	ug/kg	67	170
Hexachloropropene	02/11/11	N.D.	ug/kg	100	330
Hexachlorobutadiene	02/11/11	N.D.	ug/kg	67	170
N-Nitrosodi-n-butylamine	02/11/11	N.D.	ug/kg	67	170
1,4-Phenylenediamine	02/11/11	N.D.	ug/kg	12000	33000
4-Chloro-3-methylphenol	02/11/11	N.D.	ug/kg	67	170
Safrole	02/11/11	N.D.	ug/kg	67	170
2-Methylnaphthalene	02/11/11	N.D.	ug/kg	33	170

PUK63 0351

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA02 / SBLKLA036 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Hexachlorocyclopentadiene	02/11/11	N.D.	ug/kg	170	500
1,2,4,5-Tetrachlorobenzene	02/11/11	N.D.	ug/kg	67	170
2,4,6-Trichlorophenol	02/11/11	N.D.	ug/kg	33	170
2,4,5-Trichlorophenol	02/11/11	N.D.	ug/kg	67	170
Isosafrole	02/11/11	N.D.	ug/kg	67	170
2-Chloronaphthalene	02/11/11	N.D.	ug/kg	33	170
2-Nitroaniline	02/11/11	N.D.	ug/kg	33	170
1,4-Naphthoquinone	02/11/11	N.D.	ug/kg	830	3300
Dimethylphthalate	02/11/11	N.D.	ug/kg	67	170
1,3-Dinitrobenzene	02/11/11	N.D.	ug/kg	67	170
2,6-Dinitrotoluene	02/11/11	N.D.	ug/kg	33	170
Acenaphthylene	02/11/11	N.D.	ug/kg	33	170
3-Nitroaniline	02/11/11	N.D.	ug/kg	67	170
Acenaphthene	02/11/11	N.D.	ug/kg	33	170
2,4-Dinitrophenol	02/11/11	N.D.	ug/kg	330	1000
4-Nitrophenol	02/11/11	N.D.	ug/kg	170	500
Pentachlorobenzene	02/11/11	N.D.	ug/kg	67	170
2,4-Dinitrotoluene	02/11/11	N.D.	ug/kg	67	170
Dibenzofuran	02/11/11	N.D.	ug/kg	33	170
1-Naphthylamine	02/11/11	N.D.	ug/kg	170	500
2,3,4,6-Tetrachlorophenol	02/11/11	N.D.	ug/kg	67	170
2-Naphthylamine	02/11/11	N.D.	ug/kg	170	500
Diethylphthalate	02/11/11	N.D.	ug/kg	67	170
Thionazin	02/11/11	N.D.	ug/kg	67	170
Fluorene	02/11/11	N.D.	ug/kg	33	170
4-Chlorophenyl-phenylether	02/11/11	N.D.	ug/kg	33	170
5-Nitro-o-toluidine	02/11/11	N.D.	ug/kg	170	500
4-Nitroaniline	02/11/11	N.D.	ug/kg	67	170
4,6-Dinitro-2-methylphenol	02/11/11	N.D.	ug/kg	170	500
N-Nitrosodiphenylamine	02/11/11	N.D.	ug/kg	33	170
Tetraethyldithiopyrophosphate	02/11/11	N.D.	ug/kg	67	170
1,3,5-Trinitrobenzene	02/11/11	N.D.	ug/kg	170	500
Phenacetin	02/11/11	N.D.	ug/kg	67	170
4-Bromophenyl-phenylether	02/11/11	N.D.	ug/kg	33	170
Diallate TRANS/CIS	02/11/11	N.D.	ug/kg	33	170
Hexachlorobenzene	02/11/11	N.D.	ug/kg	33	170
Dimethoate	02/11/11	N.D.	ug/kg	170	500
Pentachlorophenol	02/11/11	N.D.	ug/kg	170	500
4-Aminobiphenyl	02/11/11	N.D.	ug/kg	170	500
Pentachloronitrobenzene	02/11/11	N.D.	ug/kg	67	170
Pronamide	02/11/11	N.D.	ug/kg	33	170
Phenanthrene	02/11/11	N.D.	ug/kg	33	170
Anthracene	02/11/11	N.D.	ug/kg	33	170
Di-n-butylphthalate	02/11/11	N.D.	ug/kg	67	170
4-Nitroquinoline-1-oxide	02/11/11	N.D.	ug/kg	330	1000

PUK63 #352.

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA02 / SBLKLA036 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Methapyrilene	02/11/11	N.D.	ug/kg	1700	5000
Isodrin	02/11/11	N.D.	ug/kg	33	170
Fluoranthene	02/11/11	N.D.	ug/kg	33	170
Pyrene	02/11/11	N.D.	ug/kg	33	170
Aramite	02/11/11	N.D.	ug/kg	67	1700
p-Dimethylaminoazobenzene	02/11/11	N.D.	ug/kg	67	170
Chlorobenzilate	02/11/11	N.D.	ug/kg	33	170
Butylbenzylphthalate	02/11/11	N.D.	ug/kg	67	170
3,3'-Dimethylbenzidine	02/11/11	N.D.	ug/kg	330	1000
2-Acetylaminofluorene	02/11/11	N.D.	ug/kg	67	170
bis(2-Ethylhexyl)phthalate	02/11/11	N.D.	ug/kg	67	330
3,3'-Dichlorobenzidine	02/11/11	N.D.	ug/kg	100	330
Benzo(a)anthracene	02/11/11	N.D.	ug/kg	33	170
Chrysene	02/11/11	N.D.	ug/kg	33	170
Di-n-octylphthalate	02/11/11	N.D.	ug/kg	67	170
7,12-Dimethylbenz[a]anthracene	02/11/11	N.D.	ug/kg	33	170
Benzo(b)fluoranthene	02/11/11	N.D.	ug/kg	33	170
Benzo(k)fluoranthene	02/11/11	N.D.	ug/kg	33	170
Benzo(a)pyrene	02/11/11	N.D.	ug/kg	33	170
3-Methylcholanthrene	02/11/11	N.D.	ug/kg	67	170
Indeno(1,2,3-cd)pyrene	02/11/11	N.D.	ug/kg	33	170
Dibenz(a,h)anthracene	02/11/11	N.D.	ug/kg	33	170
Benzo(g,h,i)perylene	02/11/11	N.D.	ug/kg	33	170

PUK63: 8353

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026	Phenol-d6		2-Fluorophenol		2,4,6-Tribromophenol		Nitrobenzene-d5		2-Fluorobiphenyl		Terphenyl-d14	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
036LALCS	85	42 - 130	83	39 - 136	83	28 - 139	83	55 - 121	85	56 - 121	80	43 - 124
036LALCSD2	101	42 - 130	97	39 - 136	101	28 - 139	87	55 - 121	91	56 - 121	80	43 - 124
6199070	87	42 - 130	85	39 - 136	88	28 - 139	83	55 - 121	82	56 - 121	90	43 - 124
6199070 MSD	91	42 - 130	87	39 - 136	73	28 - 139	87	55 - 121	86	56 - 121	94	43 - 124
6199070 MS	95	42 - 130	92	39 - 136	85	28 - 139	83	55 - 121	86	56 - 121	90	43 - 124
SBLKLA036	90	42 - 130	91	39 - 136	94	28 - 139	87	55 - 121	94	56 - 121	86	43 - 124

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/kg)
Terphenyl-d14	3333.333
2-Fluorobiphenyl	3333.333
Nitrobenzene-d5	3333.333
2,4,6-Tribromophenol	6666.667
2-Fluorophenol	6666.667
Phenol-d6	6666.667

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
1,4-Dioxane	1666.666	N.D.	800	1,000	37	48	31-77	25	30
N-Nitrosodimethylamine	1666.666	N.D.	1,700	1,800	79	84	68-117	6	30
Pyridine	1666.666	N.D.	1,300	1,500	62	68	16-108	10	30
2-Picoline	1666.666	N.D.	1,300	1,500	61	68	38-89	10	30
N-Nitrosomethylethylamine	1666.666	N.D.	1,900	1,900	87	90	33-135	3	30
Methyl methanesulfonate	1666.666	N.D.	98	410	5 *	19 *	29-96	122 *	30
N-Nitrosodiethylamine	1666.666	N.D.	2,100	2,000	95	94	33-137	1	30
Ethyl methanesulfonate	1666.666	N.D.	820	1,300	38 *	60 *	68-108	46 *	30
Phenol	1666.666	N.D.	2,100	2,000	95	92	39-151	4	30
Aniline	1666.666	N.D.	1,500	1,300	71	59	10-131	19	30
bis(2-Chloroethyl)ether	1666.666	N.D.	2,000	2,100	94	98	45-139	4	30
2-Chlorophenol	1666.666	N.D.	2,100	2,000	95	91	53-141	4	30
1,3-Dichlorobenzene	1666.666	N.D.	1,900	1,900	88	89	63-109	1	30
1,4-Dichlorobenzene	1666.666	N.D.	1,900	2,000	87	91	36-136	4	30
Benzyl alcohol	1666.666	N.D.	2,100	2,200	97	102	38-136	5	30
1,2-Dichlorobenzene	1666.666	N.D.	1,900	2,000	89	92	41-132	3	30
2-Methylphenol	1666.666	N.D.	2,000	1,800	91	83	30-145	10	30
bis(2-Chloroisopropyl)ether	1666.666	N.D.	2,100	2,200	96	100	40-130	4	30
N-Nitrosopyrrolidine	1666.666	N.D.	2,100	2,100	98	98	36-137	1	30
4-Methylphenol	1666.666	N.D.	2,100	1,800	96	85	36-149	12	30
N-Nitroso-di-n-propylamine	1666.666	N.D.	2,000	2,100	94	98	46-128	4	30
Acetophenone	1666.666	N.D.	2,000	2,100	94	97	38-136	3	30
N-Nitrosomorpholine	1666.666	N.D.	2,100	2,200	98	103	36-138	5	30
o-Toluidine	1666.666	N.D.	1,700	1,600	80	73	29-96	8	30
Hexachloroethane	1666.666	N.D.	1,900	2,000	87	94	71-104	8	30
Nitrobenzene	1666.666	N.D.	2,000	2,000	90	94	37-139	5	30
N-Nitrosopiperidine	1666.666	N.D.	2,000	2,100	92	95	48-131	4	30
Isophorone	1666.666	N.D.	1,900	2,100	89	96	54-122	8	30
2-Nitrophenol	1666.666	N.D.	2,000	2,000	91	94	25-151	3	30
2,4-Dimethylphenol	1666.666	N.D.	1,800	1,400	83	65	27-143	25	30
O,O,O-Triethylphosphorothioate	1666.666	N.D.	1,900	2,100	89	95	51-123	6	30
bis(2-Chloroethoxy)methane	1666.666	N.D.	1,900	2,000	89	91	60-118	2	30
a,a-Dimethylphenethylamine	1666.666	N.D.	450	500	21 *	23 *	70-130	10	30
2,4-Dichlorophenol	1666.666	N.D.	2,000	2,000	93	91	48-141	2	30
1,2,4-Trichlorobenzene	1666.666	N.D.	1,900	2,100	88	96	62-121	9	30
Naphthalene	1666.666	N.D.	1,900	2,000	89	93	52-132	4	30
4-Chloroaniline	1666.666	N.D.	1,200	1,300	56	62	11-114	11	30
2,6-Dichlorophenol	1666.666	N.D.	2,000	1,900	92	88	67-120	5	30
Hexachloropropene	1666.666	N.D.	1,200	1,600	57	73	39-124	25	30
Hexachlorobutadiene	1666.666	N.D.	1,900	2,000	87	95	52-124	8	30
N-Nitrosodi-n-butylamine	1666.666	N.D.	2,100	2,200	98	101	38-136	3	30
1,4-Phenylenediamine	33333.33	N.D.	N.D.	N.D.	0 *	0 *	70-130	0	30
4-Chloro-3-methylphenol	1666.666	N.D.	2,000	2,000	94	90	33-144	4	30
Safrole	1666.666	N.D.	2,000	2,100	95	97	35-142	2	30

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
2-Methylnaphthalene	1666.666	N.D.	1,900	2,000	87	91	34-139	5	30
Hexachlorocyclopentadiene	3333.333	N.D.	1,100	1,900	26	44	10-153	51 *	30
1,2,4,5-Tetrachlorobenzene	1666.666	N.D.	1,900	1,900	89	90	57-123	1	30
2,4,6-Trichlorophenol	1666.666	N.D.	2,000	1,900	91	89	41-142	3	30
2,4,5-Trichlorophenol	1666.666	N.D.	2,000	2,000	91	91	25-143	1	30
Isosafrole	1666.666	N.D.	2,100	2,100	97	95	70-109	2	30
2-Chloronaphthalene	1666.666	N.D.	1,600	1,600	75	74	43-149	1	30
2-Nitroaniline	1666.666	N.D.	2,000	2,000	94	91	46-146	3	30
1,4-Naphthoquinone	1666.666	N.D.	1,600	1,400	72	66 *	70-130	8	30
Dimethylphthalate	1666.666	N.D.	1,900	1,900	89	87	49-134	2	30
1,3-Dinitrobenzene	1666.666	N.D.	2,000	2,000	92	92	71-114	0	30
2,6-Dinitrotoluene	1666.666	N.D.	2,000	1,900	92	90	44-140	3	30
Acenaphthylene	1666.666	N.D.	2,000	2,000	92	90	47-137	2	30
3-Nitroaniline	1666.666	N.D.	1,700	1,900	80	89	34-134	11	30
Acenaphthene	1666.666	N.D.	2,000	2,000	92	91	51-135	1	30
2,4-Dinitrophenol	3333.333	N.D.	3,200	3,100	73	72	20-143	2	30
4-Nitrophenol	1666.666	N.D.	2,500	2,700	116	124	15-149	6	30
Pentachlorobenzene	1666.666	N.D.	2,100	1,900	97	90	60-123	8	30
2,4-Dinitrotoluene	1666.666	N.D.	1,900	1,800	86	83	27-147	3	30
Dibenzofuran	1666.666	N.D.	2,000	1,800	92	85	38-148	8	30
1-Naphthylamine	3333.333	N.D.	910	790	21	18	10-118	14	30
2,3,4,6-Tetrachlorophenol	1666.666	N.D.	2,000	1,700	92	78	45-127	16	30
2-Naphthylamine	3333.333	N.D.	410	330	9 *	8 *	10-78	20	30
Diethylphthalate	1666.666	N.D.	2,000	1,900	90	86	52-130	5	30
Thionazin	1666.666	N.D.	2,000	2,000	94	93	33-145	1	30
Fluorene	1666.666	N.D.	2,000	1,900	93	87	46-137	7	30
4-Chlorophenyl-phenylether	1666.666	N.D.	2,000	1,800	90	84	57-127	7	30
5-Nitro-o-toluidine	1666.666	N.D.	1,900	1,600	90	74	47-109	19	30
4-Nitroaniline	1666.666	N.D.	1,800	1,500	81	70	26-124	14	30
4,6-Dinitro-2-methylphenol	1666.666	N.D.	1,800	1,800	82	85	10-148	3	30
N-Nitrosodiphenylamine	1666.666	N.D.	1,900	1,800	87	84	33-148	4	30
Tetraethyldithiopyrophosphate	1666.666	N.D.	2,000	2,100	92	99	66-121	7	30
1,3,5-Trinitrobenzene	1666.666	N.D.	1,500	1,400	70	65	31-120	8	30
Phenacetin	1666.666	N.D.	2,000	2,000	92	93	27-146	1	30
4-Bromophenyl-phenylether	1666.666	N.D.	1,900	2,000	86	92	58-136	7	30
Diallate TRANS/CIS	1666.666	N.D.	2,000	2,000	92	94	34-150	3	30
Hexachlorobenzene	1666.666	N.D.	2,000	1,900	91	88	53-137	3	30
Dimethoate	1666.666	N.D.	1,400	1,700	65	77	39-178	17	30
Pentachlorophenol	1666.666	N.D.	1,700	1,700	78	77	23-145	1	30
4-Aminobiphenyl	1666.666	N.D.	620	300	29	14	10-93	70 *	30
Pentachloronitrobenzene	1666.666	N.D.	2,100	2,000	96	94	72-112	2	30
Pronamide	1666.666	N.D.	1,900	2,000	88	90	67-130	3	30
Phenanthrene	1666.666	N.D.	1,900	2,000	87	91	34-147	4	30
Anthracene	1666.666	N.D.	1,900	2,000	88	90	40-147	3	30
Di-n-butylphthalate	1666.666	N.D.	1,900	1,900	86	89	55-131	3	30

PUK63 P356

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
4-Nitroquinoline-1-oxide	16666.66	N.D.	11,000	9,900	51	46	10-160	11	30
Methapyrilene	6666.666	N.D.	N.D.	N.D.	0 *	0 *	70-130	0	30
Isodrin	1666.666	N.D.	1,900	2,000	89	92	45-139	4	30
Fluoranthene	1666.666	N.D.	1,800	1,800	84	84	48-122	0	30
Pyrene	1666.666	N.D.	2,300	2,500	105	115	76-124	9	30
Aramite	1666.666	N.D.	1,800	2,000	85	94	70-130	10	30
p-Dimethylaminoazobenzene	1666.666	N.D.	2,400	2,500	109	114	62-134	5	30
Chlorobenzilate	1666.666	N.D.	2,400	2,600	111	120	80-141	8	30
Butylbenzylphthalate	1666.666	N.D.	2,200	2,400	103	112	42-155	9	30
3,3'-Dimethylbenzidine	3333.333	N.D.	660	N.D.	15	0 *	10-103	200 *	30
2-Acetylaminofluorene	1666.666	N.D.	2,100	2,200	96	100	70-121	5	30
bis(2-Ethylhexyl)phthalate	1666.666	N.D.	2,100	2,300	99	105	38-151	6	30
3,3'-Dichlorobenzidine	1666.666	N.D.	1,500	690	70	32	10-143	75 *	30
Benzo(a)anthracene	1666.666	N.D.	1,900	2,000	86	92	32-150	7	30
Chrysene	1666.666	N.D.	1,900	2,000	89	94	76-114	6	30
Di-n-octylphthalate	1666.666	N.D.	2,600	2,900	121	132	43-149	9	30
7,12-Dimethylbenz[a]anthracene	1666.666	N.D.	2,300	2,400	105	111	59-123	6	30
Benzo(b)fluoranthene	1666.666	N.D.	2,200	2,400	99	113	53-131	13	30
Benzo(k)fluoranthene	1666.666	N.D.	2,200	2,400	101	112	61-131	10	30
Benzo(a)pyrene	1666.666	N.D.	2,100	2,100	95	99	57-129	4	30
3-Methylcholanthrene	1666.666	N.D.	2,200	2,200	103	103	54-139	1	30
Indeno(1,2,3-cd)pyrene	1666.666	N.D.	2,000	2,100	91	98	61-123	7	30
Dibenz(a,h)anthracene	1666.666	N.D.	2,000	2,100	93	98	37-151	5	30
Benzo(g,h,i)perylene	1666.666	N.D.	1,800	2,000	85	91	60-123	7	30

PUK63 8357

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
1,4-Dioxane	1666.666	820		49		38-75		
N-Nitrosodimethylamine	1666.666	1,600		94		69-126		
Pyridine	1666.666	1,100		69		50-107		
2-Picoline	1666.666	1,200		71		54-95		
N-Nitrosomethylethylamine	1666.666	1,300		78		69-100		
Methyl methanesulfonate	1666.666	1,100		66		41-88		
N-Nitrosodiethylamine	1666.666	1,400		84		71-101		
Ethyl methanesulfonate	1666.666	1,500		87		73-107		
Phenol	1666.666	1,400		86		74-115		
Aniline	1666.666	1,100		66		30-101		
bis(2-Chloroethyl)ether	1666.666	1,400		83		77-115		
2-Chlorophenol	1666.666	1,400		87		83-119		
1,3-Dichlorobenzene	1666.666	1,300		81		79-113		
1,4-Dichlorobenzene	1666.666	1,400		82		79-112		
Benzyl alcohol	1666.666	1,500		88		68-111		
1,2-Dichlorobenzene	1666.666	1,400		82		79-112		
2-Methylphenol	1666.666	1,400		86		80-119		
bis(2-Chloroisopropyl)ether	1666.666	1,400		86		65-122		
N-Nitrosopyrrolidine	1666.666	1,500		89		66-112		
4-Methylphenol	1666.666	1,400		85		74-116		
N-Nitroso-di-n-propylamine	1666.666	1,500		88		70-113		
Acetophenone	1666.666	1,400		85		70-106		
N-Nitrosomorpholine	1666.666	1,500		89		67-110		
o-Toluidine	1666.666	910		54		10-95		
Hexachloroethane	1666.666	1,400		83		76-109		
Nitrobenzene	1666.666	1,500		91		78-122		
N-Nitrosopiperidine	1666.666	1,500		92		78-103		
Isophorone	1666.666	1,500		91		72-107		
2-Nitrophenol	1666.666	1,500		88		81-114		
2,4-Dimethylphenol	1666.666	1,600		95		83-120		
O,O,O-Triethylphosphorothioate	1666.666	1,500		92		78-106		
bis(2-Chloroethoxy)methane	1666.666	1,500		90		82-113		
a,a-Dimethylphenethylamine	1666.666	360		22 *		70-130		
2,4-Dichlorophenol	1666.666	1,500		92		87-117		
1,2,4-Trichlorobenzene	1666.666	1,400		87		81-119		
Naphthalene	1666.666	1,500		88		83-112		
4-Chloroaniline	1666.666	1,100		64		10-97		
2,6-Dichlorophenol	1666.666	1,600		93		77-113		
Hexachloropropene	1666.666	1,500		90		85-115		
Hexachlorobutadiene	1666.666	1,400		87		70-112		
N-Nitrosodi-n-butylamine	1666.666	1,700		99		51-139		
1,4-Phenylenediamine	33333.33	8,500	13,000	25 *	40 *	70-130	45 *	30
4-Chloro-3-methylphenol	1666.666	1,500		90		74-119		

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Safrole	1666.666	1,600		94		79-109		
2-Methylnaphthalene	1666.666	1,400		84		79-110		
Hexachlorocyclopentadiene	3333.333	3,000		91		64-127		
1,2,4,5-Tetrachlorobenzene	1666.666	1,400		84		84-109		
2,4,6-Trichlorophenol	1666.666	1,500		88		88-114		
2,4,5-Trichlorophenol	1666.666	1,500		89		84-109		
Isosafrole	1666.666	1,600		94		79-99		
2-Chloronaphthalene	1666.666	1,400		82		59-139		
2-Nitroaniline	1666.666	1,400		86		83-118		
1,4-Naphthoquinone	1666.666	1,300		77		70-130		
Dimethylphthalate	1666.666	1,500		87		85-111		
1,3-Dinitrobenzene	1666.666	1,400		86		81-117		
2,6-Dinitrotoluene	1666.666	1,400		86		79-115		
Acenaphthylene	1666.666	1,500		91		68-120		
3-Nitroaniline	1666.666	1,300		80		66-114		
Acenaphthene	1666.666	1,500		88		83-111		
2,4-Dinitrophenol	3333.333	2,300		69		51-124		
4-Nitrophenol	1666.666	1,600		97		57-131		
Pentachlorobenzene	1666.666	1,500		90		81-110		
2,4-Dinitrotoluene	1666.666	1,400		84		80-116		
Dibenzofuran	1666.666	1,500		89		85-110		
1-Naphthylamine	3333.333	2,000		60		27-103		
2,3,4,6-Tetrachlorophenol	1666.666	1,500		89		80-117		
2-Naphthylamine	3333.333	1,600		47		10-103		
Diethylphthalate	1666.666	1,400		86		82-113		
Thionazin	1666.666	1,500		91		78-106		
Fluorene	1666.666	1,500		88		81-117		
4-Chlorophenyl-phenylether	1666.666	1,500		89		79-110		
5-Nitro-o-toluidine	1666.666	1,000		62		41-88		
4-Nitroaniline	1666.666	1,000		61		52-92		
4,6-Dinitro-2-methylphenol	1666.666	1,300		80		60-113		
N-Nitrosodiphenylamine	1666.666	1,400		85 *		86-112		
Tetraethyldithiopyrophosphate	1666.666	1,600		96		81-107		
1,3,5-Trinitrobenzene	1666.666	1,200		70		61-109		
Phenacetin	1666.666	1,500		88		79-111		
4-Bromophenyl-phenylether	1666.666	1,400		85		79-117		
Diallate TRANS/CIS	1666.666	1,500		89		84-116		
Hexachlorobenzene	1666.666	1,400		86		79-115		
Dimethoate	1666.666	1,200		71		51-146		
Pentachlorophenol	1666.666	1,200		73		50-133		
4-Aminobiphenyl	1666.666	840		50		24-90		
Pentachloronitrobenzene	1666.666	1,500		88		82-107		
Pronamide	1666.666	1,500		88		81-107		
Phenanthrene	1666.666	1,400		86		83-109		

PUK63 0359

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: Semivolatiles by GC/MS

11036SLA026 Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Anthracene	1666.666	1,400		87		83-111		
Di-n-butylphthalate	1666.666	1,400		85		79-112		
4-Nitroquinoline-1-oxide	16666.66	13,000		80		59-140		
Methapyrilene	6666.666	2,500		37 *		70-130		
Isodrin	1666.666	1,600		94		88-126		
Fluoranthene	1666.666	1,400		84		80-113		
Pyrene	1666.666	1,500		92		80-121		
Aramite	1666.666	1,200		70		70-130		
p-Dimethylaminoazobenzene	1666.666	1,600		96		72-110		
Chlorobenzilate	1666.666	1,700		99		89-132		
Butylbenzylphthalate	1666.666	1,600		93		83-122		
3,3'-Dimethylbenzidine	3333.333	1,300		40		10-83		
2-Acetylaminofluorene	1666.666	1,400		87		74-116		
bis(2-Ethylhexyl)phthalate	1666.666	1,500		89		80-119		
3,3'-Dichlorobenzidine	1666.666	1,300		76		35-94		
Benzo(a)anthracene	1666.666	1,400		87		82-111		
Chrysene	1666.666	1,500		89		81-111		
Di-n-octylphthalate	1666.666	1,600		96		65-141		
7,12-Dimethylbenz[a]anthracene	1666.666	1,600		98		67-120		
Benzo(b)fluoranthene	1666.666	1,600		97		61-133		
Benzo(k)fluoranthene	1666.666	1,600		95		71-135		
Benzo(a)pyrene	1666.666	1,600		95		63-138		
3-Methylcholanthrene	1666.666	1,700		102		70-115		
Indeno(1,2,3-cd)pyrene	1666.666	1,600		94		64-128		
Dibenz(a,h)anthracene	1666.666	1,500		93		67-129		
Benzo(g,h,i)perylene	1666.666	1,600		96		63-130		

PUK63 8368

Semivolatiles by GC/MS Data (SIM)

PUR63 0674

Case Narrative Conformance/Nonconformance Summary

PUX63 8675.

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Semivolatiles
Fraction: PAH by GC/MS-SIM

SIM PAHs - soil

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199070	Field# 73SB01-05		X	DF10

See QC Reference List for Associated Batch QC Samples.

SAMPLE PREPARATION:

No problems were encountered with the preparation of the samples.

ANALYSIS:

Dilutions are listed in the table above.

Reporting limits were raised for 6199070 due to interference from the sample matrix.

No other problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA Methods for organic compounds do no require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

PUK63: 0676

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

GC/MS Semivolatiles
Fraction: PAH by GC/MS-SIM

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

Narrative Reviewed and Approved 2-27-11 by Grace Salin
(Date)

PUK63 8672

Quality Control and Calibration Summary Forms

PUK63 0678

Lancaster Laboratories

Quality Control Summary
Method Blank
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: PAH by GC/MS-SIM

11040SLB02 / SBLKLB040 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Naphthalene	02/11/11	N.D.	ug/kg	0.67	1.7
2-Methylnaphthalene	02/11/11	N.D.	ug/kg	0.67	1.7
1-Methylnaphthalene	02/11/11	N.D.	ug/kg	0.67	1.7
Acenaphthylene	02/11/11	N.D.	ug/kg	0.33	1.7
Acenaphthene	02/11/11	N.D.	ug/kg	0.67	1.7
Fluorene	02/11/11	N.D.	ug/kg	0.67	1.7
Phenanthrene	02/11/11	N.D.	ug/kg	0.67	1.7
Anthracene	02/11/11	N.D.	ug/kg	0.33	1.7
Fluoranthene	02/11/11	N.D.	ug/kg	0.67	1.7
Pyrene	02/11/11	N.D.	ug/kg	0.67	1.7
Benzo(a)anthracene	02/11/11	N.D.	ug/kg	0.67	1.7
Chrysene	02/11/11	N.D.	ug/kg	0.33	1.7
Benzo(b)fluoranthene	02/11/11	N.D.	ug/kg	0.67	1.7
Benzo(k)fluoranthene	02/11/11	N.D.	ug/kg	0.67	1.7
Benzo(a)pyrene	02/11/11	N.D.	ug/kg	0.67	1.7
Indeno(1,2,3-cd)pyrene	02/11/11	N.D.	ug/kg	0.67	1.7
Dibenz(a,h)anthracene	02/11/11	N.D.	ug/kg	0.67	1.7
Benzo(g,h,i)perylene	02/11/11	N.D.	ug/kg	0.67	1.7

PUK63 8679

Lancaster Laboratories

Quality Control Summary
Surrogates
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: PAH by GC/MS-SIM

11040SLB026	Nitrobenzene-d5		2-Fluorobiphenyl		Terphenyl-d14	
Sample	% Recovery	Limits	% Recovery	Limits	% Recovery	Limits
040LBLCS	99	53 - 152	99	52 - 132	111	51 - 141
6199070	86	53 - 152	80	52 - 132	83	51 - 141
6199070 MSD	74	53 - 152	75	52 - 132	80	51 - 141
6199070 MS	95	53 - 152	91	52 - 132	95	51 - 141
SBLKLB040	103	53 - 152	107	52 - 132	124	51 - 141

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/kg)
Terphenyl-d14	33.333
2-Fluorobiphenyl	33.333
Nitrobenzene-d5	33.333

PUK63 8688

2/23/2011 11:31:57 AM

Lancaster Laboratories

Quality Control Summary
Matrix Spike/Matrix Spike Duplicate
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: PAH by GC/MS-SIM

11040SLB026 Compound	Spike Added ug/kg	Unspiked Conc ug/kg	MS Conc ug/kg	MSD Conc ug/kg	MS %Rec	MSD %Rec	%Rec Limits	%RPD	%RPD Limits
Naphthalene	33.33333	N.D.	36	29	82	68	61-113	19	30
2-Methylnaphthalene	33.33333	N.D.	34	28	78	64	49-134	20	30
1-Methylnaphthalene	33.33333	N.D.	35	29	81	67	50-118	19	30
Acenaphthylene	33.33333	N.D.	34	28	78	64	63-120	19	30
Acenaphthene	33.33333	N.D.	34	28	78	65	65-110	17	30
Fluorene	33.33333	N.D.	35	30	80	69	65-116	15	30
Phenanthrene	33.33333	N.D.	36	31	83	71	37-134	16	30
Anthracene	33.33333	N.D.	35	28	80	66	56-121	20	30
Fluoranthene	33.33333	N.D.	37	32	85	73	47-135	16	30
Pyrene	33.33333	N.D.	39	34	91	79	31-120	14	30
Benzo(a)anthracene	33.33333	N.D.	40	34	92	79	66-114	15	30
Chrysene	33.33333	N.D.	40	35	92	80	41-126	13	30
Benzo(b)fluoranthene	33.33333	N.D.	39	34	90	78	26-142	15	30
Benzo(k)fluoranthene	33.33333	N.D.	40	34	93	77	49-145	18	30
Benzo(a)pyrene	33.33333	N.D.	36	30	83	69	57-117	18	30
Indeno(1,2,3-cd)pyrene	33.33333	N.D.	26	22	61	52	25-136	16	30
Dibenz(a,h)anthracene	33.33333	N.D.	26	22	59	50	29-138	16	30
Benzo(g,h,i)perylene	33.33333	N.D.	25	21	59	49	33-141	18	30

PUK63 0681

Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
GC/MS Semivolatiles
SDG: PUK63
Matrix: SOLID

Fraction: PAH by GC/MS-SIM

11040SLB026 Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Naphthalene	33.33333	31		92		67-105		
2-Methylnaphthalene	33.33333	28		84		62-115		
1-Methylnaphthalene	33.33333	31		93		72-114		
Acenaphthylene	33.33333	31		93		67-100		
Acenaphthene	33.33333	31		92		73-104		
Fluorene	33.33333	31		94		75-110		
Phenanthrene	33.33333	31		93		76-109		
Anthracene	33.33333	31		93		69-107		
Fluoranthene	33.33333	30		91		78-114		
Pyrene	33.33333	36		108		71-109		
Benzo(a)anthracene	33.33333	34		102		74-112		
Chrysene	33.33333	35		105		79-111		
Benzo(b)fluoranthene	33.33333	33		100		60-126		
Benzo(k)fluoranthene	33.33333	34		101		65-130		
Benzo(a)pyrene	33.33333	33		100		70-109		
Indeno(1,2,3-cd)pyrene	33.33333	33		99		53-128		
Dibenz(a,h)anthracene	33.33333	33		99		49-135		
Benzo(g,h,i)perylene	33.33333	34		101		49-135		

PUK63 8682

Organochlorine Pesticides Data

PUR63 0795

Case Narrative Conformance/Nonconformance Summary

PUR63 8796

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

Pesticide Residue Analysis
Fraction: Pesticides

App IX OC Pesticides - soil

Sample #	Client ID	Matrix Liquid	Matrix Solid	Comments
6199070	Field# 73SB01-05		X	
6199071	Field# 73SB01-05D		X	Field Duplicate Sample

See QC Reference List for Associated Batch QC Samples

SAMPLE PREPARATION:

There were no dilutions performed for analyses associated with samples in this SDG.

No problems were encountered with the preparation of the samples.

ANALYSIS:

No problems were encountered with the analysis of the samples.

QUALITY CONTROL AND NONCONFORMANCE SUMMARY:

Please note that US EPA Methods for organic compounds do no require action by the laboratory based on out-of-specification MS/MSD results.

For preparation/method blank results > LOQ, corrective action is not required if the sample is ND or > 10 times the blank concentration, unless otherwise specified in the method or by the client.

Surrogate recoveries that are outside the QC window are confirmed unless attributed to a dilution or otherwise noted.

All QC is within specification.

DATA INTERPRETATION:

No further interpretation is necessary for the data submitted.

Abbreviation Key

UNSPK = Unspiked (for MS/MSD)	LOQ = Limit of Quantitation
MS = Matrix Spike	MDL = Method Detection Limit
MSD = Matrix Spike Duplicate	ND = Not Detected
BKG = Background (for Duplicate)	J = Estimated Value
D = Duplicate (DUP)	E= out of calibration range
LCS = Lab Control Sample	
LCSD = Lab Control Sample Duplicate	* = Out of Specification

PUK63 0897

Lancaster Laboratories

CLIENT: U.S. Army IPH
SDG: PUK63

Pesticide Residue Analysis
Fraction: Pesticides

Narrative Reviewed and Approved _____ by
(Date)

PUK63 0790

2/23/2011 5:52:07 PM

Quality Control and Calibration Summary Forms

PUR63 8799

Lancaster Laboratories

Quality Control Summary
Method Blank
Pesticide Residue Analysis
SDG: PUK63
Matrix: SOLID

Fraction: Pesticides

110360005 / PBLK05036 Analyte	Analysis Date	Blank Results	Units	MDL	LOQ
Endrin Aldehyde	02/07/11	N.D.	ug/kg	0.33	1.7
Alpha BHC	02/07/11	N.D.	ug/kg	0.17	0.83
Beta BHC	02/07/11	N.D.	ug/kg	0.96	1.9
Gamma BHC - Lindane	02/07/11	N.D.	ug/kg	0.17	0.83
Delta BHC	02/07/11	N.D.	ug/kg	0.45	0.83
Heptachlor	02/07/11	N.D.	ug/kg	0.17	0.83
Aldrin	02/07/11	N.D.	ug/kg	0.17	0.83
Heptachlor Epoxide	02/07/11	N.D.	ug/kg	0.17	0.83
p,p-DDE	02/07/11	N.D.	ug/kg	0.33	1.7
p,p-DDD	02/07/11	N.D.	ug/kg	0.33	1.7
p,p-DDT	02/07/11	N.D.	ug/kg	0.33	1.7
Methoxychlor	02/07/11	N.D.	ug/kg	1.7	8.3
Dieldrin	02/07/11	N.D.	ug/kg	0.33	1.7
Endrin	02/07/11	N.D.	ug/kg	0.33	1.7
Chlordane	02/07/11	N.D.	ug/kg	4.0	17
Toxaphene	02/07/11	N.D.	ug/kg	11	33
Endosulfan I	02/07/11	N.D.	ug/kg	0.22	0.83
Endosulfan II	02/07/11	N.D.	ug/kg	0.33	1.7
Endosulfan Sulfate	02/07/11	N.D.	ug/kg	0.33	1.7
Kepone	02/07/11	N.D.	ug/kg	2.3	7.0

PUK63 8888

Lancaster Laboratories

Quality Control Summary
Surrogates
Pesticide Residue Analysis
SDG: PUK63
Matrix: SOLID

Fraction: Pesticides

110360005A	Tetrachloro-m-xylene		Decachlorobiphenyl	
Sample	% Recovery	Limits	% Recovery	Limits
6199070	88	55 - 131	98	45 - 150
6199071	82	55 - 131	125	45 - 150
LCS05036	91	55 - 131	103	45 - 150
LCSD05036	90	55 - 131	105	45 - 150
PBLK05036	96	55 - 131	107	45 - 150

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the case narrative.

Surrogate	Spike Added (ug/kg)
Decachlorobiphenyl	10.4
Tetrachloro-m-xylene	10.4

PUK63: 0001

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Lancaster Laboratories

Quality Control Summary
Laboratory Control Standard (LCS)
Laboratory Control Standard Duplicate (LCSD)
Pesticide Residue Analysis
SDG: PUK63
Matrix: SOLID

Fraction: Pesticides

110360005A Compound	Spike Added ug/kg	LCS Conc ug/kg	LCSD Conc ug/kg	LCS %Rec	LCSD %Rec	%Rec Limits	%RPD	%RPD Limits
Endrin Aldehyde	6.58	6.3	6.4	95	97	55-132	2	35
Alpha BHC	3.28	3.2	3.1	97	95	38-130	2	50
Beta BHC	3.24	3.2	3.3	99	101	56-134	2	50
Gamma BHC - Lindane	3.29	3.1	3.1	95	94	46-127	2	50
Delta BHC	3.24	3.6	3.6	110	110	55-144	0	50
Heptachlor	3.27	3.2	3.2	99	99	43-124	0	50
Aldrin	3.3	3.2	3.2	98	98	38-159	0	50
Heptachlor Epoxide	3.26	3.2	3.3	99	101	38-159	2	50
p,p-DDE	6.49	6.4	6.6	98	102	59-141	3	50
p,p-DDD	6.66	6.8	6.9	102	104	60-137	2	50
p,p-DDT	6.52	6.0	6.3	92	96	54-130	4	50
Methoxychlor	34.9	34	34	96	97	59-125	1	50
Dieldrin	6.57	6.8	6.9	103	105	65-129	2	50
Endrin	6.56	6.7	6.8	103	103	62-129	1	50
Endosulfan I	3.3	2.9	3.0	88	89	45-123	2	50
Endosulfan II	6.55	6.5	6.6	99	100	63-127	1	50
Endosulfan Sulfate	6.52	6.9	7.1	106	109	72-138	3	50

PUK63 0002

2/23/2011 5:50:09 PM

Moisture Data

PUR63 1160

Lancaster Laboratories

MOISTURE

CLIENT: U.S. Army IPH
SDG: PUK63

SAMPLE NUMBERS:

Sample #	Sample Code
6199070	70001BKG
6199071	70002FD

Laboratory Compliance Quality Control

Analysis Name	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Max
Batch number: 11040820001B	Sample number(s): 6199070-6199071				
Moisture	100		99-101		

Sample Matrix Quality Control

Analysis Name	BKG Conc	DUP Conc	RPD	RPD Max
Batch number: 11040820001B	Sample number(s): 6199070-6199071			
Moisture	23.1	22.8	1	15

* - Outside of specification
(1) - The result for one or both determinations was less than five times the LOQ.

Moisture Data Report

Batch #: 11040820001

Sample ID	Batch ID	Analysis#	Tare Wt	Sample Wt	Dry Wt	%Moisture	Analysis Date (Emp#)	Verified Date (Emp#)
LCS 89.5% Std.			1.1088	5.0324	1.6390	89.46	2/ 9/11 (1201/SWF)	2/10/11 (0236/CW)
6199070BKG	B	00111	1.0663	8.6601	7.7293	23.06	2/ 9/11 (1201/SWF)	2/10/11 (0236/CW)
6199071FD	B	00111	1.0849	7.3121	6.8728	20.84	2/ 9/11 (1201/SWF)	2/10/11 (0236/CW)

PUK63 1169

2/28/2011 4:13:53PM

USAPHC

UNITED STATES ARMY PUBLIC HEALTH COMMAND (Provisional)

CHAIN OF CUSTODY RECORD

PAGE ____ OF ____

INSTALLATION - Camp Moscrip, PR
PROJECT NUMBER - 38-0995-11
PROJECT OFFICER - Mr. Hammond
TURN AROUND TIME - (PLEASE X ONE)
X STD (20 BUS DAYS) ____ HIGH (10 BUS DAYS) ____ TOP (5 BUS DAYS)

PRESERVATIVE (See Codes)

ANALYSIS REQUESTED

FIELD SAMPLE ID	DATE SAMPLED	TIME SAMPLED	Grab	Comp	Matrix (See codes)	No. of Containers	~~Approx. metals~~	App IX VOCs	% moisture	pesticides	SVOC/LC PAH						
							N	4	4	4	4						
~~38~~ 73 SB01-05	2 Feb 11	0945	X		SO	~~3~~ 5		3		1	1						
73 SB01-05 D	2 Feb 11	0945	X		SO	5		4		1							
73 SB01-05 MS & MSD	2 Feb 11	0945	X		SO	2		2									
73 SB01-05	2 Feb 11	0945	X		SO	1			1								

<- Total Number of Containers

SHIPMENT METHOD - Fed Ex

Date Shipped- 2 Feb 2011

Relinquished By:	Date & Time	Accepted By:	Date & Time	Comment/Remarks
Ron Hammond	2 Feb 11 / 1530	Fed Ex		
		Mary Kline US	2/3/11 945	Cooler #1 temp = 1.4°C

Matrix Codes: A-Air GW-Ground Water WS-Surface Water DW-Drinking Water WD-Domestic Waste WI-Industrial Waste SW-Salt Water SO-Soil SS-Sediment/sludge B-Bulk O-Other(specify)
Preservative Codes: 4C - Ice only H - HCl+ice N - HNO3+ice S - H2SO4+ice Na - NaOH+ice AA-Ascorbic Acid O - Other (specify)

LIDS 235-R-E, Oct 05 (MCHB-TS-LID)

Replaces CHPPM Form 235-R-E, Jan 05, which is obsolete

USAPHC (PROV)
Directorate of Laboratory Sciences
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TERMINOLOGY & ABBREVIATIONS

DF: Dilution Factor

DLS: Directorate of Laboratory Sciences

g: gram

J: The reported result is an estimated value; the result is between the method detection limit (MDL) and the reporting limit.

kg: kilogram

L: Liter

LCS: Laboratory Control Sample

LCSD: Laboratory Control Sample Duplicate

MDL: Method Detection Limit

mg: milligram

MS: Matrix Spike

MSD: Matrix Spike Duplicate

pCi: picocurie

Qual: Data Qualifier

RPD: Relative Percent Difference

(S): Surrogate Standard (Found in Analytical Results and QC Listings)

U: The analyte was not detected and is reported as less than the method reporting limit. Analytes not detected are reported as having a concentration below the reporting limit (as opposed to below the method detection limit (MDL)) due to the relatively high potential for reporting false negatives at the MDL.

ug: microgram

Uncert: Measurement Uncertainty (Reported in Radiochemical Analyses Only)

**Indicates QC failure. For example, recoveries or relative percent difference (RPD) out of range.

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PUERTO RICO CHEMIST CERTIFICATION

Recently, I received the analytical data for Project: Camp Moscrip.
The data was generated by the following laboratories:

Microbac Laboratories, Inc.- Baltimore Division
Lancaster Laboratories- Lancaster, PA

The data packages received and reviewed included reports, case narratives, quality control data, raw data, chain of custody records and other pertinent information.

The reports received and reviewed are listed in the following table:

Report Number	Sample Numbers	Analyzed by
11B0334	11B0334-01 to 06	Microbac Laboratories
11B0382	11B0382-01 to 03	Microbac Laboratories
SDG# PUK 62	6199064- 6199069	Lancaster Laboratories
SDG# PUK 63	6199070- 6199071	Lancaster Laboratories

I hereby certify that I have reviewed the data included in the previous table and, to the best of my knowledge, the results are correct and reliable.

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Lic 2314
QUIMICO LICENCIADO
A 1327543

May 18, 11

APPENDIX D
FATE AND TRANSPORT ALGORITHM FOR ECOLOGICAL PARAMETERS

Development of Fate and Transport Parameter Datasets for Use in Environmental Health Risk Assessments

Version 4

March 21, 2007

US Army Center for Health Promotion and Preventive Medicine
Environmental Health Risk Assessment Program
Aberdeen Proving Ground, Maryland

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1. PURPOSE

This document describes a standing operating procedure (SOP) for the development of substance-specific data for the fate and transport parameters (F&T parameters) identified in Table 1. The document has been revised from a previous version. Section 10 describes the substantive revisions.

2. PARAMETERS

F&T parameters are chemical/physical properties, biological partition coefficients (biotransfer factors), and related factors relevant to exposure assessment. F&T parameters are used in risk assessments to model the concentrations of substances in various environmental media and living tissues.

This document contains a compilation of F&T parameters from different risk assessment methodology (or guidance) documents published by the U.S. Environmental Protection Agency (EPA) and other agencies. The F&T parameters addressed in this SOP include all of the parameters that are needed to conduct human health and ecological health risk assessments using the EPA combustion facility risk assessment guidance documents:

- Final Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities (HHRAP) (EPA 2005a-b).

- Peer Review Draft, Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (SLERAP) (EPA 1999b-d).

The methods used to develop values for F&T parameters that are not addressed by the HHRAP and SLERAP are derived from other sources, including other EPA guidance documents where appropriate.

Values for the F&T parameters are typically generated using one of three procedures. First, they may only be generated directly from source documents. Second, they may be generated directly from source documents, but when source documents do not provide values, then they may be estimated using specified equations in this document. Last, they may only be estimated using specified equations that include other parameters in this document as inputs.

3. GENERAL APPROACH TO DEVELOPING PARAMETER VALUES

Parameter values are generated by using a decision logic process that incorporates a parameter-specific hierarchy of sources and methods for the majority of substances. Using each parameter-specific hierarchy, a parameter value is developed for each substance using a step-wise process. The source or method identified in each step is exhausted before moving to the next step in the hierarchy. The general method for generating values for F&T parameters is summarized in the following three steps. However, the detailed methods sections do include some exceptions.

In addition, the parameter-specific methods for F&T parameters addressed in the EPA combustion guidance (EPA 2005a-b, 1999b-d) are largely based on an integration of those two EPA guidance documents. The integration required the resolution of discrepancies and the provision of additional detail.

Table 1 – Fate and Transport Parameters Included in this SOP

Parameter Label, Definition, and Default Units		**
Chemical/physical properties		
MW	Molecular weight [g/mol]	1°
T_m	Melting point temperature [Kelvin]	
BP	Boiling point temperature [°C]	
Vp	Vapor pressure at 25°C (298 K) [atm]	1°
S	Aqueous solubility [mg/L]	1°
H	Henry's law constant [atm-m^3/mol]	
Fv	Fraction of air concentration in the vapor phase [unitless]	
p°_L	Liquid phase vapor pressure [atm]	
p°_S	Solid phase vapor pressure [atm]	
D_a	Diffusivity in air [cm^2/s]	
D_w	Diffusivity in water [cm^2/s]	
Abiotic partition coefficients and related parameters		
Vdv	Dry deposition velocity [cm/s]	
K_{ow}	Octanol/water partition coefficient [unitless]	1°
$\log K_{ow}$	Logarithm of the octanol/water partition coefficient [unitless]	
K_{oc}	Soil organic carbon-water partition coefficient [mL/g]	
$\log K_{oc}$	Logarithm of the soil organic carbon-water partition coefficient [mL/g]	
Kd_s	Soil-water partition coefficient [cm^3/g]	
Kd_{sw}	Suspended sediment-surface water partition coefficient [L/kg]	
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient [cm^3/g]	
ksg	Soil loss constant due to degradation [1/yr]	
$t_{1/2}$	Half-life in soil [yr]	1°
ER	Soil enrichment ratio [unitless]	
Partition coefficients and related parameters for humans		
f_1	Fraction of ingested substance stored in body fat of mothers [unitless]	
f_4	Fraction of ingested substance that is absorbed by the body [unitless]	
h_{human}	Half-life in adult humans [days]	
ABSd	Dermal absorption fraction from soil to skin [proportion]	
Kp	Dermal permeability coefficient of a substance in water [cm/hr]	
FA	Fraction of substance absorbed from dermal contact with water [unitless]	
t_{sc}/τ_{event}	Desquamation rate to lag time ratio [day/(hr/event)]	
B	Dimensionless ratio of the permeability coefficient of a substance through the stratum corneum relative to its permeability coefficient across the viable epidermis [unitless]	
c	2nd lag time correlation coefficient (Flynn's data) for dermal contact with a substance in water [unitless]	
d	1st lag time correlation coefficient (Flynn's data) for dermal contact with a substance in water [unitless]	
Kpv	Dermal permeability coefficient of a substance in vapor [cm/hr]	

Parameter Label, Definition, and Default Units		**
Partition coefficients and related parameters for plants		
Fw	Fraction of wet deposition that adheres to plant surfaces [unitless]	
RCF	Root concentration factor [(µg/g DW plant)/(µg/mL soil water)]	
$Br_{rootveg}$	Plant-soil bioconcentration factor for root vegetables [(µg/g DW plant)/(µg/g soil)]	
Br_{ag}	Plant-soil bioconcentration factor for aboveground produce [(µg/g DW plant)/(µg/g soil)]	
$Br_{forage/silage}$	Plant-soil bioconcentration factor for forage and silage [(µg/g DW plant)/(µg/g soil)]	
Br_{grain}	Plant-soil bioconcentration factor for grain [(µg/g DW plant)/(µg/g soil)]	
Br_{tp}	Plant-soil bioconcentration factor for terrestrial plants [(mg/kg DW plant)/(mg/kg DW soil)]	
Bv_{ag}	Air-to-plant biotransfer factor for aboveground produce [(µg/g DW plant)/(µg/g air)]	
$Bv_{forage/silage}$	Air-to-plant biotransfer factor for forage and silage [(µg/g DW plant)/(µg/g air)]	
Bv_{tp}	Air-to-plant biotransfer factor for terrestrial plants [(µg/g DW plant)/(µg/g air)]	
$VG_{rootveg}$	Empirical correction factor for belowground produce [unitless]	
VG_{agp}	Empirical correction factor for aboveground produce [unitless]	
VG_{agf}	Empirical correction factor for aboveground forage [unitless]	
VG_{ags}	Empirical correction factor for aboveground silage [unitless]	
Bs	Soil bioavailability factor [unitless]	
BCF_{sav}	Bioconcentration factor for sediment to aquatic vegetation [(mg/kg DW tissue)/(mg/kg DW sediment)]	
$BCF_{w\text{-}al}$	Bioconcentration factor for water to algae [(mg/kg WW tissue)/(mg dissolved/L water)]	
Partition coefficients and related parameters for animals		
Ba_{beef}	Biotransfer factor for beef [day/kg FW tissue]	
Ba_{fat}	Biotransfer factor for fat [day/kg FW tissue]	
Ba_{milk}	Biotransfer factor for dairy milk [day/kg FW tissue]	
Ba_{pork}	Biotransfer factor for pork [day/kg FW tissue]	
$Ba_{chicken}$	Biotransfer factor for chicken meat [day/kg FW tissue]	
Ba_{egg}	Biotransfer factor for chicken eggs [day/kg FW tissue]	
Ba_{deer}	Biotransfer factor for deer meat [day/kg FW tissue]	
Ba_{turkey}	Biotransfer factor for turkey [day/kg FW tissue]	
Ba_{mammal}	Biotransfer factor for mammals [day/kg FW tissue]	
Ba_{bird}	Biotransfer factor for birds [day/kg FW tissue]	
Ba_{goat}	Biotransfer factor for goat [day/kg FW tissue]	
Ba_{game}	Biotransfer factor for wild game [day/kg FW tissue]	
Ba_{fowl}	Biotransfer factor for wild fowl [day/kg FW tissue]	
MF	Livestock and game metabolism factor [unitless]	
BCF_{ti}	Bioconcentration factor for terrestrial invertebrates [unitless]	
BCF_{bi}	Bioconcentration factor for benthic invertebrates [unitless]	
BSAF	Biota sediment accumulation factor for gamefish [unitless]	
$BCF_{gamefish}$	Bioconcentration factor for gamefish [L/kg FW tissue]	
BCF_{TLfish}	Bioconcentration factor for trophic level fish [L/kg FW tissue]	
$BAF_{gamefish}$	Bioaccumulation factor for gamefish [L/kg FW tissue]	

Parameter Label, Definition, and Default Units		**
BEF	Bioaccumulation equivalency factor [unitless]	
FCM_2	Food-chain multiplier for trophic level 2 [unitless]	
FCM_3	Food-chain multiplier for trophic level 3 [unitless]	
FCM_4	Food-chain multiplier for trophic level 4 [unitless]	

** Parameters with a gray box are needed to implement the current HHRAP and SLERAP protocols for combustion sources. Other parameters (without the gray box) are used in other risk assessment protocols.
The five primary parameters are indicated (1°) and can be used to calculate estimates of many of the other parameters (see Section 3.2 for more detail).

1. First, a parameter value for a substance is obtained from the HHRAP Hazardous Waste Companion Database, a Microsoft Access™ File (HHRAP Database) (EPA 2005b). The HHRAP Database updates and replaces the hard-copy listing of chemical-specific parameter values found in Appendix A of the 1998 Peer Review Draft HHRAP (EPA 1998). EPA states on their website that periodic updates to the HHRAP Database will be posted on the webpage.

2. If a value is not found in the HHRAP Database, then a value is developed using parameter-specific hierarchies described in HHRAP Appendix A-2, Chemical-Specific Parameter Values, Pages A-2-1 through A-2-33 (HHRAP Hierarchy) (EPA 2005a).

3. Other sources may be used for certain parameters when the above steps fail to generate a value.

Some of the parameter values vary depending upon ambient temperature and pressure conditions at the time of measurement. The default approach to developing the dataset is to use data that are relevant at standard reference conditions of temperature and pressure—25°C and 1 atm. In those cases where a single source indicates more than one value for the same parameter, values which are at reference conditions are chosen preferentially. If more than one value is provided from a source at reference conditions, then an average of those values is used. If the source provides no values at reference conditions, then values at near reference conditions (e.g., ± 5°C) may be acceptable. If the provided values are not at near reference conditions, then no value should be selected from that source.

3.1 Primary Sources

The primary sources of information used for generating values for F&T parameters are listed here.

- EPA human health and ecological combustion facility guidance database and data tables (HHRAP and SLERAP) (EPA 2005a-b, 1999b-d).
- EPA Superfund Chemical Data Matrix (SCDM) (EPA 2004a).
- Syracuse Research Corporation (SRC) CHEMFATE Database (CHEMFATE) (SRC 2005).
- SRC PHYSPROP Database (PHYSPROP) (SRC 2004).
- The CRC Handbook (Lide 2003, 2006).
- The Merck Index (O'Neil and Smith 2001, 2005).
- Hazardous Substances Data Bank (HSDB) (USNLM 2004).
- A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture (Baes et al. 1984)

3.1.1 *EPA Human Health & Ecological Combustion Guidance*

The HHRAP (EPA 2005a-b) was developed to provide a set of "user-friendly" procedures for performing risk assessments for combustion facilities, as well as to provide a data source needed to complete those procedures. The HHRAP simplifies the exposure assessment task by standardizing many of the exposure assessment components and their inputs. The HHRAP is the primary guidance used to complete the development of the F&T parameters for substances.

The SLERAP (EPA 1999b-d), similar to the HHRAP, was developed as a "user-friendly set of procedures for performing risk assessments", including a process to obtain and evaluate various types of technical information that will enable a risk assessor to perform a risk assessment. A national guidance created to consolidate information presented in other guidance documents; it outlines a multipathway screening approach that is based on "reasonable, protective assumptions" about the ecological receptors. Additionally the guidance provides: (1) example food webs; (2) example measurement receptor natural history information; (3) fate and transport data, bioconcentration factors, and toxicity reference values for 38 substances.

3.1.2 *Superfund Chemical Data Matrix (SCDM)*

The SCDM (EPA 2004a) is a source for some chemical/physical properties, biotransfer factors, and health benchmark values. The values in the SCDM are applied when evaluating potential National Priorities List (NPL) sites using the Hazard Ranking System (HRS) under the Superfund Program. The chemical/physical properties and biotransfer factors are part of the "HRS mathematical equation for determining the relative threat posed by a hazardous waste site and reflect hazardous substance characteristics." The health benchmarks are limits developed by or used in other EPA regulatory programs. The SCDM contains values for substances that are frequently found at sites evaluated using the HRS.

EPA released an updated SCDM on January 28, 2004 (EPA 2004a). It contains many revisions to the HRS factor values and benchmarks. These revisions were needed because the SCDM procedures used to assign HRS factor values and benchmarks were updated and because revisions to pertinent standards and criteria for substances were made.

3.1.3 *SRC CHEMFATE Database*

CHEMFATE is one of several sub-databases comprising the Syracuse Research Corporation (SRC) environmental fate database (EFDB). In November 1979, SRC initiated the EFDB under the sponsorship of the EPA. The EFDB is a free on-line database that was developed, and is maintained, by SRC and is comprised of several interrelated databases: DATALOG, CHEMFATE, BIOLOG, and BIODEG. The databases share a Chemical Abstract Service Registry Number (CASRN) file including over 20,000 chemicals with preferred name and formula, and a bibliographic file containing full references. CHEMFATE contains 25 categories of environmental fate and physical/chemical property information on commercially important chemical substances. CHEMFATE contains 17,260 records on 1,728 chemicals (SRC 2005).

3.1.4 *SRC PHYSPROP Database*

The Physical Properties Database (PHYSPROP) is a free on-line database of chemical structures, names and physical properties for over 25,250 chemicals. The properties in the database are collected from various sources, and include experimental, extrapolated, and estimated values. The database was started

as a database of physical properties for substances being evaluated by SRC for the Hazardous Substances Data Bank (HSDB) and was compiled by SRC over the last twenty years. Since that time, PHYSPROP was also used as a repository for physical and chemical property data that were used to develop estimation methods for the EPI Suite™ software (owned by the EPA). The PHYSPROP on-line database is continually updated (SRC 2004).

3.1.5 *The CRC Handbook*

The CRC Handbook (Lide 2003, 2006) provides all types of data commonly encountered by physical scientists, engineers, R&D professionals, and students. The CRC Handbook is an accurate, reliable, and current resource for properties data for inorganic and organic compounds. The source includes a wide variety of information covering a wide range of information: basic constants, units, and conversion factors; symbols, terminology, and nomenclature; physical and properties elements and organic and inorganic substances; thermochemistry, electrochemistry, and kinetics; fluid properties; biochemistry analytical chemistry; molecular structure and spectroscopy, atomic, molecular, and optical physics; nuclear and particle physics; properties of solids and polymers; geophysics, astronomy, and acoustics; practical laboratory data; and health and safety information.

The CRC Handbook is available in CD-ROM (Lide 2006) and in hard copy (Lide 2003). Use of the CD-ROM is preferred because less errors will be made. This is because substances can be more easily searched for and found using the CASRN or the name, and found values can be cut and pasted directly from the source to an interim database.

3.1.6 *The Merck Index*

The Merck Index (13th ed.)(O'Neil and Smith 2001) contains a diverse collection of over 10,000 articles (monographs) on individual substances. More than 4,000 articles are devoted to a wide variety of drugs and pharmaceuticals, over 2,000 describe common organic chemicals and laboratory reagents, and another 2,000 cover naturally occurring substances and plants. An additional 1,000 articles focus on the elements and inorganic chemicals. The monographs contain a wide variety of information on each substance including CASRN, chemical formula and structure, chemical and physical properties, biological and pharmacological information, derivatives information, alternate names and/or trademarks, usage information and literature references. The Merck Index is available in CD-ROM and in hard copy.

The Merck Index is available in CD-ROM (O'Neil and Smith 2005) and in hard copy (O'Neil and Smith 2001). Use of the CD-ROM is preferred because less errors will be made. This is because substances can be more easily searched for and found using the CASRN or the name, and found values can be cut and pasted directly from the source to an interim database.

3.1.7 *Hazardous Substances Data Bank (HSDB)*

Both chemical/physical properties and biotransfer factors can be found in the US National Library of Medicine's (USNLM) Hazardous Substances Data Bank (HSDB®) (USNLM 2004). The HSDB is a data file that is part of the USNLM Toxicology Data Network (TOXNET®). The HSDB is a broad, peer-reviewed, database which contains data for more than 4500 substances. Information is included in the areas of "toxicity, environmental fate, human exposure, chemical safety, waste disposal, emergency handling, and regulatory core requirements." The data contained in the HSDB is referenced and derived from a collection of books, government documents, reports and preferred primary journal literature (USNLM 2004).

3.1.8 *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture*

This source document (Baes et al. 1984) depicts the quantification of nuclide transport through agricultural systems. Parameters describing soil-to-plant uptake for vegetative and non-vegetative growth, ingestion-to-milk transfer, ingestion-to-meat transfer for beef and the soil-water distribution coefficient are noted in this source. Baes et al. assume that variability among isotopes of the same element is insignificant when compared to the variability which is found among different elements. Therefore, it designates values for each element. When the algorithm indicates that Baes et al. should be consulted for inorganics or metals values, then the appropriate figure of the periodic table should be consulted. Within the periodic table figures, the parameter value which is listed with each specific element should be used.

3.2 Primary Parameters

When possible, values for primary parameters should be generated first, since they are needed to calculate many of the other parameters. The primary parameters are:

- Molecular Weight (*MW*) — used in the equations for Henry's Law Constant (H), diffusivity in air (D_a) and diffusivity in water (D_w)
- Vapor Pressure (*Vp*) — used in the equation for H
- Solubility (*S*) — used in the equation for H
- *n*-octanol/water partition coefficient (K_{ow}) or the logarithm of K_{ow} (log K_{ow}) — used in numerous equations and in rules for selecting appropriate values for some parameters
- Half-life of Substance in Soil ($t_{½}$) — used in the *ksg* equation

3.3 Data Gaps and Null Values

After exhausting each of the steps identified in the parameter-specific sections below, a null value (meaning no value at all) can still be the end result. This type of null value is considered a "data gap." However, there are three types of null values:

- Data gap: The value is a true data gap (DG) because all steps in the hierarchy have been exhausted and the information is simply not available from the sources and methods contained in this document. In this case the "null" value is a true missing value and it can be referenced with a code, such as "9999".
- Source-provided null: The selected source in the hierarchy specifically defines the value for the substance as "null". In this case, the "null" value is referenced with the source where the "null" decision is provided.
- Parameter is not needed or not applicable for a substance: The parameter is not needed (NN) for modeling the substance or the parameter is not applicable (NA) to the substance. In this case, the "null" value can be referenced with a code, such as "7777".

4. PARAMETER-SPECIFIC ALGORITHMS: CHEMICAL/PHYSICAL PROPERTIES

The following subsections provide the specific methods used to generate values for each parameter. When no value is developed after all steps in the parameter-specific algorithm are exhausted, the parameter value is determined to be "missing" (or "null") for that substance.

4.1 Molecular Weight (*MW*)

4.1.1 *Background*

The molecular weight (*MW*) of a substance is defined as the sum of atomic weights of all atoms in the substance's molecule. *MW* is expressed in units of grams per mole (g/mol). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

4.1.2 *Method*

1. HHRAP Database (EPA 2005b).
2. The SCDM (EPA 2004a).
3. CHEMFATE Database (SRC 2005).
4. PHYSPROP Database (SRC 2004).
5. The CRC Handbook (Lide 2003, 2006).
6. The Merck Index (O'Neil and Smith 2001, 2005).
7. The HSDB® (USNLM 2004).

4.2 Melting Point Temperature (T_m)

4.2.1 *Background*

Melting point (T_m) is the temperature of the substance at which the solid state of the substance undergoes a phase change to a liquid phase. T_m is expressed in Kelvin (K). At ambient temperatures and at an atmospheric pressure of 1 atmosphere, substances are either in a solid or liquid state. The parameter units in the source are checked to determine if a unit conversion is necessary before using the value. If the source provides a range of values for the substance, the mean (average) of the values is estimated and used.

4.2.2 *Method*

1. HHRAP Database (EPA 2005b).
2. The SCDM (EPA 2004a).

3. CHEMFATE Database (SRC 2005).

4. PHYSPROP Database (SRC 2006b).

5. The CRC Handbook (Lide 2003, 2006).

6. The Merck Index (O'Neil and Smith 2001, 2005).

4.3 Boiling Point Temperature (*BP*)

4.3.1 *Background*

The boiling point (*BP*) is the temperature at which the vapor pressure of a liquid is equal to the pressure of the surrounding gases. Another way of expressing this is the boiling point of a substance is the temperature at which it can change its state from a liquid to a gas throughout the bulk of the liquid. The boiling point is useful as a relative measure of the volatility of a substance. The lower the boiling point the more volatile the chemical. The boiling point will vary with the pressure of the surrounding gases. Boiling point temperatures are normally provided at standard pressure (i.e., 760 mm Hg or 1 atmosphere) and care should be taken to ensure that the boiling point data from a source is expressed at the standard pressure.

4.3.2 *Method*

The algorithm hierarchy for finding a value is provided below. The default unit of measure for *BP* is Celsius (°C) and values provided in other units must be converted.

1. The Merck Index (O'Neil and Smith 2001, 2005)

2. The CRC Handbook (Lide 2003, 2006)

3. Groundwater Chemicals Desk Reference (Montgomery and Welkom 1991).

4. The HSDB® (USNLM 2004)

5. ChemIDPlus Advanced (USNLM 2004)

4.4 Vapor Pressure (*Vp*)

4.4.1 *Background*

The vapor pressure (*Vp*) of a substance is defined as the pressure exerted by the vapor (gas) of a substance when it is under equilibrium conditions at 25°C (298 K). It is expressed in units of atmospheres (atm). It provides a semi-quantitative rate at which it will volatilize from soil and/or water.

The parameter units in the source are checked to determine if a unit conversion is necessary before using the value. The source must also be checked to ensure that the value provided is at 25°C (298 K). Values which are not at or near reference conditions (25°C or 298 K) should not be used (see Section 3).

4.4.2 *Method*

Null values are assigned for metals that are not in the HHRAP. Values are not provided for metals by the HHRAP because metals are considered nonvolatile at ambient temperatures and generally insoluble in water (except as some weak acids) (EPA 2005a).

For all other substances:

1. HHRAP Database (EPA 2005b).
2. The SCDM (EPA 2004a).
3. CHEMFATE Database (SRC 2006a).
4. PHYSPROP Database (SRC 2006b).
5. The CRC Handbook (Lide 2003, 2006).
6. The HSDB® (USNLM 2004).

If *Vp* remains null after implementing the above hierarchy, and a value must be generated, methods for estimating *Vp* for organics are available to fill data gaps. The HHRAP recommends methods in Handbook of Chemical Property Estimation Methods (Lyman et al. 1990) to estimate a value. Methods from that source can be used, but require additional input parameters and other chemical knowledge, so if used, a chemist will implement the method. This will be applied on a case-by-case basis for chemicals that are deemed necessary.

Note that the HHRAP identifies The Merck Index (O'Neil and Smith 2001, 2005) as a source for *Vp* data, but the Merck Index does not contain this data.

4.5 Aqueous Solubility (*S*)

4.5.1 *Background*

The aqueous solubility (*S*) of a substance is defined as the saturated concentration of the substance in water at a given temperature and pressure, usually at soil/water temperatures and atmospheric pressure (Montgomery and Welkom 1991). It is expressed in units of milligrams per liter (mg/L).

The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

4.5.2 *Method*

1. HHRAP Database (EPA 2005b).
2. The SCDM (EPA 2004a).
3. CHEMFATE Database (SRC 2005).
4. PHYSPROP Database (SRC 2006b).

5. Lange's Handbook of Chemistry (Dean 2002).

6. The HSDB® (USNLM 2004).

If *S* remains null after implementing the above hierarchy, and a value must be generated, methods for estimating *S* for organics are available to fill data gaps. The HHRAP recommends methods in Handbook of Chemical Property Estimation Methods (Lyman et al. 1990) to estimate a value. Methods from that source can be used, but require additional input parameters and other chemical knowledge, so if used, a chemist will implement the method. This will be applied on a case-by-case basis for chemicals that are deemed necessary.

4.6 Henry's Law Constant (*H*)

4.6.1 *Background*

Henry's Law constant (*H*), also referred to as the air-water partition coefficient, is defined as the ratio of the partial pressure of a substance in air to the concentration of the substance in water at a given temperature under equilibrium conditions. Henry's Law constant values can generally be measured, calculated from the theoretical equation defining the constant, or estimated from the substance structure. However, experimental and estimated *H* values from literature reports are temperature-dependent and difficult to measure, are generally obtained from various literature sources that use different experimental and estimation methods, and are only available for a limited number of substances. Henry's Law constant is expressed in units of atmospheres cubic meters per mole (atm-m^3/mol). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

4.6.2 *Method*

Null values are assigned for metals, other than mercury and mercuric compounds, including those that are not in the HHRAP. The HHRAP states that *H* is zero because *Vp* is zero due to the nonvolatile nature of metals, and *S* is also zero. However, null values are more appropriate than zero values.

For all other substances:

1. HHRAP Database (EPA 2005b).

2. The SCDM (EPA 2004a).

3. CHEMFATE Database (SRC 2005).

4. PHYSPROP Database (SRC 2006b).

5. Calculate using Equation 1, Handbook of Chemical Property Estimation Methods (Lyman et al. 1990).

Equation 1 – Henry's Law Constant (*H*) for Organics

$$H = \frac{Vp \cdot MW}{S}$$

H = Henry's Law constant (atm·m^3/mol)
Vp = Vapor pressure (atm) at 25 °C (298 K)
MW = Molecular weight (g/mol)
S = Solubility in water (mg substance/L)

Source: HHRAP (EPA 2005a, Lyman et al. 1990).

4.7 Fraction of Air Concentration in the Vapor Phase (*Fv*), Liquid Phase Vapor Pressure (p°_L), and Solid Phase Vapor Pressure (p°_S)

4.7.1 *Background*

Substance emissions to the environment occur in the vapor or the particle phase. In general, most metals and organic substances with very low volatility are assumed to occur only in the particle phase. Organic substances occur as either only vapor phase (an *Fv* of 1.0) or with a portion of the vapor condensed onto the surface of particulates (e.g., particle-bound organic substances). Substances which are assumed to be present in the particulate phase and not in the vapor phase have an *Fv* of 0. The *Fv* is a unitless parameter and ranges in value from 0 to 1.

The liquid phase vapor pressure (p°_L) and solid phase vapor pressure (p°_S) are required to estimate *Fv* when an *Fv* value is not found in the sources provided. The p°_L represents the vapor pressure of substances that are liquid at ambient temperature (25 °C). The p°_S represents the vapor pressure of organic substances that are solid at ambient temperature (25 °C). These parameters are expressed in units of atmospheres (atm).

The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

4.7.2 *Method*

A value of zero for the *Fv* is assigned for metals, other than chromium, mercury and mercuric compounds, including those substances that are not in the HHRAP. Chromium, mercury and mercuric compounds can be found in the HHRAP Database. Metals are assumed to be present in the particulate phase and not in the vapor phase (i.e., *Vp* = 0), and so are assigned *Fv* values of zero (EPA 2005a, EPA 1994).

All final values of *Fv* are rounded to three decimal places as is done in the HHRAP Database. Values are presented in numeric format, not scientific notation.

For all other substances:

1. HHRAP Database (EPA 2005b).

2. For organic substances that are liquid at ambient temperatures (i.e., $T_m < 298$ K) and the p°_L is known, Equation 2 is used to calculate an *Fv*. If the substance is a liquid at ambient temperature (i.e., $T_m < 298$ K) then $p°_L$ is the vapor pressure (*Vp*) of the liquid substance at 25° C (298 K). Equation 2 requires the *Vp* (or $p°_L$ for these substances) to calculate an *Fv*. The $p°_S$ is not applicable for these substances and $p°_S$ is referenced as not needed.

3. For organic substances that are solid at ambient temperature (i.e., $T_m \geq 298$) and the p°_S is known, Equations 3B is used to calculate the p°_L. Equations 3B requires the substances melting point temperature (T_m) to calculate the p°_L. Then Equation 2 is used to calculate an *Fv*. If the substance is a solid at ambient temperature (i.e., $T_m \geq 298$ K) the *Vp* of the solid is also the $p°_S$ for that substance.

Equation 2 – Fraction of Pollutant Air Concentration in the Vapor Phase (*Fv*)

$$Fv = 1 - \frac{c \cdot S_T}{p°_L + c \cdot S_T}$$

Fv	= Fraction of Pollutant Air Concentration in the Vapor Phase
c	= Junge constant = 1.7E-04 (atm-cm)
S_T	= Whitby's average surface area of particulates (aerosols) (3.5E-06 cm^2/cm^3 air for background and local sources)
$c \cdot S_T$	= 5.95E-10 (atm)
p°_L	= Liquid phase vapor pressure of substance (atm)

Source: HHRAP (EPA 2005a, Section A2-2.5, Table B-1-1; Junge 1977).

Equations 3A and 3B – Liquid Phase Vapor Pressure of Substance Calculated from Solid Phase Vapor Pressure of Substance (p°_L to p°_S)

(A) $$ln\left(\frac{p^\circ_L}{p^\circ_S}\right) = \frac{\Delta S_f}{R} \cdot \frac{(MP - T)}{T}$$

(B) $$p^\circ_L = p^\circ_S \cdot exp\left(\frac{\Delta S_f}{R} \cdot \frac{(MP - T)}{T}\right)$$

$$= p^\circ_S \cdot exp\left(6.79 \cdot \frac{(MP - T)}{T}\right)$$

ln	= Natural logarithm
p°_L	= Liquid phase vapor pressure of substance (atm)
p°_S	= Solid phase vapor pressure of substance (atm)
ΔS_f	= Entropy of fusion (unitless)
R	= Universal ideal gas constant [(atm-m^3)/(mole x K)]
$\Delta S_f / R$	= 6.79 (unitless)
MP(or T_m)	= Melting point temperature of substance (K); HHRAP uses the T_m notation.
T	= Ambient temperature = 298 K (25°C)

Source: HHRAP (EPA 2005a, Table B-1-1, Bidleman 1988). Equations 3B was derived from Equation 2 and Equations 3A.

4.8 Diffusivity in Air (D_a) and Water (D_w)

4.8.1 *Background*

Diffusivity in air (D_a) and water (D_w), also called diffusion coefficients, are used to calculate the liquid or gas phase transfer of a substance into a waterbody. Diffusivity is expressed in units of squared centimeters per second (cm^2/s). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

4.8.2 *Method*

Null values are assigned for metals, other than chromium, mercury and mercuric compounds, including those that are not in the HHRAP. Chromium, mercury and mercuric compounds can be found in the HHRAP Database.

For all other substances:

1. HHRAP Database (EPA 2005b).

2. WATER9 (EPA 2004b).

3. Calculate using Equation 4 – 6; HHRAP (EPA 2005a).

Equation 4 – Default Equation for Diffusivity in Air (D_a)

$$D_a = \frac{1.9}{MW^{(2/3)}}$$

Da = Diffusivity of substance in air (cm2/s)
MW = Molecular weight (g/mol)

Source: HHRAP (EPA 2005a, Mercury Study Report to Congress, Volume III, EPA 1997a).

Equation 5 – Default Equation for Diffusivity in Water (D_w)

$$D_w = \frac{22 \times 10^{-5}}{MW^{(2/3)}}$$

D_w = Diffusivity of substance in water (cm^2/s)
MW = Molecular weight (g/mol)

Source: HHRAP (EPA 2005a, Mercury Study Report to Congress, Volume III, EPA 1997a).

Equation 6 – Diffusivity in Air (D_a) for Dioxins and Furans

$$\frac{D_x}{D_y} = \left(\frac{MW_y}{MW_x}\right)^{0.5}$$

$D_{x,y}$ = Diffusivities in air (D_a) of congeners x and y (cm^2/s)
$MW_{x,y}$ = Molecular weights of congeners x and y (g/mol)

Instruction: Values for dioxin congeners, calculate using the D_a value and MW for 2, 3, 7, 8-TCDD. Values for furans are calculated using the D_a value and MW for 2, 3, 7, 8-TCDF.

Source: HHRAP (EPA 2005a, Estimating Exposure to Dioxin-Like Compounds, EPA 2000).

5. PARAMETER-SPECIFIC ALGORITHMS: ABIOTIC PARTITION COEFFICIENTS AND RELATED PARAMETERS

The following subsections provide the specific methods used to generate values for each parameter. When no value is developed after all steps in the parameter-specific algorithm are exhausted, the parameter value is determined to be "missing" (or "null") for that substance.

5.1 Dry Deposition Velocity (*Vdv*)

5.1.1 *Background*

Dry deposition velocity (*Vdv*) is used in the estimation of soil concentration due to deposition, when implementing the Peer Review Draft HHRAP and SLERAP (EPA 1998, 1999b-d). *Vdv* is expressed in units of centimeters per second (cm/s). In final HHRAP (EPA 2005a), *Vdv* is directly estimated in the air dispersion model, thus the *Vdv* is not needed as a default input parameter.

5.1.2 *Method*

The Peer Review Draft HHRAP (EPA 1998) default value of 3 is assigned to all substances. There is great uncertainty associated with this parameter. The recommended default value is based on the median dry deposition velocity for HNO_3. HNO_3 is considered the most similar to the substances recommended for consideration in the HHRAP (EPA 1998, Table B-1-1).

5.2 Octanol/Water Partition Coefficient (K_{ow}) and Logarithm (log K_{ow})

5.2.1 *Background*

The *n*-octanol/water partition coefficient (K_{ow}) is defined as the ratio of the solute concentration in the water-saturated *n*-octanol phase to the solute concentration in the *n*-octanol-saturated water phase (Montgomery and Welkom 1991). K_{ow} is a unitless parameter.

The following K_{ow} parameters are optional for derivation of Ba_{beef} and Ba_{milk} values (see Section 8.1.2 for more detail).

- K_{ow}^{n} *n*-octanol/water partition coefficient for the neutral species
- K_{ow}^{i} *n*-octanol/water partition coefficient for the ionized species
- *wKow* weighted *n*-octanol/water partition coefficient based on the neutral species fraction

5.2.2 *Method*

1. HHRAP Database (EPA 2005b).
2. The SCDM (EPA 2004a).
3. CHEMFATE Database (SRC 2005).
4. PHYSPROP Database (SRC 2004).
5. The CRC Handbook (Lide 2003, 2006).

6. The HSDB® (USNLM 2004).

Null values are assigned to inorganic substances (including metals) not found in the above sources. Some sources provide a K_{ow} and some provide a log K_{ow}. Both parameters must be compiled under this algorithm. If the K_{ow} is provided by the source, this value must be converted to the log K_{ow}. This is done with a simple conversion by taking the log of each K_{ow} value. If the log K_{ow} is provided by the source, this value must be converted to the K_{ow}. This is done with a simple conversion by taking the antilog of the log K_{ow} value. The source of the original value is referenced.

5.3 Soil Organic Carbon-Water Partition Coefficient (K_{oc}) and Logarithm (log K_{oc})

5.3.1 *Background*

The soil organic carbon-water partition coefficient (K_{oc}), also called the organic carbon normalized soil sorption coefficient, is defined as the ratio of adsorbed substance per unit weight of organic carbon to the aqueous solute concentration (Montgomery and Welkom 1991). The K_{oc} is expressed in units of mL water/g soil.

5.3.2 *Method*

Values for K_{oc} for ionizing organic substances and non-ionizing organic substances are developed differently due to their different partitioning properties. Ionizing substances contain functional groups that ionize under specific pH conditions, which impact the K_{oc} values. The following table provides a limited list of organic substances as classified by the HHRAP (EPA 2005a).

Null values are assigned for metals and mercuric compounds including those that are not in the HHRAP. The prevalent assumption is that organic carbon in soils does not play a major role in metal partitioning in soil and sediments (EPA 2005a). When a source provides multiple values for K_{oc} based on pH, the value for the pH of 7 is selected for use. If a value is not provided for a pH of 7, then the value for the pH closest to 7 (e.g., 6.8) is selected.

For all other substances:

1. HHRAP Database (EPA 2005b).

2. Ionizing substances: Soil Screening Guidance: Technical Background Document and User's Guide (EPA 1996).

3. Non-ionizing organic substances: Soil Screening Guidance: Technical Background Document and User's Guide (EPA 1996). For non-ionizing substances, when a substance is not included in the EPA 1996 source, correlation equations provided in that source are used to calculate a value (see Equation 7 - 9).

Table 2 – Selected Lists of Ionizing and Non-Ionizing Organic Substances

Ionizing Organic Substances
Includes amines, carboxylic acids, and phenols

Organic acids		Organic bases
2,4,6-trichlorophenol	2-chlorophenol	n-nitroso-di-n-propylamine
pentachlorophenol	phenol	n-nitrosodiphenylamine
2,3,4,5-tetrachlorophenol	2,4-dimethylphenol	4-chloroaniline
2,3,4,6-tetrachlorophenol	2-methylphenol	
2,4,5-trichlorophenol	2,4-dinitrophenol	
2,4-dichlorophenol	benzoic acid	

Non-ionizing Organic Substances
Most other organic substances not listed above, including volatile organic substances, chlorinated pesticides, polynuclear aromatic hydrocarbons (PAHs), and phthalates.

Source: HHRAP (EPA 2005a).

Equation 7 – Correlation Equation for Soil Organic Carbon-Water Partition Coefficient (K_{oc}) for Most Semi-Volatile Non-ionizing Organic Substances

$$K_{oc} = 10^{[0.00028+(0.983\cdot(\log Kow))]}$$

K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, Soil Screening Guidance: Technical Background Document and User's Guide, 1996).

Equation 8 – Correlation Equation for Soil Organic Carbon-Water Partition Coefficient (K_{oc}) for Volatile Non-ionizing Organics Chlorinated Benzenes, and Certain Chlorinated Pesticides

$$K_{oc} = 10^{[0.0784+(0.7919\cdot(\log Kow))]}$$

K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a; Soil Screening Guidance: Technical Background Document and User's Guide, 1996).

Equation 9 – Correlation Equation for Soil Organic Carbon-Water Partition Coefficient (K_{oc}) for Dioxins and Furans

$$K_{oc} = 10^{(\log Kow)-0.21}$$

K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, Karickhoff et al. 1979).

Some of the sources in the hierarchy above provide a K_{oc} and some provide the log K_{oc}. Both parameters are compiled under this algorithm. If the K_{oc} is provided by the source, this value must be converted to the log K_{oc}. This is done with a simple conversion by taking the log of each K_{oc} value. If the log K_{oc} is provided by the source, this value must be converted to the K_{oc}. This is done with a simple conversion by taking the antilog of the log K_{oc} value. The source of the original value must be referenced.

5.4 Partition Coefficients for Soil-Water (Kd_s), Suspended Sediment-Surface Water (Kd_{sw}), and Bottom Sediment-Sediment Pore Water (Kd_{bs})

5.4.1 *Background*

Partition coefficients (*Kd* terms) describe the partitioning of a substance between sorbing material, such as soil, soil pore-water, surface water, suspended solids, and bed sediments. For organic substances, *Kd* has been estimated to be a function of the organic-carbon partition coefficient and the fraction of organic carbon in the partitioning media. For metals, *Kd* is assumed to be independent of the organic carbon in the partitioning media and, therefore, partitioning is similar in all sorbing media.

The soil-water partition coefficient (Kd_s) describes the partitioning of a substance between soil pore-water and soil particles, and strongly influences the release and movement of a substance into the subsurface soils and underlying aquifer. The Kd_s is expressed in units of centimeters cubed per gram (cm^3/g).

The suspended sediment-surface water partition coefficient (Kd_{sw}) coefficient describes the partitioning of a substance between surface water and suspended solids or sediments. The Kd_{sw} is expressed in units of liters per kilogram (L/kg).

The bed sediment-sediment pore-water partition coefficient (Kd_{bs}) coefficient describes the partitioning of a substance between the bed sediments and bed sediment pore-water. The Kd_{bs} is expressed in units of centimeters cubed per gram (cm^3/g).

When a source provides multiple values for a *Kd* term based on pH, the value for the pH of 7 is selected for use. If a value is not provided for a pH of 7, then the value for the pH closest to 7 (e.g., 6.8) is selected. The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

5.4.2 *Method*

1. *Kd* terms from the HHRAP Database (EPA 2005b).

2. Kd_s for all other substances:

   a. The SCDM (EPA 2004a) – Appendix A. Data is listed by substance and can be searched by substance name or by CASRN. In this source the Kd_s is found in the section in each substance table titled "MOBILITY" and the Kd_s is labeled "Distrib Coef".

   b. Soil Screening Guidance: Technical Background Document and User's Guide, (EPA 1996).

   c. Baes et al. (1984) – Figure 2.31. This figure is in a periodic table format, so the periodic symbol of the substance must be known when finding the value.

   d. RTI (1996).

3. For the remaining organic substances *Kd* terms are calculated using Equation 10, Equation 11, or Equation 12 based on the fraction of organic carbon (f_{oc}) in the soil, benthic sediment, or suspended sediments (EPA 1993a), which preceded the current combustion guidance (EPA 2005a). Soil organic carbon is assumed to be the dominant sorbing component in soils and sediments.

4. For metals, including those that are not in the HHRAP: *Kd* terms are governed by factors other than organic carbon, such as pH, redox, iron content, cation exchange capacity, and ion-chemistry. Therefore, *Kd* values for metals cannot be calculated using the same correlation equations specified for organic substances. Instead, *Kd* values for the metals must be obtained directly from Soil Screening Guidance: Technical Background Document and User's Guide (EPA 1996). This source provides values that are based on pH, and are estimated using the geochemical speciation model MINTEQ2 (EPA 2005a).

Equation 10 – Correlation Equation for Soil-water Partition Coefficient (Kd_s) for Organic Substances

$$Kd_s = f_{oc,s} \cdot K_{oc}$$

Kd_s = Soil-water partition coefficient (cm^3/g)
$f_{oc,s}$ = Fraction of organic carbon in soil (unitless)
K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)

Source: HHRAP (EPA 2005a, Review Draft Addendum to the Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, 1993a).

Based on the HHRAP (EPA 2005a), the default $f_{oc,s}$ is 0.01 is used, which is the mid-range value between 0.002 and 0.024 for soils.

Equation 11 – Correlation Equation for Suspended Sediment-surface water Partition Coefficient (Kd_{sw}) for Organic Substances

$$Kd_{sw} = f_{oc,sw} \cdot K_{oc}$$

Kd_{sw} = Suspended sediment-surface water partition coefficient (L/kg)
$f_{oc,sw}$ = Fraction of organic carbon in suspended sediment (unitless)
K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)

Source: HHRAP (EPA 2005a, Review Draft Addendum to the Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, 1993a).

Based on the HHRAP (EPA 2005a), the default $f_{oc,sw}$ is 0.075 is used, which is the mid-range value between 0.05 and 0.1 for suspended sediments.

Equation 12 – Correlation Equation for Bed sediment-sediment pore-water Partition Coefficient (Kd_{bs}) for Organic Substances

$$Kd_{bs} = f_{oc,bs} \cdot K_{oc}$$

Kd_{bs} = Bed sediment-sediment pore-water partition coefficient (cm^3/g)
$f_{oc,bs}$ = Fraction of organic carbon in bed sediment (unitless)
K_{oc} = Soil organic carbon-water partition coefficient (mL water/g soil)

Source: HHRAP (EPA 2005a, Review Draft Addendum to the Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions, 1993a).

Based on the HHRAP (EPA 2005a), the default $f_{oc,bs}$ is 0.04 is used, which is the mid-range value between 0.03 and 0.05 for bed sediments.

5.5 Soil Loss Constant Due to Degradation (*ksg*) and Soil Half-life ($t_{1/2}$)

5.5.1 *Background*

Soil loss constant due to degradation (*ksg*) reflects loss of a substance from the soil by processes other than leaching. The HHRAP states that *ksg* is ideally the sum of all biotic and abiotic mechanisms of degradation, except for leaching. However, literature sources "do not provide sufficient data for all such mechanisms, especially for soil" (EPA 2005a, Appendix A-2, Section A2-2.11). Degradation rates in the soil media include biotic and abiotic mechanisms of transformation. Abiotic degradation includes photolysis, hydrolysis, and redox reactions. Hydrolysis and redox reactions can be significant abiotic mechanisms in soil (EPA 1990). The *ksg* is expressed in units of an inverse year (yr^{-1}, or 1/yr).

The half-life of a substance in soil ($t_{1/2}$) is required to calculate the soil loss constant due to degradation (*ksg*) when a *ksg* value is not found in the sources provided. The units for $t_{1/2}$ required for

Equation 13 are year (yr). The value from the Howard et al. (1991) must be converted before use in the equation because the value is expressed in days in that source.

When a *ksg* value is found in the source provided, $t_{1/2}$ is not needed to estimate a *ksg* value for that substance and $t_{1/2}$ is therefore referenced as "7777".

The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

5.5.2 *Method for ksg*

Null values are assigned to all metals, including elemental mercury, mercuric chloride, and methyl mercury. Metals are transformed, but not degraded, by such mechanisms and, therefore, *ksg* values are not applicable to metals (EPA 2005a).

For all other substances for *ksg*:

1. HHRAP Database (EPA 2005b).

2. Calculate using Equation 13; HHRAP (EPA 2005a).

Equation 13 – Soil Loss Constant Due to Degradation (*ksg*)

$$ksg = \frac{0.693}{t_{1/2}}$$

Ksg = Soil loss constant due to degradation (yr^{-1})
$t_{1/2}$ = Half-life of substance in soil (yr)

Source: HHRAP (EPA 2005a).

5.5.3 *Method for $t_{1/2}$*

Values for half-life in soil are generated from the following sources:

1. For organic substances other than dioxins, furans, and polychlorinated biphenyls:

    a. The Handbook of Environmental Degradation Rates (Howard et al. 1991, EPA 2005a). High-end values from the source are selected so as to be consistent with the HHRAP.

    b. The HSDB® (USNLM 2004). The HSDB can be searched by substance name or by CASRN. The number of data categories is quite large and varied. In the HSDB the half-life in soil, if available in the substance record, can be found in the category Environmental Fate & Exposure, subcategory Environmental Fate, and then in "TERRESTRIAL FATE." The user should also check in the category Chemical/Physical

Properties to see if half-life in soil is listed as an entry in the record. Search for the term "half-life" on the page, determine if the study is a soil study for the substance and then cut and paste the value into the interim database. If more than one half-life in soil value is provided from the same study, the average of the values should be taken.

2. For all congeners of dioxin, furan and polychlorinated biphenyls: 0.0277 yr^{-1} or 25 years (EPA 2000, 2005a).

5.6 Soil Enrichment Ratio (*ER*)

5.6.1 *Background*

Soil enrichment ratio (*ER*) is unitless parameter that accounts for differing amounts of soil erosion based on concentrations of organic substances in the soil.

5.6.2 *Method*

In the absence of site-specific data, the HHRAP (EPA 2005a, Table B-4-11) recommends the following default values:

1. For organic substances: 3

2. For inorganic substances: 1

6. PARAMETER-SPECIFIC ALGORITHMS: PARTITION COEFFICIENTS AND RELATED PARAMETERS FOR HUMANS

The following subsections provide the specific methods used to generate values for each parameter. When no value is developed after all steps in the parameter-specific algorithm are exhausted, the parameter value is determined to be "missing" (or "null") for that substance.

6.1 Fraction of Ingested Substance Stored in Body Fat of Mothers (f_1)

6.1.1 *Background*

The parameter f_1 represents the fraction of an ingested substance that is stored in the body fat of mothers. It is expressed as a proportion and is unitless. This parameter is used to model substance concentrations in mother's breast milk.

6.1.2 *Method*

1. A value of 0.9 is assigned to 2,3,7,8-TCDD and for the dioxin TEQ (EPA 2005a, Table C-3-1). This value can be used with TEFs to address dioxin and furan congeners and dioxin-like PCBs in the risk assessment.

2. Null values are assigned to all other substances and are referenced as not needed "7777". This parameter only applies to dioxins, furans, and dioxin-like PCBs, when following the HHRAP (EPA 2005a).

6.2 Fraction of Ingested Substance Absorbed by the Body (f_4)

6.2.1 *Background*

The parameter f_4 represents the fraction of an ingested substance that is absorbed by the body. It is expressed as a proportion and is, therefore, unitless. This parameter is used to model substance concentrations in mother's breast milk.

6.2.2 *Method*

1. A value of 0.9 is assigned to 2,3,7,8-TCDD and for the dioxin TEQ (EPA 2005a, Table C-3-2). This value can be used with TEFs to address dioxins, furans, and dioxin-like PCBs in the risk assessment.

2. Null values are assigned to all other substances and are referenced as not needed "7777". This parameter only applies to dioxins, furans, and dioxin-like PCBs, when following the HHRAP (EPA 2005a).

6.3 Half-life of a Substance in Humans (h_{human})

6.3.1 *Background*

Half-life in humans (h_{human}) represents the half-life of dioxins and furans in the human tissue. This parameter is used to estimate the concentration of a substance in human tissues (e.g., breast milk). Half-life in humans (h_{human}) is expressed in units of time (i.e., days). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

6.3.2 *Method*

1. A value of 2,555 days is assigned to 2,3,7,8-TCDD and for the dioxin TEQ (EPA 2005a, Table C-3-1). This value can be used to address dioxins, furans, and dioxin-like PCBs in the risk assessment.

2. Null values are assigned to all other substances and are referenced as not needed "7777". This parameter only applies to dioxins, furans, and dioxin-like PCBs, when following the HHRAP (EPA 2005a).

6.4 Dermal Absorption Fraction from Soil to Skin (*ABSd*)

6.4.1 *Background*

The dermal absorption fraction (*ABSd*) is used to estimate the amount of substance absorbed through the skin from contact with contaminated soil. This parameter is expressed as a fraction of the amount of substance on the skin that is absorbed, so is unitless. The *ABSd* is affected by various factors such as soil particle size or soil layer on the skin. Values that are expressed as a percent absorbed must first be converted to a fraction by dividing by 100 before inserting into the EPA equation for estimating the dermal dose from soil contact.

The EPA provides substance-specific *ABSd* values, and recommends default values for substances with no *ABSd* (EPA 2004c, EPA 2004d). Although substance-specific *ABSd* values were derived from studies based on 24-hour exposure events, the EPA states these values should not be adjusted for time (EPA 2004c). Instead, site-specific conditions should be accounted for by adjusting the exposure frequency and exposure duration (EPA 2004c). *ABSd* values for chemical warfare agents (CWA) are also available but are expressed as an absorption rate (CHPPM 1999). Unlike EPA recommended substance-specific defaults, *ABSd* rates for CWAs were derived from an empirical relationship developed by Fiserova-Bergorova (1990). Since the absorption rates are in units of percent per hour, they must be adjusted for event duration.

6.4.2 *Method*

1. Use the substance-specific values presented in Table 3.

2. Check EPA's website for additional *ABSd* values. If values are presented in percent, convert to a fraction by dividing by 100.
   http://www.epa.gov/oswer/riskassessment/ragse/index.htm

3. Substances with no value from the above sources:

- Semi-volatile organic substances: 0.1
- Volatile organic substances: null
- Inorganic substances: null

Table 3 – *ABSd* Values Expressed as Fraction Absorbed per Exposure Event

Substances Provided by EPA*	24-hr Event	CWA**	1-Hr Event
Arsenic	0.03	GB	0.0035 per hour
Cadmium	0.001	GA	0.0026 per hour
Chlordane	0.04	GD	0.0078 per hour
2,4-Dichlorophenoxyacetic acid	0.05	VX	0.0027 per hour
DDT	0.03	HD	0.0070 per hour
TCDD and other dioxins	0.03***		
Lindane	0.04		
Benzo(a)pyrene and other PAHs	0.13		
Aroclors 1254 and 1242, and other PCBs	0.14		
Pentachlorophenol	0.25		
Hexahdro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.015		
Thiodiglycol	0.0075		
Trinitrobenzene	0.019		
2,4-Dinitrotoluene (2,4-DNT)	0.102		
2,6-Dinitrotoluene (2,6-DNT)	0.099		
2-Amino-4,6-dinitrotoluene	0.006		
4-Amino-2,6-dinitrotoluene	0.009		
2,4-Diamino-6-nitrotoluene	0.011		
2,6-Diamino-4-nitrotolene	0.005		
Trinitrotoluene (TNT)	0.032		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	0.006		
N-methyl-N,2,4,6-tetranitrobenzamine (tetryl)	0.00065		

* Exhibit 3-4 in EPA 2004c and EPA 2004d (values converted to fraction from percent, if necessary)
** Values for chemical warfare agents (CWA) are provided in CHPPM 1999, but are expressed on a per-hour basis.
*** If the soil organic carbon content is greater than 10%, then the *ABSd* = 0.001 for TCDD and other dioxins (EPA 2004c). Note that the HHRAP default fraction organic carbon in soil is 1% (EPA 2005a, page A-2-13).

6.5 Dermal Permeability Coefficient from Water (*Kp*)

6.5.1 *Background*

The dermal permeability coefficient (*Kp*) represents the rate at which a substance in water penetrates the skin. Generally expressed in units of centimeters per hour (cm/hr), *Kp* is used only when estimating dermal exposure from contact with substances in water (EPA 2004c).

6.5.2 *Method*

For organic substances, the Dermal Risk Assessment Guidance recommends that tabulated values of predicted *Kp* from Appendix B be used in conjunction with EPA's equations for estimating dermal uptake

of substances in water (EPA 2004c). Even though these *Kp* values were estimated from octanol-water partition coefficients (K_{ow}) and molecular weights (*MW*) that may differ from those derived following this algorithm's approaches, this algorithm adopts EPA's recommended *Kp* values when they are provided. Values of K_{ow} and *MW* generated from this algorithm are not expected to vary greatly from those used by the EPA. Additionally, using EPA-derived *Kp* values reduces uncertainties inherent in models recommended by the EPA because the models were derived from empirical data using specific assumptions. The EPA notes *Kp* values estimated from its recommended empirical relationship may underestimate or overestimate substances that fall outside the "Effective Prediction Domain" (EPD) (EPA 2004c).

1. Organic substances (in order):

    a. Exhibit B-3 (EPA 2004c). EPA includes *Kp* values outside the EPD in this table and identifies them with an asterisk. *Kp* values are also listed in a spreadsheet provided by the EPA, available at the following:
    http://www.epa.gov/oswer/riskassessment/ragse/pdf/org04_01.xls

    b. Calculate using Equation 14.

    c. Null values are assigned if *Kp* cannot be calculated because required input parameters for Equation 14 are not available.

2. For inorganic substances:

    a. Select values in Table 4.

    b. A default value of 0.001 is assigned if no substance-specific *Kp* value is available.

Equation 14 – Empirical Predictive Correlation for Permeability Coefficient (*Kp*) of Organic Substances

$$Kp = 10^{-2.80 + 0.66 \cdot log\ Kow - 0.0056 \cdot MW}$$

Kp = Predicted permeability coefficient (cm/hr)
K_{ow} = Octanol-water partition coefficient (unitless)
MW = Molecular weight (g/mol)

Source: Equation 3.8 of the Dermal Risk Assessment Guidance (EPA 2004c). Equation 14 is modified from the Dermal Risk Assessment Guidance where *Kp* is expressed as "log *Kp*".

This model for *Kp* is technical valid when a substance is within the Effective Prediction Domain (EFD) (see next section). However, at this time the EPA does not suggest excluding such calculated *Kp* values for substances outside the EPD. However, as the agency receives additional data, the EPD range may shift; therefore, the EPA advises users to check for updates (EPA 2004c).

Table 4 – Water Permeability Coefficients (*Kp*) for Inorganic Substances

Inorganic Substance	Water Permeability Coefficient (cm/hr)
Cadmium	0.001
Chromium (+6)	0.002
Chromium (+3)	0.001
Cobalt	0.0004
Lead	0.0001
Mercury (+2)	0.001
Methyl mercury	0.001
Mercury vapor	0.24
Nickel	0.0002
Potassium	0.002
Silver	0.0006
Zinc	0.0006

Source: Dermal Risk Assessment Guidance (EPA 2004c).

6.6 Fraction Absorbed from Dermal Contact with Water (*FA*)

6.6.1 *Background*

The fraction absorbed (*FA*) modifies the amount of substance available for absorption by accounting for loss due to natural shedding of the outer skin layer (desquamation) (EPA 2004c). The current EPA model estimates a total dose dissolved into the skin at the end of an exposure (EPA 2004c). This could potentially overestimate the amount of substance available for absorption, and is particularly true of substances that are either highly lipophilic or have a long lag-time (EPA 2004c). The EPA has shown that under normal desquamation rates (about 14 days), only substances with a relatively high octanol-water partition coefficient (log K_{ow} greater than 3.5), or those with a relatively long lag-time (greater than 10 hours) would be affected by loss due to desquamation (EPA 2004c). This means for most substances, the *FA* value will be close to 1.

6.6.2 *Method*

1. *FA* is not needed for inorganic substances (EPA 2004c) so their values are null and then referenced as not needed "7777."

2. For organic substances, select a value from the 209 tabulated values provided in Exhibit B-3 of the Dermal Risk Assessment Guidance (EPA 2004c). These values of *FA* are also listed in a spreadsheet available at: http://www.epa.gov/oswer/riskassessment/ragse/pdf/org04_01.xls

   These provided values were extrapolated by the EPA from Exhibit A-5 in their guidance using substance-specific parameters which may differ from those recommended in this algorithm. However, because the EPA recommends that *FA* values be reported to the nearest one significant figure, discrepancies in substance-specific input parameters are not expected to generate significant differences in *FA* values.

3. *FA* values of 1 are assigned to all other organic substances which fall within the following Effective Prediction Domain (EFD) (EPA 2004c).

Equation 15 – Effective Prediction Domain (EFD) associated with dermal permeability coefficients

$$-0.06831 \le \left[\left(5.103 \times 10^{-4} \cdot MW\right) + \left(0.05616 \cdot log\, K_{ow}\right)\right] \le 0.5577 \qquad \textbf{(A)}$$

$$-0.3010 \le \left[\left(-5.103 \times 10^{-4} \cdot MW\right) + \left(0.05616 \cdot log\, K_{ow}\right)\right] \le 0.1758 \qquad \textbf{(B)}$$

K_{ow} = *n*-octanol/water partition coefficient (unitless)
MW = Molecular weight (g/mol)

Source: Dermal guidance (EPA 2004c, equations 3.9 and 3.10). The constants 5.103 x 10^{-4} and -5.103 x 10^{-4} are corrected versions of those that appear in the guidance (we confirmed their accuracy by evaluating the EPA spreadsheet available on-line).

4. *FA* values for all other organic substances which fall outside the EFD are extrapolated from Exhibit A-5 (EPA 2004c) according to the following steps.

    a. Use the calculated value of the desquamation rate to lag time ratio (t_{sc}/τ_{event}), rounded to the nearest significant digit, to look up the correct location on bottom x-axis of Exhibit A-5. Note the bottom x-axis that represents t_{sc}/τ_{event} is on the logarithmic scale so tick marks are not evenly spaced.

    b. Use the calculated value of the dimensionless skin permeability coefficient (*B*), rounded to the nearest significant digit, to look up the correct location on the y-axis of Exhibit A-5. Select the *B* curve that is closest to what was calculated. Locate the calculated t_{sc}/τ_{event} along the x-axis, and trace vertically until you intersect the *B* curve. From that intersection, trace horizontally to find the corresponding *FA* value on the y-axis. EPA states *FA* should be rounded to the nearest one significant figure (EPA 2004c).

5. Null values are assigned to organic substances if *FA* values cannot be extrapolated because necessary parameter values are not available.

6.7 Desquamation Rate to Lag Time Ratio (t_{sc}/τ_{event})

6.7.1 *Background*

The ratio of the desquamation rate to lag time is needed so values of *FA* (previous section) can be extrapolated from Exhibit A-5 of the dermal guidance (EPA 2004c). The desquamation rate (t_{sc}), also referred to as the stratum corneum turnover rate and is expressed in units of time (i.e., days). The normal desquamation rate, in which the skin's stratum corneum is completely replaced, generally takes about 14 days (EPA 2004c).

Lag time per event (τ_{event}) refers to the time it takes a substance to travel across the stratum corneum, expressed on a dermal contact event basis. This chemical-specific parameter has units of time per event (i.e., hrs/event). Substances that are not highly lipophilic but have a long lag time may be removed by desquamation before they are absorbed, resulting in a lower absorbed dose.

6.7.2 *Method*

1. For inorganic substances, this parameter is not needed and null values are assigned.

2. For organic substances, the ratio is derived using Equation 16 (EPA 2004c). Null values are assigned if the molecular weight is not available.

Equation 16 – Desquamation Rate to Lag Time Ratio (t_{sc}/τ_{event})

$$t_{sc}/\tau_{event} = 336\ hr \Big/ \left(\frac{l_{sc}}{6 \times 10^{(-2.80-0.0056 \cdot MW)}} \right)$$

t_{sc}/τ_{event} = Desquamation rate to lag time ratio (day/hr/event)
l_{sc} = Apparent thickness of stratum corneum (cm)
MW = Molecular weight (g/mol)

Source: Dermal guidance (EPA 2004c). This equation combines the guidance method into a single equation to represent the ratio that forms the x-axis of Exhibit A-5 of the dermal guidance. This form of the equation is only applicable when the desquamation rate (t_{sc}) is 14 days (or 336 hours), as suggested in the guidance. The denominator represents τ_{event}, which is a combination of equations A.3 and A.4 from the guidance. The guidance default value of l_{sc} is 0.001 cm.

6.8 Dimensionless skin permeability ratio (*B*)

6.8.1 *Background*

This parameter (*B*) is defined as the ratio of a substance's permeability coefficient through the stratum corneum (uppermost layer of the skin) to that substance's permeability coefficient through the viable epidermis (layer beneath the stratum corneum) (EPA 2004c). This parameter is needed for estimating the amount of organic substance absorbed through the skin from contact with water, and used only for long-term exposures (EPA 2004c). Since it is a ratio of two permeability coefficients (cm/hr), *B* has no units.

6.8.2 *Method*

1. For organic substances, calculate *B* using Equation 17; EPA 2004c, Equation A.1. Null values are assigned if *B* cannot be calculated because required input parameters are not available.

2. All other substances are referenced as not needed "7777". This parameter only applies to organic substances when following EPA guidance (EPA 2004c).

Equation 17 – Dimensionless Skin Permeability Ratio (*B*)

$$B = Kp \cdot \frac{\sqrt{MW}}{2.6}$$

B = Dimensionless skin permeability ratio (unitless)
Kp = Dermal permeability coefficient in water (cm/hr)
MW = Molecular weight (g/mol)

Source: Dermal Risk Assessment Guidance (EPA 2004c, equation A.1).

6.9 1st and 2nd Lag Time Correlation Coefficients (Flynn's Data) (*d* and *c*)

6.9.1 *Background*

The 1st lag-time correlation coefficient (*d*) and the 2nd lag-time correlation coefficient (*c*) are substance-specific parameters derived from a set of experimental data compiled by Flynn to provide a relationship between a substance's permeability coefficient, and its molecular weight and octanol-water partition coefficient (EPA 2004c). These unitless coefficients are only used when estimating the dermal dose from contact with water (EPA 2004c). They play a role in the estimation of the time to reach steady state partitioning between water and the skin.

6.9.2 *Method for d (1st coefficient)*

1. For organic substances, calculate *d* using Equation 18; EPA 2004c, Equation A.7. Null values are assigned if *d* cannot be calculated because required input parameters are not available.

2. All other substances are referenced as not needed "7777". This parameter only applies to organic substances when following EPA guidance (EPA 2004c).

Equation 18 – 1st Lag Time Correlation Coefficient (*d*)

$$d = \frac{2 \cdot (1 + B)^2}{\pi} - c$$

d = 1st lag time correlation coefficient derived from the Flynn data set (unitless)
B = Dimensionless skin permeability ratio (unitless)
c = 2nd lag time correlation coefficient derived from the Flynn data set (unitless)
π = Pi (unitless)

Source: Dermal Risk Assessment Guidance (EPA 2004c, equation A.7).

6.9.3 *Method for c (2nd coefficient)*

1. For organic substances, calculate *c* using Equation 19; EPA 2004c, Equation A.8. Null values are assigned if *c* cannot be calculated because required input parameters are not available.

2. All other substances are referenced as not needed "7777". This parameter only applies to organic substances, when following EPA guidance (EPA 2004c).

Equation 19 – 2nd Lag Time Correlation Coefficient (*c*)

$$c = \frac{1 + 3 \cdot B + 3 \cdot B^2}{3 \cdot (1 + B)}$$

c = 2nd lag time correlation coefficient derived from the Flynn data set (unitless)
B = Dimensionless skin permeability ratio (unitless)

Source: Dermal Risk Assessment Guidance (EPA 2004c, equation A.8).

6.10 Dermal Permeability Coefficient from Vapor (*Kpv*)

6.10.1 *Background*

The dermal permeability coefficient (*Kpv*) measures the rate at which a substance in the vapor or gaseous form is absorbed by the skin (EPA 1992). Units of *Kpv* are typically expressed in centimeters per hour (cm/hr).

6.10.2 *Method*

Currently, substance-specific *Kpv* values, and methods for estimating *Kpv*, are still limited. The Dermal Exposure Assessment (DEA) document (EPA 1992) provides a regression equation that relies on a substance's fat/air partition coefficient ($K_{f/a}$) to estimate *Kpv* values; however, values of $K_{f/a}$, generally derived in experimental studies, are difficult to locate.

1. Select *Kpv* values listed in Table 5.

2. Null values are assigned to all other substances unless this exposure pathway has been determined to be inappropriate for a substance (e.g., substance is not expected to be in the vapor phase except at extremely high temperatures where human contact is unlikely).

Table 5 – Dermal Permeability Coefficients (*Kpv*) for Exposure to Vapors

Substance	*Kpv* (cm/hr)	Substance	*Kpv* (cm/hr)
1,1,1,2-Tetrachloroethane	1.01	cis-1,2-Dichloroethylene	0.073
1,1,1-Trichloroethane	0.090	Cyclohexane	0.077
1,1,1-Trifluoro-2-bromo-2-chloroethane	0.051	Dibromomethane	0.350
1,1,1-Trifluoro-2-chloroethane	<0.01	Dichloromethane	0.020
1,1,2,2-Tetrachloroethane	1.81	Diethyl ether	<0.01
1,1,2-Trichloroethane	0.666	Difluoromethane	<0.01
1,1-Dichloroethane	0.042	Fluorochloromethane	<0.01
1,1-Dichloroethylene	<0.01	Hexachloroethane	1.59
1,2-Dibromoethane	0.559	Isoflurane	0.010
1,2-Dichloroethane	0.130	Isoprene	<0.01
1,2-Dichloropropane	0.206	Isopropyl bromide	0.039
1-Bromo-2-chloroethane	0.431	Methyl chloride	<0.01
1-Chloropropane	0.019	m-xylene	0.872
1-Nitropropane	0.209	n-Heptane	0.147
2,2,4-Trimethylpentane	0.105	n-Hexane	0.039
2,3,4-Trimethylpentane	0.179	n-Propyl bromide	0.077
2-Chloropropane	<0.01	o-xylene	0.881
2-Nitropropane	0.03	Pentachloroethane	1.98
Allyl chloride	0.011	p-xylene	0.818
Benzene	0.206	Styrene	1.665
Bromochloromethane	0.121	Tetrachloroethylene	0.764
Carbon tetrachloride	0.137	Toluene	0.462
Chlorobenzene	0.587	trans-1,2-Dichloroethylene	0.034
Chlorodibromomethane	0.901	Trichloroethylene	0.233
Chloroethane	<0.01	Vinyl bromide	<0.01
Chloroform	0.061	Vinyl chloride	<0.01

Source: Dermal Exposure Assessment: Principles and Applications (EPA 1992).

Note: At this time, CHPPM does not attempt to locate fat/air partition coefficients ($K_{f/a}$) for organic substances. However, if during the conduct of a specific risk assessment, and a $K_{f/a}$ value becomes available for an organic compound that is not already included in Table 5, then use of Equation 20 can be considered in order to generate a *Kpv* for the project. Note, however, that the equation is applicable to substances with a $K_{f/a}$ value between 98.1 – 3,476 (EPA 1992).

Equation 20 – Regression Equation for Estimating the Dermal Permeability Coefficient (*Kpv*) for Exposure to Vapor

$$Kpv = \left(K_{f/a} \cdot 0.00049\right) - 0.385$$

Kpv = Dermal permeability coefficient for vapor exposures (cm/hr)
$K_{f/a}$ = Fat/air partition coefficient (unitless)

Source: DEA (EPA 1992).
The equation is applicable to substances with $K_{f/a}$ values between 98.1 – 3,476

7. PARAMETER-SPECIFIC ALGORITHMS: PARTITION COEFFICIENTS AND RELATED PARAMETERS FOR PLANTS

The following subsections provide the specific methods used to generate values for each parameter. When no value is developed after all steps in the parameter-specific algorithm are exhausted, the parameter value is determined to be "missing" (or "null") for that substance.

7.1 Fraction of Substance Wet Deposition that Adheres to Plant Surfaces (*Fw*)

7.1.1 *Background*

The fraction of substance wet deposition that adheres to plant surfaces (*Fw*), a unitless parameter, is required to estimate plant concentrations due to air deposition. *Fw* accounts for the portion of the substance that adheres to the plant surface from the wet deposition phase of the substance deposition.

7.1.2 *Method*

The HHRAP Appendix B, Table B-2-7 (EPA 2005a), and other similar tables, provide the following for assignment of the *Fw* parameter values. The HHRAP states that anions have an *Fw* value of 0.2 and that cations and most organic substances have an *Fw* value of 0.6. The guidance does not address inorganic substances specifically (other than if they happen to be an anion or a cation), nor does the HHRAP address neutral inorganic compounds (neither anionic nor cationic).

1. A value of 0.2 is assigned to the following three organic anionic substances.

   - 4-Chloroaniline (CASRN 106-47-8)
   - n-Nitrosodiphenylamine (CASRN 86-30-6)
   - n-Nitrosodi-n-propylamine (CASRN 621-64-7)

2. A value of 0.6 is assigned to all other substances.

7.2 Root Concentration Factor (*RCF*)

7.2.1 *Background*

The root concentration factor (*RCF*) represents the ratio of the substanceconcentration in the edible root of the plant to the substance concentration in the soil water. *RCF* is used in the estimation of the belowground transfer of a substance from soil to a root vegetable ($Br_{rootveg}$). *RCF* is expressed in units of microgram per gram dry weight of plant per microgram per gram soil water (µg/g DW plant)/(µg/mL soil water). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

7.2.2 *Method*

Null values are assigned to all metals, including mercuric compounds. No *RCF* values are available in published literature (EPA 2005a).

For all other substances:

3. HHRAP Database (EPA 2005b).

4. For substances with a log *Kow* value of 2.0 or higher: Calculate using Equation 21; modified from the HHRAP (EPA 2005a, Briggs et al. 1982).

   The HHRAP (EPA 2005a) states that the equation estimates a value in fresh weight (FW) units. In the HHRAP Database, the value is then converted to DW units using a moisture content of 87 percent in root vegetables citing the Exposure Factors Handbook, Food Ingestion Factors (EPA 1997b) and Food Value of Portions Commonly Used (Pennington 1994).

5. For substances with a log K_{ow} value of less than 2.0: Calculate using Equation 22; modified from the HHRAP (EPA 2005a, Briggs et al. 1982).

Equation 21 – Root Concentration Factor (*RCF*) for Substances with a log K_{ow} of 2.0 or Higher

$$RCF = 10^{[(0.77 \cdot (\log Kow)) - 1.52]}$$

RCF = Root concentration factor (µg/g dry weight (DW) plant)/(µg/mL soil-water)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, modified from "Relationships Between Lipophilicity and Root Uptake and Translocation of Nonionized Chemicals by Barley," Briggs et al. 1982).

Equation 22 – Root Concentration Factor (*RCF*) for Substances with a log K_{ow} Less than 2.0

$$RCF = 10^{[((0.77 \cdot (\log Kow)) - 1.52) + 0.82}$$

RCF = Root concentration factor (µg/g dry weight (DW) plant)/(µg/mL soil-water)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, modified from "Relationships Between Lipophilicity and Root Uptake and Translocation of Nonionized Chemicals by Barley," Briggs et al. 1982).

7.3 Plant-Soil Bioconcentration Factor for Root Vegetables ($Br_{rootveg}$)

7.3.1 *Background*

The plant-soil bioconcentration factor ($Br_{rootveg}$) represents the ratio of transferred substance (concentration) in the plant to the substance concentration in the soil. This proportion of substance in the produce is used in the equation to estimate the concentration of each substance in the root vegetable. $Br_{rootveg}$ is expressed in units of microgram per gram dry weight of plant per microgram per gram soil (µg/g DW plant)/(µg/g soil). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

7.3.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For remaining organic substances, calculate using Equation 23; HHRAP (EPA 2005a, EPA 1995a).

Equation 23 – Plant-Soil Bioconcentration Factor in Root Vegetables ($Br_{rootveg}$)

$$Br_{rootveg} = \frac{RCF}{Kd_s}$$

$Br_{rootveg}$ = Plant-soil bioconcentration factor in root vegetables (µg-g DW plant/µg-g soil)
RCF = Root concentration factor (µg-g DW plant/µg-mL soil-water)
Kd_s = Substance soil-water partition coefficient (cm^3/g)

Source: HHRAP (EPA 2005a; Development of Human Health-Based and Ecologically-Based Exit Criteria for the Hazardous Waste Identification Project, EPA 1995a).

3. For metals other than those in the HHRAP Database, use the dry weight (DW) basis values for nonvegetative (reproductive) growth from Review and Analysis of Parameters and Assessing Transport of Environmentally Released Radionuclides Through Agriculture, Figure 2.2 (Baes et al. 1984).

7.4 Plant-Soil Bioconcentration Factors for Aboveground Produce (Br_{ag}), Forage and Silage ($Br_{forage/silage}$), and Grain (Br_{grain})

7.4.1 *Background*

The plant-soil bioconcentration factors for aboveground produce (Br_{ag}), for forage and silage ($Br_{forage/silage}$), and for grain (Br_{grain}) represent the ratio of transferred substance (concentration) in the plant to the substance concentration in the soil for these types of edible plants. This proportion of substance in the produce is used in the equation to estimate the concentration of each substance in each edible plant. The notation for these parameters has been modified from the HHRAP (EPA 2005a) in order to improve clarity. These parameters are expressed in units of microgram per gram dry weight of plant per microgram per gram soil (µg/g DW plant) / (µg/g soil). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

Algorithm Notation	HHRAP Notation

Br_{ag} =	Br_{ag}
$Br_{forage/silage}$ =	Br_{forage}
Br_{grain} =	Br_{grain} (metals)
	Br_{forage} (organic substances)

7.4.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For remaining organic substances, calculate using Equation 24; Bioconcentration of Organics in Beef, Milk, and Vegetation (Travis et al. 1988) to calculate values on a DW basis.

Equation 24 – Plant-Soil Bioconcentration Factor for Aboveground Produce (Br_{ag}), Forage and Silage ($Br_{forage/silage}$), and Grain (Br_{grain})

$$Br_x = 10^{(1.588-0.578\cdot(\log Kow))}$$

Br_x = Plant-soil bioconcentration factor for aboveground produce, forage and silage, or grain (µg-g DW plant/µg-g soil)

K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, Bioconcentration of Organics in Beef, Milk, and Vegetation, Travis et al. 1988).

3. For metals other than those in the HHRAP Database, use the dry weight (DW) basis values for nonvegetative (reproductive) growth from Review and Analysis of Parameters and Assessing Transport of Environmentally Released Radionuclides Through Agriculture, Figure 2.2 (Baes et al. 1984).

7.5 Soil-to-Plant Bioconcentration Factor for Terrestrial Plants (Br_{tp})

7.5.1 *Background*

Terrestrial plants are defined here as wild (and domesticated) plants that are consumed by wild animals, which are assessed in an ecological risk assessment. Thus, the terrestrial plants are a different exposure point than domesticated plants (e.g., crops) assessed in human health risk assessments.

The plant-to-soil bioconcentration factor accounts for plant uptake of substances from soil. Data for a variety of plants and food crops were used to determine recommended BCF values. The Br_{tp} is expressed in units of milligram per kilogram dry weight of plant over milligram per kilogram dry weight soil (mg/kg DW plant)/(mg/kg DW soil). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

After comparing the HHRAP guidance on the Br_{ag} and the SLERAP guidance on the $Br_{tp,}$ it was determined that the guidance for these two parameters is the same for organic substances.

7.5.2 *Method*

1. For organics, the same approach is used as the Br_{ag} parameter. Though the units for the Br_{tp} and Br_{ag} differ slightly, no unit conversion is needed.

2. For inorganic substances, values are generated from Table C-2 from the SLERAP (EPA 1999d).

3. For other inorganic substances not found in the above source, then values are generated using the following two sources (in order), which is consistent with the SLERAP (EPA 1999d).

   - High-end (90th percentile) uptake factors from Oak Ridge National Laboratory (ORNL 1998a), Table 1 and Table D-1.

   - Values from Baes et al. (1984).

     The *Bv* values from Baes are used, not the *Br* values. *Bv* is the soil-to-plant concentration factor for plant parts usually associated with vegetative functions (leaves, stems, straw, etc.) and is a unitless parameter.
     The *Bv* values are taken from Figure 2.1. Figure 2.1 is a periodic table format, so the periodic symbol of the substance must be known when finding the value.

7.6 Air-to-Plant Biotransfer Factors for Aboveground Produce (Bv_{ag}) and Forage and Silage ($Bv_{forage/silage}$)

7.6.1 *Background*

The air-to-plant bioconcentration factors for aboveground produce (Bv_{ag}) and for forage and silage ($Bv_{forage/silage}$) represent the ratio of transferred substance (concentration) in the plant to the substance concentration in the air. This proportion of substance in the produce is used in the equation to estimate the concentration of a substance in the edible part of the plant. The notation for these parameters has been modified from the HHRAP (EPA 2005a) in order to improve clarity. These parameters are expressed in units of microgram per gram dry weight of plant per microgram per gram air (µg/g DW plant)/(µg/g air). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

Algorithm Notation	HHRAP Notation
Bv_{ag} =	Bv_{ag}
$Bv_{forage/silage}$ =	Bv_{forage}

7.6.2 *Method*

1. For all metals and inorganics (except for mercury) values of zero are assigned, based on the guidance for metals provided in the HHRAP (EPA 2005a).

2. For organic substances and mercury, the HHRAP Database (EPA 2005b).

3. For the remaining organic substances, calculate using Equation 25B; HHRAP (EPA 2005a, Bacci et al. 1992, Bacci et al. 1990). The HHRAP (EPA 2005a), page A-2-21, states that *Bv* values provided in the HHRAP Database were calculated using the Bacci equations and then were

reduced by a factor of 100 for all organic substances, other than the 17 dioxin-like dioxins and furans. This factor of 100 was added to the second equation.

Equation 25 – Correlation Equations for Air-to-Plant Biotransfer Factor for Aboveground Produce and Forage (Bv_{ag} and $Bv_{forage/silage}$)

(A) $$\log B_{vol} = (1.065 \cdot (\log K_{ow})) - (\log\left(\frac{H}{RT}\right)) - 1.654$$

(B) $$Bv = \frac{\left(\frac{\rho_{air} \cdot B_{vol}}{(1 - f_{water}) \cdot \rho_{forage}}\right)}{100}$$

B_{vol} = Volumetric air-to-plant biotransfer factor (FW basis)
Bv = Mass-based air-to-plant biotransfer factor (DW basis)
f_{water} = 0.85 (fraction of forage that is water (Macrady and Maggard 1993)
H = Henry's Law constant (atm-m^3/mol)
K_{ow} = *n*-octanol/water partition coefficient (unitless)
ρ_{air} = 1.19 (g/L) (Weast 1981)
ρ_{forage} = 770 (g/L) (Macrady and Maggard 1993)
R = Gas constant of 8.2057459E-05 [(atm-m^3)/(mol-°K)]
T = Working temperature (°K), set as 298.1 °K

Source: HHRAP (EPA 2005a, "Chlorinated Dioxins: Volatilization from Soils and Bioconcentration in Plant Leaves" (Bacci et al. 1992). Equation B is a modified version of that presented in the HHRAP, where the factor of 100 is included here (see text).

7.7 Plant Biotransfer Factor for Terrestrial Plants (Bv_{tp})

7.7.1 *Background*

Terrestrial plants are defined here as wild (and domesticated) plants that are consumed by wild animals, which are assessed in an ecological risk assessment. Thus, the terrestrial plants are a different exposure point than domesticated plants (e.g., crops) assessed in human health risk assessments.

The air-to-plant biotransfer factor (Bv_{tp}) is unitless and is defined as the ratio of substance concentrations to exposed aboveground plant parts to the substance concentration in air.

7.7.2 *Method*

After comparing the HHRAP guidance on the Bv_{ag} and the SLERAP guidance on the $Bv_{tp,}$ it was determined that the guidance for these two parameters is the same except for the Lorber and Pinsky source for dioxins and furans is 1999 in the SLERAP and it is 1995 in the HHRAP.

For Bv_{tp}, the same approach is used for the Bv_{ag} parameter values. The units for both of these parameters are the same and are expressed in units of microgram per gram dry weight of plant per microgram per gram air (µg/g DW plant)/(µg/g air). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

7.8 Empirical Correction Factor for Belowground Produce ($VG_{rootveg}$)

7.8.1 *Background*

The empirical correction factor for belowground produce ($VG_{rootveg}$) is a unitless correction factor that reduces the belowground produce concentration to better approximate the transfer of substances into the parts of belowground produce typically consumed by humans. The term is used in equations that estimate belowground produce substance concentrations due to root uptake from soil. EPA states that this factor is used "because of the protective outer skin, size, and shape of bulky produce, the transfer of lipophilic substances to the center of the produce is not likely. In addition, typical preparation techniques, such as washing, peeling, and cooking, will further reduce [substance] residues." (EPA 2005a, Table B-2-10).

7.8.2 *Method*

1. A value of 0.01 is assigned to organic substances with a log $K_{ow} > 4$ (EPA 2005a).
2. A value of 1.0 is assigned to organic substances with a log $K_{ow} \leq 4$ (EPA 2005a).
3. Null values are assigned to all inorganic substances (EPA 2005a).

7.9 Empirical Correction Factor for Aboveground Produce (VG_{agp})

7.9.1 *Background*

The empirical correction factor for aboveground produce (VG_{agp}) is a unitless correction factor that reduces the aboveground produce concentration to better approximate the transfer of substances into leafy vegetation rather than into bulkier aboveground produce, such as apples (EPA 2005a, Table B-2-8). The term is used to estimate aboveground produce substance concentrations due to air-to-plant transfer.

7.9.2 *Method*

1. A value of 0.01 is assigned to organic substances with a log $K_{ow} > 4$ (EPA 2005a).
2. A value of 1.0 is assigned to organic substances with a log $K_{ow} \leq 4$ (EPA 2005a).
3. Null values are assigned to all inorganic substances (EPA 2005a).

7.10 Empirical Correction Factor for Aboveground Forage (VG_{agf})

7.10.1 *Background*

The empirical correction factor for aboveground forage (VG_{agf}) is a unitless empirical correction factor that reduces the aboveground forage concentration to better approximate the transfer of substances into leafy vegetation used for forage, rather than into bulkier aboveground produce, such as apples (EPA

2005a, Table B-3-8). The term is used to estimate aboveground forage substance concentrations due to air-to-plant transfer.

7.10.2 *Method*

1. A value of 1.0 is assigned to all organic substances (EPA 2005a).

2. Null values are assigned to all inorganic substances (EPA 2005a).

7.11 Empirical Correction Factor for Aboveground Silage (VG_{ags})

7.11.1 *Background*

The empirical correction factor for aboveground forage (VG_{ags}) is a unitless correction factor that reduces the aboveground silage concentration to better approximate the transfer of substances into bulky vegetation parts used for silage, rather than into leafier parts of plants (EPA 2005a, Table B-3-8). The term is used to estimate aboveground silage substance concentrations due to air-to-plant transfer.

7.11.2 *Method*

1. A value of 0.5 is assigned to all organic substances (EPA 2005a).

2. Null values are assigned to all inorganic substances (EPA 2005a).

7.12 Soil Bioavailability Factor (*Bs*)

7.12.1 *Background*

The soil bioavailability factor (*Bs*) is the ratio between the biotransfer factor for soil and the biotransfer factor for vegetation for a given substance. The efficiency of the transfer of a substance from soil may differ from the transfer from plants for some substances. Transfer from soil that is lower than that from plants would give a *Bs* of less than one. Soil transfer that is equal to or greater than that from plants would give a *Bs* equal to or greater than one. *Bs* is expressed as unitless because the units for the two biotransfer factors cancel out.

7.12.2 *Method*

All substances are assigned a value of 1.0. The HHRAP states that there is not enough data on bioavailability from soil, so this default value is recommended for all substances until more data becomes available for this parameter (EPA 2005a, Table B-3-10).

7.13 Bioconcentration Factor for Sediment-to-Aquatic Vegetation (BCF_{sav})

7.13.1 *Background*

The sediment-to-aquatic vegetation bioconcentration factor (BCF_{sav}) is unitless and accounts for plant uptake of substances from sediments. The BCF_{sav} is calculated using laboratory and field measured values, and the data set used to calculate them is based on soil-to-plant bioconcentration studies.

7.13.2 *Method*

1. SLERAP Appendix C, Table C-2 (EPA 1999d).

2. For inorganic substances not found in the above source, values are generated from Baes et al. (1984).

   - The *Bv* values from Baes are used, not the *Br* values. *Bv* is the soil-to-plant concentration factor for plant parts usually associated with vegetative functions (leaves, stems, straw, etc.) and is a unitless parameter.
   - The *Bv* values are taken from Figure 2.1. Figure 2.1 is a periodic table format, so the periodic symbol of the substance must be known when finding the value.

3. For organics not found in the above source, values are calculated by taking the antilog of the result from the following Travis and Arms (1988) regression equation.

Equation 26 – Bioconcentration Factor for Sediment-to-Aquatic Vegetation (BCF_{sav})

$$BCF_{sav} = 10^{1.588-0.578\cdot(\log Kow)}$$

BCF = Sediment-to-aquatic vegetation bioconcentration factor (unitless)
K_{ow} = *n*-octanol-water partition coefficient of the substance (unitless)

Source: SLERAP (EPA 1999b-d).

7.14 Bioconcentration Factor for Water-to-Algae ($BCF_{w\text{-}al}$)

7.14.1 *Background*

The water-to-algae bioconcentration factor ($BCF_{w\text{-}al}$) accounts for algae uptake of substances from the water. The reported values are presented as the amount of substance in algae divided by the amount of substance in water or [(mg substance/kg wet tissue)/(mg dissolved substance/L water)]. The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

7.14.2 *Method*

For all substances:

1. SLERAP Appendix C, Table C-4 (EPA 1999d).

2. For inorganic substances and metals not found in the above source, null values are assigned.

3. For organics not found in the above source, values are calculated by taking the antilog of the result from the regression equation (Equation 27) by Southworth et al. (1978).

Equation 27 – Bioconcentration Factor for Water-to-Algae ($BCF_{w\text{-}al}$)

$$BCF_{w-al} = 10^{(0.819 \cdot \log Kow) - 1.146}$$

BCF_{w-al} = Bioconcentration factor for water to algae (L/kg FW)
K_{ow} = *n*-octanol-water partition coefficient (unitless)

Source: Southworth et al. (1978).

8. PARAMETER-SPECIFIC ALGORITHMS: PARTITION COEFFICIENTS AND RELATED PARAMETERS FOR ANIMALS

The following subsections provide the specific methods used to generate values for each parameter. When no value is developed after all steps in the parameter-specific algorithm are exhausted, the parameter value is determined to be "missing" (or "null") for that substance.

8.1 Biotransfer Factors for Beef (Ba_{beef}) and Dairy Milk (Ba_{milk})

8.1.1 *Background*

The biotransfer factor for beef and milk (Ba_{beef} and Ba_{milk}) is the ratio of the substance concentration in fresh weight (FW) in beef or milk to the daily intake of the substance by beef and dairy cows. These factors are expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.1.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For remaining inorganic substances not found in the above source, assign values obtained from Review and Analysis of Parameters and Assessing Transport of Environmentally Released Radionuclides Through Agriculture, Figure 2.25 for beef and Figure 2.24 for milk (Baes et al. 1984).

3. For all remaining organic substances, values are calculated using Equation 28A–C; HHRAP (EPA 2005a, RTI 2005). For remaining organic substances having a log K_{ow} between -0.67 and 8.2, calculate using substance-specific log *Kow* values. For organic substances having a log K_{ow} value less than -0.67, Ba_{beef} and Ba_{milk} values are calculated using a log K_{ow} value of -0.67. For organic substances having a log K_{ow} value greater than 8.2, Ba_{beef} and Ba_{milk} are calculated using a log K_{ow} value of 8.2.

Equation 28 – Biotransfer Factor for Beef (Ba_{beef}) and Milk (Ba_{milk}) for Organic Substances

(A) $$\log Ba_{fat} = [(-0.099 \cdot (\log K_{ow})^2) + (1.07 \cdot (\log Kow))] - 3.56$$

(B) $$Ba_{beef} = 10^{(\log Ba_{fat})} \cdot 0.19$$

(C) $$Ba_{milk} = 10^{(\log Ba_{fat})} \cdot 0.04$$

Ba_{fat} = Biotransfer factor for fat (day/kg FW tissue)
Ba_{beef} = Biotransfer factor for beef (day/kg FW tissue)
Ba_{milk} = Biotransfer factor for milk (day/kg FW tissue)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a, RTI 2005).

For remaining ionizing organic substances (organic acids) (see Table 2), if Ba_{beef} and Ba_{milk} remain null after implementing the above hierarchy, then a value can be generated using methods in *Methodology for Predicting Cattle Biotransfer Factors* (RTI 2005). By default, values are not generated using these methods. The need to fill these data gaps is a project-specific decision and should be made on a case-by-case basis for ionizing organic substances (organic acids). The RTI methods require additional input parameters and other chemical knowledge, so a chemist should implement the method. The method is summarized below.

For ionizing organic substances (organic acids), the Ba_{beef} and Ba_{milk} may be calculated using Equation 28B and C with a weighted K_{ow} (HHRAP, EPA 2005a). The K_{ow} is weighted based on the fraction of the substance present in the neutral species (*FracNeutral*) using Equation 29. The *FracNeutral* is estimated using Equation 30.

Equation 29 – Weighted K_{ow} for Organic Acids

$$wK_{ow} = K_{ow}^{n} \cdot FracNeutral + K_{ow}^{i} \cdot (1 - FracNeutral)$$

wK_{ow} = *n*-octanol/water partition coefficient (unitless) weighted based on the fraction of the substance present in the neutral species
K_{ow}^{n} = *n*-octanol/water partition coefficient (unitless) for the neutral species
FracNeutral = fraction of neutral species present in organic acid (unitless)
K_{ow}^{i} = *n*-octanol/water partition coefficient (unitless) for the ionized species

Source: HHRAP (EPA 2005a), Section A2-2.13.1.

Equation 30 – *FracNeutral* for Organic Acids

$$FracNeutral = \frac{[HA]}{[HA] - [A-]}$$

$$= 1 + [(10pH) - pKa]$$

FracNeutral = fraction of neutral species present in organic acid (unitless)
[HA] = equilibrium concentration of organic acid (mol/L)
[A-] = equilibrium concentration of anion (mol/L)
pKa = acid dissociation constant (unitless)

Source: HHRAP (EPA 2005a), Section A2-2.13.1; Lee et al., 1990.

8.2 Biotransfer Factor for Pork (Ba_{pork})

8.2.1 *Background*

The biotransfer factor for pork meat (Ba_{pork}) is the ratio of the substance concentration in fresh weight (FW) in pork meat to the daily intake of the substance by hogs. These factors are expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.2.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For all remaining organic substances, values are calculate using Equation 31; HHRAP (EPA 2005a, RTI 2005). For remaining organic substances having a log K_{ow} between -0.67 and 8.2, calculate using substance-specific log *Kow* values. For organic substances having a log K_{ow} value less than -0.67 Ba_{pork} is calculated using a log K_{ow} value of -0.67. For organic substances having a log K_{ow} value greater than 8.2, Ba_{pork} is calculated using a log K_{ow} value of 8.2.

Equation 31 – Biotransfer Factor for Pork for Organic Substances (Ba_{pork})

$$Ba_{pork} = 10^{(\log Ba_{fat})} \cdot 0.23$$

Ba_{pork} = Biotransfer factor for pork (day/kg FW tissue)
Ba_{fat} = Biotransfer factor for fat (day/kg FW tissue)

Source: HHRAP (EPA 2005a).

3. For remaining inorganic substances not included in the HHRAP Database, the HHRAP (EPA 2005a) states that no data are available in the literature to calculate Ba_{pork} values.

8.3 Biotransfer Factors for Chicken Meat ($Ba_{chicken}$) and Chicken Eggs (Ba_{egg})

8.3.1 *Background*

The biotransfer factors for chicken meat and eggs ($Ba_{chicken}$ and Ba_{egg}) are ratios of the substance concentration in fresh weight (FW) in meat or eggs to the daily intake of the substance by chickens (EPA 2005a). These factors are expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.3.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For all remaining organic substances, values are calculate using Equation 32 and 33; HHRAP (EPA 2005a, RTI 2005). For remaining organic substances having a log K_{ow} between -0.67 and 8.2, calculate using substance-specific log *Kow* values. For organic substances having a log K_{ow} value less than -0.67, $Ba_{chicken}$ and Ba_{egg} are calculated using a log K_{ow} value of -0.67. For organic substances having a log K_{ow} value greater than 8.2, $Ba_{chicken}$ and Ba_{egg} are calculated using a log K_{ow} value of 8.2.

Equation 32 – Biotransfer Factor for Chicken Meat for Organic Substances ($Ba_{chicken}$)

$$Ba_{chicken} = 10^{(\log Ba_{fat})} \cdot 0.14$$

$Ba_{chicken}$ = Biotransfer factor for chicken meat (day/kg FW)
Ba_{fat} = Biotransfer factor for fat (day/kg FW tissue)

Source: HHRAP (EPA 2005a).

Equation 33 – Biotransfer Factor for Chicken Eggs for Organic Substances (Ba_{egg})

$$Ba_{egg} = 10^{(\log Ba_{fat})} \cdot 0.08$$

Ba_{egg} = Biotransfer factor for chicken eggs (day/kg FW)
Ba_{fat} = Biotransfer factor for fat (day/kg FW tissue)

Source: HHRAP (EPA 2005a).

3. For remaining inorganic substances not included in the HHRAP Database, the HHRAP (EPA 2005a) states that no data are available in the literature to calculate $Ba_{chicken}$ and Ba_{egg} values.

8.4 Biotransfer Factor for Deer (Ba_{deer})

8.4.1 *Background*

The biotransfer factor for deer (Ba_{deer}) is the ratio of the substance concentration in fresh weight (FW) in deer meat to the daily intake of the substance by deer. These factors are expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

As ruminants, deer are not unlike cattle. It is therefore reasonable to assume they may have similar physiological processes that could yield similar biotransfer factors. Unlike beef, however, deer meat does not undergo marbling with fat, and deer fat is unpalatable. Therefore, it is likely to be trimmed rather than consumed. Therefore, the biotransfer factors for edible venison (Ba_{deer}) can be derived by adjusting the biotransfer factor for beef (Ba_{beef}) by accounting for differences in fat content.

8.4.2 *Method*

Calculate values for all organic and inorganic substances using Equation 34 (CHPPM 2003). The parameter value is considered missing for a substance if the equation returns a null value because Ba_{beef} is null.

Equation 34 – Biotransfer Factor for Deer (Ba_{deer})

$$Ba_{deer} = Ba_{beef} \cdot \frac{f_{lipid/deer}}{f_{lipid/beef}}$$

Ba_{deer} = Biotransfer factor for deer meat (i.e., venison) (day/kg FW)
Ba_{beef} = Biotransfer factor for beef (day/kg FW)
$f_{lipid/deer}$ = Fraction of deer meat that is lipid (i.e., fat) (unitless)
$f_{lipid/beef}$ = Fraction of beef that is lipid (i.e., fat) (unitless)

Source: ANCDF risk assessment (CHPPM 2003).
Default values for the f_{lipid} terms are 0.029 ($f_{lipid/deer}$) and 0.144 ($f_{lipid/beef}$) (IT Corporation 2000).

8.5 Biotransfer Factor for Turkey (Ba_{turkey})

8.5.1 *Background*

The biotransfer factor for wild turkey (Ba_{turkey}) is the ratio of the substance concentration in fresh weight (FW) in wild turkey meat to the daily intake of the substance by wild turkey. These factors are expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

As predominantly ground-dwelling avians, turkeys are not unlike chickens. It is therefore reasonable to assume they may have similar physiological processes that could yield similar biotransfer factors (*Ba*). Biotransfer factors for edible wild turkey meat (Ba_{turkey}) can be derived by adjusting the biotransfer factor for chicken by accounting for differences in fat content of cooked meat.

8.5.2 *Method*

Calculate values for all organic and inorganic substances using Equation 35 (CHPPM 2003). The parameter value is considered missing for a substance if the equation returns a null value because $Ba_{chicken}$ is null.

Equation 35 – Biotransfer Factor for Wild Turkey (Ba_{turkey})

$$Ba_{turkey} = Ba_{chicken} \cdot \frac{f_{lipid\,/\,turkey}}{f_{lipid\,/\,chicken}}$$

Ba_{turkey} = Biotransfer factor for wild turkey meat (day/kg FW)
$Ba_{chicken}$ = Biotransfer factor for chicken meat (day/kg FW)
$f_{lipid/turkey}$ = Fraction of turkey meat that is lipid (i.e., fat) (unitless)
$f_{lipid/chicken}$ = Fraction of chicken meat that is lipid (i.e., fat) (unitless)

Source: ANCDF risk assessment (CHPPM 2003).
Default values for the f_{lipid} terms are 0.0497 ($f_{lipid/turkey}$) and 0.0741 ($f_{lipid/chicken}$) (Exposure Factors Handbook, EPA 1997b).

8.6 Biotransfer Factors for Mammals (Ba_{mammal})

8.6.1 *Background*

This parameter is an ecological health risk assessment biotransfer factor for mammalian receptors (Ba_{mammal}), which is defined as the ratio of a compound concentration in fresh (wet) weight animal tissue to the daily intake of a compound by the animal through the ingestion of food items and media (i.e., soil, sediment, and surface water). Biotransfer factors, in conjunction with receptor-specific ingestion rates, can be used to calculate food-item- and media-to-animal bioconcentration factors (BCFs). The Ba_{mammal} is reported in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.6.2 *Method*

The Ba_{beef} values generated using the method in Section 8.1 are used as surrogate data.

8.7 Biotransfer Factors for Birds (Ba_{bird})

8.7.1 *Background*

This parameter is an ecological health risk assessment biotransfer factor for avian receptors (Ba_{bird}), which is defined as the ratio of a compound concentration in fresh (wet) weight animal tissue to the daily intake of a compound by the animal through the ingestion of food items and media (i.e., soil, sediment, and surface water). Biotransfer factors, in conjunction with receptor-specific ingestion rates, can be used to calculate food-item- and media-to-animal bioconcentration factors (*BCFs*) The Ba_{bird} is reported in units of day per kilogram of fresh weight tissue (day/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.7.2 *Method*

The $Ba_{chicken}$ values generated using the method in Section 8.3 are used as surrogate data.

8.8 Biotransfer Factors for Goats (Ba_{goat})

8.8.1 *Background*

The biotransfer factor for goat (Ba_{goat}) is the ratio of the substance concentration in fresh weight (FW) in mutton to the daily intake of the substance by goats. This factor is expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue).

8.8.2 *Method*

Calculate values for all organic and inorganic substances using Equation 36. The parameter value is considered missing for a substance if the equation returns a null value because Ba_{beef} is null.

Equation 36 – Biotransfer Factor for Mutton (Ba_{goat})

$$Ba_{goat} = Ba_{beef} \cdot \frac{f_{lipid\,/\,goat}}{f_{lipid\,/\,beef}}$$

Ba_{goat} = Biotransfer factor for mutton (day/kg FW)
Ba_{beef} = Biotransfer factor for beef (day/kg FW)
$f_{lipid/goat}$ = Fraction of mutton that is lipid (i.e., fat) (unitless)
$f_{lipid/beef}$ = Fraction of beef that is lipid (i.e., fat) (unitless)

Default values for the f_{lipid} terms are 0.12 ($f_{lipid/goat}$) (Skeen 2006) and 0.19 ($f_{lipid/beef}$) (HHRAP; EPA 2005a).

8.9 Biotransfer Factors for Wild Game (Ba_{game})

8.9.1 *Background*

The biotransfer factor for wild game (Ba_{game}) is the ratio of the substance concentration in the tissue of the wild game, in fresh weight (FW), to the daily intake of the substance by the wild game. The Ba_{game} is expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue).

8.9.2 *Method*

Values of Ba_{game} can differ depending on the wild game. Due to the varied nature of how "wild game" can be defined across risk assessment projects, a default definition is required for this document. The approach articulated in the Umatilla Risk Assessment Work Plan (RAWP)(ODEQ 2004) is used as the default approach, where wild game refers to a collection of game such as rabbit or venison, which are consumed by Native Americans. Consistent with the RAWP, Ba_{beef} values generated using the method in Section 8.1 are used as surrogate data for Ba_{game}.

8.10 Biotransfer Factors for Wild Fowl (Ba_{fowl})

8.10.1 *Background*

The biotransfer factor for wild fowl (Ba_{fowl}) is the ratio of the substance concentration in wild fowl meat, in fresh weight (FW), to the daily intake of the substance by wild fowl. This factor is expressed in units of day per kilogram of fresh weight tissue (day/kg FW tissue).

8.10.2 *Method*

The $Ba_{chicken}$ values generated using the method in Section 8.3 are used as surrogate data.

8.11 Livestock and Game Metabolism Factor (*MF*)

8.11.1 *Background*

The livestock and game metabolism factor (*MF*) accounts for animal metabolism and excretion of a substance. The *MF* is a unitless parameter used to model the substance concentration in beef, milk and pork.

8.11.2 *Method*

The HHRAP Appendix B, Table B-3-10 (EPA 2005a), and other similar tables, specify the *MF* parameter values.

1. A value of 0.01 is assigned to Bis(2-ethylhexyl)phthalate (CASRN 117-81-7).

2. A value of 1.0 is assigned to all other organic and all inorganic substances.

8.12 Bioconcentration Factor for Terrestrial Invertebrates (BCF_{ti})

8.12.1 *Background*

The bioconcentration factor for terrestrial invertebrates (BCF_{ti}) is unitless (see paragraph below) and accounts for terrestrial invertebrate uptake of substances from the soil. The BCF_{ti} is calculated using laboratory and field measured values, and the data set used to calculate them is based on soil-to-plant bioconcentration studies.

While this parameter is unitless, it does technically have units which cancel out. Also, the units for this parameter can vary according to the information source; however, the exposure model that uses these values accounts for this difference. The parameter units in the source should be checked to determine if a unit conversion is necessary. The alternative units are as follows:

1. (mg substance/kg FW tissue) / (mg substance/kg DW soil)
2. (mg substance/kg DW tissue) / (mg substance/kg DW soil)
3. Empirically unitless

8.12.2 *Method*

1. For inorganic substances, high-end (90th percentile) uptake factors from Sample et al. (1998, Table 11). Values from this source are reported in units of (mg substance/kg DW tissue) / (mg substance/kg DW soil).

2. For remaining inorganic substances and organic substances, SLERAP Appendix C, Table C-1 (EPA 1999d). Values from this source are reported in units of (mg substance/kg FW tissue) / (mg substance/kg DW soil).

3. For other organic substances, calculate using Equation 37 developed by Connell and Markwell (1990), which is appropriate for a log K_{ow} range of 1.0 to 6.5. Values from this source are empirically unitless.

Equation 37 – Bioconcentration Factor for Terrestrial Invertebrates (BCF_{ti}) for Organics

$$BCF_{ti} = \frac{Y_l \cdot log\ K_{ow}^{\ b-a}}{x \cdot f_{oc}} \qquad \text{where: } 1 \le \log K_{ow} \le 6.5$$

BCF_{ti}	= Bioconcentration factor for terrestrial invertebrate (unitless)
Y_l	= Terrestrial invertebrate lipid content (unitless) = 0.02
K_{ow}	= *n*-octanol-water partition coefficient (unitless)
b-a	= Nonlinearity constant = 0.05
x	= Proportionality constant = 0.66
f_{oc}	= Site-specific fraction of organic carbon in soil (unitless)

Source: Connell and Markwell (1990).
Based on the SLERAP (EPA 1999c, Page A-2-13), the default f_{oc} is 0.01 is used.

8.13 Bioconcentration Factor for Benthic Invertebrates (BCF_{bi})

8.13.1 *Background*

The bioconcentration factor for benthic invertebrates (BCF_{bi}) is unitless (see paragraph below) and accounts for benthic invertebrate uptake of substances from the sediment.

While this parameter is unitless, it does technically have units which cancel out. Also, the units for this parameter can vary according to the information source; however, the exposure model that uses these values accounts for this difference. The parameter units in the source should be checked to determine if a unit conversion is necessary. The alternative units are as follows:

1. (mg substance/kg FW tissue) / (mg substance/kg DW soil)
2. (mg substance/kg DW tissue) / (mg substance/kg DW soil)

8.13.2 *Method*

1. For inorganic substances, high-end (90th percentile) uptake factors from Oak Ridge National Laboratory (ORNL 1998b, Table 2). Values from this source are reported in units of (mg substance/kg DW tissue) / (mg substance/kg DW soil).

2. For other inorganic substances and organic substances, SLERAP Appendix C, Table C-6 (EPA 1999d). Values from this source are reported in units of (mg substance/kg FW tissue) / (mg substance/kg DW soil).

3. For other organic substances, calculate using Equation 38 from SLERAP (1999d) and Southworth et al. (1978).

Equation 38 – Bioconcentration Factor for Benthic Invertebrates (BCF_{bi}) for Organics

$$BCF_{bi} = anti\,log[(0.819 \cdot log\,K_{ow}) - 1.146]$$

BCF_{bi} = Bioconcentration factor for benthic invertebrates (unitless)
K_{ow} = *n*-octanol-water partition coefficient (unitless)

Source: SLERAP (1999d), Southworth et al. (1978).

8.14 Biota-Sediment Accumulation Factor (*BSAF*)

8.14.1 *Background*

The fish biota-sediment accumulation factor (*BSAF*) accounts for the transfer of dioxins, furans and PCBs from the bottom sediment of a waterbody to the lipid (fat) of fish. This pathway addresses bioaccumulation of significantly lipophilic substances within the food chain. EPA (2000) recommends using *BSAF* for modeling of dioxin-like compounds, including PCBs, because of their lipophilic nature.

For dioxins, furans and PCBs, the HHRAP Database includes *BSAF* values instead of bioaccumulation factor (*BAF*) values for fish (EPA 2005a). The *BSAF* is expressed as a unitless parameter.

8.14.2 *Method*

Null values are assigned to all substances other than dioxins, furans and PCBs (EPA 2005a). For dioxins, furans and PCBs: HHRAP Database (EPA 2005b).

8.15 Bioconcentration Factor for Gamefish ($BCF_{gamefish}$)

8.15.1 *Background*

The gamefish bioconcentration factor ($BCF_{gamefish}$) is the ratio of the substance concentration in gamefish to the substance concentration in the water column where the fish live. The $BCF_{gamefish}$ is expressed in units of liters per kilogram fresh weight tissue (L/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value. This factor accounts for uptake of a substance by fish primarily from passing the water over the gills. In the HHRAP, $BCF_{gamefish}$ values were derived for the modeling of fish concentrations for chemicals with a log K_{ow} of less than 4 and for all metals, other than lead and mercury as cited in EPA (1995b) (EPA 2005a). $BCF_{gamefish}$ values for substances with a log K_{ow} of 4 or greater are used to generate $BAF_{gamefish}$ values for most substances.

8.15.2 *Method*

1. HHRAP Database (EPA 2005b).

2. For all other substances calculate using Equation 39 or Equation 40. Equations are chosen depending upon the substance's ionic state (see Table 2) and log K_{ow} (EPA 2005a, Meylan et al. 1999).

Equation 39 – Nonionic Substances: Bioconcentration Factor for Gamefish ($BCF_{gamefish}$)

(A) log K_{ow} less than 1 $$BCF_{gamefish} = 10^{0.50}$$

(B) log K_{ow} from 1 to 7 $$BCF_{gamefish} = 10^{[0.77 \cdot \log K_{ow} - 0.70 + \sum Correction\ Factors]}$$

(C) log K_{ow} greater than 7 to 10.5 $$BCF_{gamefish} = 10^{[-1.37 \cdot \log K_{ow} + 14.4 + \sum Correction\ Factors]}$$

(D) log K_{ow} greater than 10.5 $$BCF_{gamefish} = 10^{0.50}$$

$BCF_{gamefish}$ = Bioconcentration factor for gamefish (L/kg FW)
K_{ow} = *n*-octanol/water partition coefficient (unitless)
CorrectionFactors = For purposes of this algorithm, the correction factors' sum is assumed to be "missing" (i.e., a null value) (see text below).

Source: HHRAP (EPA 2005a, Meylan et al. 1999). The equations for substances with a log K_{ow} between 1 and 7, requires the use of a sum of correction factors. The correction factors are provided in Table 6 and they vary based on chemical category (Meylan et al. 1999). The correction factors can be used, but the selection of the appropriate factor requires sufficient chemical knowledge. Therefore, if used, a

chemist should implement the method. These correction factors are applied on a case-by-case, project-specific basis for chemicals for which the method is deemed necessary.

Equation 40 – Ionic Substances: Bioconcentration Factor for Gamefish ($BCF_{gamefish}$)

(A) log K_{ow} less than 5 $BCF_{gamefish} = 10^{0.50}$

(B) log K_{ow} from 5 to 6 $BCF_{gamefish} = 10^{0.75}$

(C) log K_{ow} from greater than 6 to 7 $BCF_{gamefish} = 10^{1.75}$

(D) log K_{ow} from greater than 7 to 9 $BCF_{gamefish} = 10^{1.00}$

(E) log K_{ow} greater than 9 $BCF_{gamefish} = 10^{0.50}$

$BCF_{gamefish}$ = Bioconcentration factor for gamefish (L/kg FW)
K_{ow} = *n*-octanol/water partition coefficient (unitless)

Source: HHRAP (EPA 2005a), (Meylan et al. 1999).

Table 6 – Correction Factors for Use in $BCF_{gamefish}$ Equation 39

$BCF_{gamefish}$ Correction Factor	Value
Compounds with an aromatic *s*-triazine ring (three compounds)	-0.32
Compounds containing an aromatic alcohol (e.g., phenol) with two or more halogens attached to aromatic ring (17 compounds)	-0.40
Compounds containing an aromatic ring with a *tert*-butyl group in a position ortho to an –OH group (e.g., *tert-butyl ortho*-phenol) (six compounds)	-0.45
Compounds containing an aromatic ring and an aliphatic alcohol in the form of –CH–OH (e.g., benzyl alcohol) (four compounds)	-0.65
Phosphate ester, O=P(O–R)(O–R)(O–R), where R is carbon (one R can be H) (18 compounds)	-0.78
Ketone with one or more aromatic connections (18 compounds)	-0.84
Nonionic compounds with an alkyl chain containing 8 or more –CH2– groups (13 compounds)	-1.00 (log K_{ow} of 4–6) -1.50 (log K_{ow} of 6–10)
Compounds containing a cyclopropyl ester of the form cyclopropyl–C(5O)–O– (e.g., permethrins) (six compounds)	-1.65

$BCF_{gamefish}$ Correction Factor	Value
Compounds containing a phenanthrene ring (four compounds)	+0.48
Multiply halogenated biphenyls and polyaromatics containing only aromatic carbons and halogens (e.g., PCBs) (19 compounds)	+0.62
Organometallic compounds containing tin or mercury (12 compounds)	+1.40

Source: Meylan et al. (1999) used a database of 694 BCF values when they came up with the methodology for the BCF. They did not specify the 694 substances, only the source of the substances as such: Measured BCF values were obtained primarily from the EPA online AQUIRE database; a large database of BCF values collected by the Japanese Chemicals Inspection and Testing Institute (CITI), the HSDB; and sources referenced in the SRC Environmental Fate Data Base (EFDB).

8.16 Bioconcentration Factor for Trophic Level Fish (BCF_{TLfish})

8.16.1 *Background*

Trophic level fish is a term that refers to various types of fish that may be consumed by wild animals, as opposed to humans. Fish that are consumed by humans are referred to as gamefish (see above section).

The bioconcentration factor for trophic level fish (BCF_{TLfish}) accounts for fish uptake of substances from the water. Experimental data for a variety of marine and freshwater fish are used to determine recommended BCF_{TLfish} values. The BCF_{TLfish} is expressed in units of liters per kilogram fresh weight tissue (L/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

8.16.2 *Method*

1. SLERAP Appendix C, Table C-5 (EPA 1999d).

2. For substances not found in the SLERAP, BCF_{TLfish} values are derived from a regression equation provided in Water Quality Guidance for the Great Lakes System and Correction (EPA 1993b), which describes the bioconcentration of various chemicals in fish during flow-through exposure experiments. Equation 41 is used to compute the value.

Equation 41 – Bioconcentration Factor for Trophic Level Fish for Organics (BCF_{TLfish})

$$BCF_{TLfish} = 10^{(0.79 \cdot \log Kow) - 0.40}$$

BCF_{TLfish} = Bioconcentration factor for trophic level fish (L/kg FW)
K_{ow} = *n*-octanol-water partition coefficient (unitless)

Source: Water Quality Guidance for the Great Lakes System and Correction (EPA 1993b).

8.17 Bioaccumulation Factor for Gamefish ($BAF_{gamefish}$)

8.17.1 *Background*

The gamefish bioaccumulation factor ($BAF_{gamefish}$) is the ratio of the substance concentration in gamefish to the substance concentration in the waterbody where the gamefish lives. The $BAF_{gamefish}$ is expressed in units of liters per kilogram fresh weight tissue (L/kg FW tissue). The parameter units in the source are checked to determine if a unit conversion is necessary before using the value.

This factor accounts for uptake of substances by fish from water and sediments passing the over the gills and from consumption of various foods such as plankton, daphnids, and other fish. The $BAF_{gamefish}$ values are used for lead, mercury, and mercuric compounds and for organic substances with a log K_{ow} of greater than or equal to 4 (except for dioxins, furans, polychlorinated biphenyls). When substances have a log K_{ow} greater than or equal to 4, the substances significantly partition into the suspended sediment organic carbon of the water column. Because of this, *BAF* values should be based on total water column concentrations that include both the dissolved and suspended phases.

8.17.2 *Method*

1. HHRAP Database (EPA 2005b).

2. Null values are assigned to organic substances not included in the HHRAP Database with log $K_{ow} < 4.0$. The HHRAP (EPA 2005a) states that in these cases a *BCF* is more applicable than a *BAF* because these substances do not tend to bioaccumulate.

3. Null values are assigned to all metals and inorganics not included in the HHRAP Database.

4. For organic substances not included in the HHRAP Database with a log $K_{ow} \geq 4$, calculate values using Equation 42.

Equation 42 – Bioaccumulation Factor for Gamefish ($BAF_{gamefish}$)

$$BAF_{gamefish} = BCF_{gamefish} \cdot FCM_4$$

$BAF_{gamefish}$ = Bioaccumulation factor for gamefish (L/kg FW tissue)
$BCF_{gamefish}$ = Bioconcentration factor for gamefish (L/kg FW tissue)
FCM_4 = Food chain multiplier for trophic level 4 (unitless)

Source: HHRAP (EPA 2005a).

8.18 Bioaccumulation Equivalency Factor (*BEF*)

8.18.1 *Background*

Modeling the exposure of dioxins and furans through the food web requires the quantification of bioaccumulation potential; however, measured bioaccumulation data specific to each congener is limited. Therefore, *BEFs*, which measure congener bioaccumulation potential relative to 2,3,7,8-TCDD, are used to calculate mammal and bird *BCFs* for those particular substances. *BEFs* are unitless parameters.

8.18.2 *Method*

For all dioxin and furan congers:

1. SLERAP (EPA 1999b, Table 2-4).

2. For congeners not found in the SLERAP, Equation 43 is used.

Null values are assigned to all other substances and are referenced with the source which defines them as such. This parameter only applies to dioxins, furans, and dioxin-like PCBs, when following the HHRAP (EPA 2005a).

Equation 43 – Bioaccumulation Equivalency Factor for Dioxin and Furan Congeners (BEF_x)

$$BEF_x = \frac{BSAF_x}{BSAF_{TCDD}}$$

BEF_x = Bioaccumulation equivalency factor for dioxin/furan congener *x* (unitless)
$BSAF_x$ = Biota-sediment accumulation factor for dioxin/furan congener *x* (unitless)
$BSAF_{TCDD}$ = Biota-sediment accumulation factor for 2,3,7,8-TCDD (unitless)

Source: SLERAP (EPA 1999b).

8.19 Food-Chain Multipliers for Fish & Other Wildlife (FCM_2, FCM_3, FCM_4)

8.19.1 *Background*

The food chain multipliers for three trophic levels (FCM_2, FCM_3, FCM_4) are unitless parameters that account for substance biomagnification in the food chain. For fish, the term is used in modeling a substance concentration in fish with the appropriate trophic level of fish ingested by an ecological receptor being specified. For wildlife, the term is used in modeling a substance concentration in food items that are ingested by guild specific (i.e., herbivores, omnivores) mammalian and bird receptors. A *FCM* ratio is applied to each animal food item ingested to account for the increase in substance concentration. *FCMs* can be obtained by dividing the bioaccumulation factor (*BAF*) by substance specific K_{ow} values.

In the EPA guidance (EPA 1995c), the *FCMs* were derived based on the percent lipid content in fish and on the percentage of each diet item consumed by the fish species selected for the study. The *FCMs* were developed assuming no metabolism of a substance. Thus, for substances where metabolism may occur (i.e., some PAHs), the substance concentration in fish ingested by an ecological receptor may be overestimated. For wildlife, this fish-based approach to calculate concentrations in terrestrial wildlife tissue is used due to the lack of other available guidance.

8.19.2 *Method*

The source for selecting *FCMs* is Table 2 of the Water Quality Guidance for the Great Lakes System (EPA 1995c). The SLERAP adopted the FCMs directly from this table, which is duplicated below as

Table 7.

The FCMs are provided based on the substance log K_{ow} for each of the three trophic levels. The guidance (EPA 1995c) only provides FCM values for log K_{ow} values ranging from 2.0 to 9.0. For the log K_{ow} values that range from 3.0 to 9.0, the values are provided in increments of tenths (i.e., 3.0, 3.1, 3.2, etc.). For substances with a log K_{ow} value below 3.0, the source only provides FCMs for substances with a log K_{ow} of 2.0 and 2.5.

The following method is used to make specific *FCM* assignments:

1. For substances without a log K_{ow} value, FCM values of 1 are assigned.

2. For substances with log K_{ow} values of 1.4 or less (rounded to the nearest tenths), FCM values of 1 are assigned.

3. For substances with log K_{ow} values from 1.5 to 1.9 (rounded to the nearest tenths), FCMs for a log K_{ow} of 2.0 are used.

4. For log K_{ow} values from 2.0 to 2.9, we select the FCMs based on the substances rounded log K_{ow} value (rounded to the nearest tenth). We assign the FCMs for log K_{ow} values of 2.0, 2.5, or 3.0 based on which the rounded log K_{ow} is nearest to.

5. For log K_{ow} values from 3.0 to 9.0 (rounded to the nearest tenths), we select the FCMs based on the substances rounded log K_{ow} value.

6. For log K_{ow} values from 9.1 or higher (rounded to the nearest tenths), FCMs for a log K_{ow} of 9.0 are used.

Table 7 – Food-Chain Multipliers for Trophic Levels 2, 3 and 4

Log K_{ow}	Trophic Levels			Log K_{ow}	Trophic Levels		
	2	**3**	**4**		**2**	**3**	**4**
2.0	1.0	1.005	1.0	6.0	1.0	10.556	15.996
2.5	1.0	1.010	1.002	6.1	1.0	11.337	17.783
3.0	1.0	1.028	1.007	6.2	1.0	12.064	19.907
3.1	1.0	1.034	1.007	6.3	1.0	12.691	21.677
3.2	1.0	1.042	1.009	6.4	1.0	13.228	23.281
3.3	1.0	1.053	1.012	6.5	1.0	13.662	24.604
3.4	1.0	1.067	1.014	6.6	1.0	13.980	25.654
3.5	1.0	1.083	1.019	6.7	1.0	14.223	26.363
3.6	1.0	1.103	1.023	6.8	1.0	14.355	26.669
3.7	1.0	1.128	1.033	6.9	1.0	14.388	26.669
3.8	1.0	1.161	1.042	7.0	1.0	14.305	26.242
3.9	1.0	1.202	1.054	7.1	1.0	14.142	25.468
4.0	1.0	1.253	1.072	7.2	1.0	13.852	24.322
4.1	1.0	1.315	1.096	7.3	1.0	13.474	22.856
4.2	1.0	1.380	1.130	7.4	1.0	12.987	21.038
4.3	1.0	1.491	1.178	7.5	1.0	12.517	18.967
4.4	1.0	1.614	1.242	7.6	1.0	11.708	16.749
4.5	1.0	1.766	1.334	7.7	1.0	10.914	14.388
4.6	1.0	1.950	1.459	7.8	1.0	10.069	12.050
4.7	1.0	2.175	1.633	7.9	1.0	9.162	9.840
4.8	1.0	2.452	1.871	8.0	1.0	8.222	7.798
4.9	1.0	2.780	2.193	8.1	1.0	7.278	6.012
5.0	1.0	3.181	2.612	8.2	1.0	6.361	4.519
5.1	1.0	3.643	3.162	8.3	1.0	5.489	3.311
5.2	1.0	4.188	3.873	8.4	1.0	4.683	2.371
5.3	1.0	4.803	4.742	8.5	1.0	3.949	1.663
5.4	1.0	5.502	5.821	8.6	1.0	3.296	1.146
5.5	1.0	6.266	7.079	8.7	1.0	2.732	0.778
5.6	1.0	7.096	8.551	8.8	1.0	2.246	0.521
5.7	1.0	7.962	10.209	8.9	1.0	1.837	0.345
5.8	1.0	8.841	12.050	9.0	1.0	1.493	0.226
5.9	1.0	9.716	13.964				

Source: Great Lakes Water Quality Initiative, Technical Support Document for the Procedure to Determine Bioaccumulation Factors (EPA 1995c).

8.20 Bioconcentration Factors for Mammals and Birds Ingesting Terrestrial Plants, Submerged Aquatic Vegetation, Water, and Soil/Sediment

8.20.1 *Background*

The bioconcentration factors for these exposure points to herbivorous or omnivorous mammals and birds are unitless parameters and are based in part on biotransfer factors (*Ba* values)(EPA 1999d). These bioconcentration factors include the following, where the indexes are: terrestrial plants (*tp*), submerged aquatic vegetation (*sav*), water (*w*), soil/sediment (*s*), herbivorous mammal or bird (*hm* or *hb*), and omnivorous mammal or bird (*om* or *ob*).

$BCF_{tp\text{-}hm}$	$BCF_{sav\text{-}hm}$	$BCF_{s\text{-}hm}$	$BCF_{w\text{-}hm}$
$BCF_{tp\text{-}hb}$	$BCF_{sav\text{-}hb}$	$BCF_{s\text{-}hb}$	$BCF_{w\text{-}hb}$
$BCF_{tp\text{-}om}$	$BCF_{sav\text{-}om}$	$BCF_{s\text{-}om}$	$BCF_{w\text{-}om}$
$BCF_{tp\text{-}ob}$	$BCF_{sav\text{-}ob}$	$BCF_{s\text{-}ob}$	$BCF_{w\text{-}ob}$

8.20.2 *Method*

Values for these parameters are not generated as part of project input data sets. These *BCF* values for wildlife are calculated by multiplying the appropriate biotransfer factor (Ba_{mammal} or Ba_{bird}) by the food-specific ingestion rate of the receptor being assessed in the risk assessment. For dioxins and furans, bioaccumulation equivalency factors (*BEFs*) are also used in the calculation.

Since these *BCF* values are not solely substance-specific, depending also on ingestion rate values used in the risk assessment, values for these parameters are not generated as part of project input data datasets. Rather they must be calculated within the project's exposure assessment model. The substance-specific input data needed for these calculations (Ba_{mammal}, Ba_{bird}, and *BEF*) is covered within this algorithm.

9. SPECIAL CONSIDERATIONS FOR SPECIFIC SUBSTANCES

9.1 Inorganic Substances

9.1.1 *Mixtures (or total recoverable forms of inorganic elements)*

Often environmental sampling data for metals and related inorganic substances reports the total recoverable forms of the element, rather than a single chemical form that can be accurately attached to a specific Chemical Abstract Service Registry Number (CASRN). In these cases, the assignment of the appropriate F&T parameter values should be based on the most appropriate chemical match between the environmental data and the physicochemical property data for similar chemical forms. The default approach used here is to adopt data found for the elemental forms of the inorganic substance, which is consistent with the HHRAP (EPA 2005a). However, project-specific protocols may require deviation from this approach.

9.1.2 *Metals*

Many of the parameter-specific methods for generating data for substances are unique to metals, as compared to other inorganics and organic substances. In some cases, the sources of data use the term "metals" to refer to only a subset of all metals (e.g., heavy metals). In other cases, it is not known whether the source means all metals or just a subset. This can cause confusion when trying to develop a standardized approach across different sources and terminologies.

In broad terms, the elements of the periodic table are classified as either Metals, Metalloids, or Nonmetals based on their ionizing and bonding properties.[1] There are 94 elemental metals subcategorized into six series (see following table). The nine elements on either side of the periodic table stair-step line that is between the Poor metals and the Nonmetals have properties somewhere in between those of metals and nonmetals. These nine elements are also sometimes referred to as semi-metals or metalloids [Boron (B), Aluminum (Al), Silicon (Si), Germanium (Ge) , Arsenic (As), Antimony (Sb), Tellurium (Te), Polonium (Po), and Astatine (At)].

When the term "metal" is used in this algorithm document (unless otherwise specified in the parameter-specific section), it is meant to refer to any and all of the metals in the following table when the substance record is either:

- the elemental form,
- the total recoverable form (e.g., Cadmium compounds), or
- an inorganic substance containing a metal (Aluminum oxide, Iron chloride).

[1] http://en.wikipedia.org/wiki/Metal

Table 8 – List of Metals

Alkali metals	Alkaline earth metals	Transitions metals		Rare earth metals		Poor metals
				Lanthanide series	Actinide series	
Cesium (Cs)	**Barium** (Ba)	**Bohrium** (Bh)	**Palladium** (Pd)	**Cerium** (Ce)	**Actinium** (Ac)	**Aluminum** (Al)
Francium (Fr)	**Beryllium** (Be)	**Cadmium** (Cd)	**Platinum** (Pt)	**Dysprosium** (Dy)	**Americium** (Am)	**Antimony** (Sb)
Lithium (Li)	**Calcium** (Ca)	**Chromium** (Cr)	**Rhenium** (Re)	**Erbium** (Er)	**Berkelium** (Bk)	**Bismuth** (Bi)
Potassium (K)	**Magnesium** (Mg)	**Cobalt** (Co)	**Rhodium** (Rh)	**Europium** (Eu)	**Californium** (Cf)	**Gallium** (Ga)
Rubidium (Rb)	**Radium** (Ra)	**Copper** (Cu)	**Roentgenium** (Rg)	**Gadolinium** (Gd)	**Curium** (Cm)	**Germanium** (Ge)
Sodium (Na)	**Strontium** (Sr)	**Darmstadtium** (Ds)	**Ruthenium** (Ru)	**Holmium** (Ho)	**Einsteinium** (Es)	**Indium** (In)
		Dubnium (Db)	**Rutherfordium** (Rf)	**Lanthanum** (La)	**Fermium** (Fm)	**Lead** (Pb)
		Gold (Au)	**Scandium** (Sc)	**Lutetium** (Lu)	**Lawrencium** (Lr)	**Thallium** (Tl)
		Hafnium (Hf)	**Seaborgium** (Sg)	**Neodymium** (Nd)	**Mendelevium** (Md)	**Tin** (Sn)
		Hassium (Hs)	**Silver** (Ag)	**Praseodymium** (Pr)	**Neptunium** (Np)	**Polonium** (Po)
		Iridium (Ir)	**Tantalum** (Ta)	**Promethium** (Pm)	**Nobelium** (No)	**Ununtrium** (Uut)
		Iron (Fe)	**Technetium** (Tc)	**Samarium** (Sm)	**Plutonium** (Pu)	**Ununquadium** (Uuq)
		Manganese (Mn)	**Titanium** (Ti)	**Terbium** (Tb)	**Protactinium** (Pa)	**Ununpentium** (Uup)
		Meitnerium (Mt)	**Tungsten** (W)	**Thulium** (Tm)	**Thorium** (Th)	**Ununhexium** (Uuh)
		Mercury (Hg)	**Ununbium** (Uub)	**Ytterbium** (Yb)	**Uranium** (U)	
		Molybdenum (Mo)	**Vanadium** (V)			
		Nickel (Ni)	**Yttrium** (Y)			
		Niobium (Nb)	**Zinc** (Zn)			
		Osmium (Os)	**Zirconium** (Zr)			

9.2 Polychlorinated Dioxin, Furan, and Biphenyl Homologues

Environmental sampling data for polychlorinated dibenzo(p)dioxins (PCDD), polychlorinated dibenzofurans (PCDF), and polychlorinated biphenyls (PCBs) can sometimes be reported as homologue groups, rather than specific congeners or specific mixtures. Determining the most appropriate F&T parameter values for these homologue groups will usually depend on specific project conditions. However, the default approach is to research parameter values from available information reported for the homologue group as a whole, rather than for a representative congener within the group.

Table 9 – PCDD, PCDF, PCB Homologues

CASRN	Homologue
41903-57-5	Tetrachlorodibenzo-p-dioxin
36088-22-9	Pentachlorodibenzo-p-dioxin
34465-46-8	Hexachlorodibenzo-p-dioxin
37871-00-4	Heptachlorodibenzo-p-dioxin
30402-14-3	Tetrachlorodibenzofuran
30402-15-4	Pentachlorodibenzofuran
55684-94-1	Hexachlorodibenzofuran
38998-75-3	Heptachlorodibenzofuran
27323-18-8	Monochlorobiphenyl
25512-42-9	Dichlorobiphenyl
25323-68-6	Trichlorobiphenyl
26914-33-0	Tetrachlorobiphenyl
25429-29-2	Pentachlorobiphenyl
26601-64-9	Hexachlorobiphenyl
28655-71-2	Heptachlorobiphenyl
55722-26-4	Octachlorobiphenyl
53742-07-7	Nonachlorobiphenyl
2051-24-3	Decachlorobiphenyl

9.3 Dioxin-Like Toxicity Equivalents

Risk assessment datasets often contain substance records for dioxin-like toxicity equivalents (TEQ), where all relevant congeners are scaled relative to 2,3,7,8-Tetrachlorinateddibenzo-p-dioxin. The typical TEQ mixtures are often expressed as either 2,3,7,8-TCDD TEQ and/or PCB TEQ. In these cases, F&T parameter values are not needed for the TEQ record, because the fate-and-transport of the congeners are modeled independently and then their concentrations are combined into the TEQ record using their toxicity equivalence factors (TEFs).

In some cases, however, the emissions or other sampling data for the individual congeners are not available and environmental data is only available for the total dioxin-like mixture. In these cases, F&T parameter values for a surrogate dioxin-like compound are applied to the mixture.

9.4 Specific Mixtures of Polychlorinated Biphenyls

In risk assessment datasets, the noncancer hazards and non-dioxin-like cancer risks posed by Polychlorinated biphenyls (PCBs) are typically assessed as specific mixtures, such as Aroclor 1254 or as generic mixtures such as those found in the following table. This is in contrast to the use of the TEQ approach to assessing dioxin-like cancer risk (see above section).

F&T parameter values for the following substances should be based on the specific chemical mixture and CASRN. Based on guidance in the HHRAP (EPA 2005a), values for Aroclor 1254 are used for 0-072*, which is the generic record for when the mixture contains congeners with 5 or more chlorines in more than 0.5 percent of the total PCB mixture. Values for Aroclor 1016 are used for 0-073*, which is the generic record for when the mixture contains congeners with 5 or more chlorines in less than 0.5 percent of the total PCB mixture.

Table 10 – Specific PCB Mixtures for Assessing Non-Dioxin Like Effects

CASRN	PCB Mixture
0-072*	PCB Mixture (non-dioxin like, 5+ chlorines)
0-073*	PCB Mixture (non-dioxin like, 1-4 chlorines)
1336-36-3	Polychlorinated biphenyls
11096-82-5	Aroclor 1260
11097-69-1	Aroclor 1254
11100-14-4	Aroclor 1268
11104-28-2	Aroclor 1221
11141-16-5	Aroclor 1232
12672-29-6	Aroclor 1248
12674-11-2	Aroclor 1016
37324-23-5	Aroclor 1262
53469-21-9	Aroclor 1242

* CHPPM database code when a CASRN is not available.

9.5 Chemical Agents

Unless otherwise stated in each parameter-specific section, the following data source hierarchy is used for F&T parameter values for the chemical agents:

1. Munro et al (1999).
2. CHPPM (1999).

10. SUMMARY OF CHANGES SINCE THE LAST VERSION

Substantive changes made to the document since the last version (Version 3.1, January 10, 2007) are identified below.

- **Bioconcentration and accumulation factors for gamefish ($BCF_{gamefish}$) and $BAF_{gamefish}$)**

The previous version did not correctly reflect the HHRAP guidance (EPA 2005a) and was corrected for these parameters.

- **Fraction absorbed from dermal contact with water (*FA*) and the desquamation rate to lag time ratio (t_{sc}/τ_{event})**

The previous version did not include a section for the desquamation rate to lag time ratio (t_{sc}/τ_{event}), which is needed in order to look up values for the fraction absorbed from dermal contact with water (*FA*). A section for the t_{sc}/τ_{event} ratio was added to the document and the *FA* section was significantly revised in order to improve clarity and to refer to the calculated t_{sc}/τ_{event} ratio.

- **Air-to-plant biotransfer factors for aboveground produce (Bv_{ag}) and forage/silage ($Bv_{forage/silage}$)**

The method description was edited in order to clarify the implementation of the HHRAP guidance (EPA 2005a) for metals and other inorganics.

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APPENDIX E

BACKGROUND STATISTICAL ANALYSIS

Table 1: Summary of Descriptive and Distributional Statistics for Step 1 of the Figure 5-2 Flowchart: **Surface Soil (mg/kg)**

Metal	Loc.	Frequency of Detection			Range		Freq. (%) of Non-Detects[4]	Arithmetic Summaries[1]			W-Test Results[1,2]		Lognormal Data Summaries[1]			
		#	%	Cat.	Detects	Non-Detects		Median	Mean	Standard Deviation	Normal?	Lognormal?	Mean of transformed data	SD of transformed data	Geo Mean	Geo SD
Arsenic	Bkgd	15/21	71.4%	D	.21-2.5	.69-1.8	28.6%	1.1	1.16	.75	Yes	Yes	-.100	.769	.905	2.157
	Site	39/45	86.7%	D	1-12	1.2-1.5	13.3%	5.7	5.428	3.396	No	No	(na)	(na)	(na)	(na)
Barium	Bkgd	20/20	100%	D	16-220	--	0%	83.6	95.28	52.08	Yes	Yes	4.404	.602	81.8	1.83
	Site	45/45	100%	D	23-430	--	0%	83	111.93	90.532	No	Yes	4.5	.633	90.0	1.88
Beryllium	Bkgd	17/19	89.5%	D	.085-.58	.04-.1	10.5%	.32	.287	.152	Yes	No	(na)	(na)	(na)	(na)
	Site	9/9	100%	D	.16-.57	--	0%	.28	.299	.123	Yes	Yes	-1.275	.381	.280	1.463
Cadmium	Bkgd	7/21	33.3%	C[3]	.18-.92	.059-1.2	66.7%	.14	.252	.253	No	Yes	-1.865	1.031	.155	2.805
	Bkgd detects only	7/7	--	--	--	--	--	.25	.397	.311	No	No	(na)	(na)	(na)	(na)
	Site	28/45	62.2%	D	.12-19	.096-3	37.8%	.325	1.116	2.923	No	No	(na)	(na)	(na)	(na)
Chromium	Bkgd	21/21	100%	D	5.9-47	--	0%	29.9	24.9	12.4	Yes	No	(na)	(na)	(na)	(na)
	Site	51/51	100%	D	.82-180	--	0%	27	39.39	40.26	No	No	(na)	(na)	(na)	(na)
Cobalt	Bkgd	19/19	100%	D	9.5-50.2	--	0%	21.2	22.8	11.7	No	Yes	3.015	.484	20.39	1.62
	Site	51/51	100%	D	4.92-290	--	0%	17	28.14	41.25	No	No	(na)	(na)	(na)	(na)
Copper	Bkgd	19/19	100%	D	13-180	--	0%	67	77.2	45.4	Yes	Yes	4.162	.667	64.219	1.949
	Site	55/55	100%	D	16-290	--	0%	170	159.76	74.09	No	No	(na)	(na)	(na)	(na)
Cyanide	Bkgd	1/20	5.0%	B	.37-.37	.39-1.2	95.0%	Not enough data to determine level – consider metal "potentially present" in background								
	Site	2/9	22.2%	C[3]	.36-.37	.53-.8	77.8%	.325	.331	.045	Yes	Yes	-1.115	.138	.328	1.147
	Ste detects only	2/2	--	--	--	--	--	.365	.365	.007	Not enough data to determine distribution					
Lead	Bkgd	19/19	100%	D	2-21	--	0%	4.4	8.4	6.8	No	No	(na)	(na)	(na)	(na)
	Site	45/45	100%	D	1.5-370	--	0%	21	46.36	65.44	No	Yes	3.021	1.373	20.52	3.95
Mercury	Bkgd	18/21	85.7%	D	.012-.12	.02-.04	14.3%	.05	.0509	.0290	Yes	No	(na)	(na)	(na)	(na)
	Site	53/57	93.0%	D	.015-4.4	.012-.027	7.0%	.123	.595	1.103	No	Yes	-2.018	1.773	.133	5.89
Nickel	Bkgd	20/20	100%	D	3.4-19	--	0%	8.2	10.3	5.22	No	Yes	2.198	.536	9.01	1.709
	Site	47/47	100%	D	5.1-63	--	0%	16	19.65	12.17	No	Yes	2.827	.541	16.89	1.718

Selenium	Bkgd	5/21	23.8%	C[3]	0.45-1.2	0.13-2.1	76.2%	.5	.54	.319	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	5/5						.56	.760	.360	Yes	Yes	-.363	.466	.696	1.593
	Site	6/24	25.0%	C[3]	1-1.8	.98-1	75.0%	.498	.692	.373	No	No	(na)	(na)	(na)	(na)
	Site detects only	6/6	--	--	--	--	--	1.2	1.283	.286	Yes	Yes	.231	.207	1.259	1.23
Silver	Bkgd	0/21	0%	A	--	.071-1.2	100%	Not enough data – consider metal "not present" in background data set.								
	Site	2/45	4.4%	C[3]	.14-.38	.19-1.5	95.6%	.14	.310	.224	No	No	(na)	(na)	(na)	(na)
	Site detects only	2/2	--	--	--	--	--	.26	.26	.170	Not enough data to determine distribution					
Sulfide	Bkgd	4/20	20.0%	C[3]	28.6-44	23-33	80.0%	14.9	18.7	9.1	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	4/4						34.5	35.4	7.36	Not enough data to determine distribution					
	Site	1/9	11.1%	B	34-34	27-41	88.9%	Not enough data to determine level – consider metal "potentially present" in site								
Thallium	Bkgd	1/20	5.0%	B	.1-.1	.08-1.2	95.0%	Not enough data to determine level – consider metal "potentially present" in background								
	Site	2/36	5.6%	C[3]	.48-.51	.39-2	94.4%	.2	.468	.367	No	No	(na)	(na)	(na)	(na)
	Site detects only	2/2	--	--	--	--	--	.495	.495	.021	Not enough data to determine distribution					
Tin	Bkgd	13/20	65.0%	D	1.4-4	.69-1.3	35.0%	1.9	1.66	1.05	Yes	No	(na)	(na)	(na)	(na)
	Site	9/9	100%	D	2.6-4.3	--	0%	2.9	3.356	.716	No	No	(na)	(na)	(na)	(na)
Vanadium	Bkgd	18/18	100%	D	35-230	--	0%	151.5	141.6	58.8	Yes	Yes	4.851	.501	127.8	1.65
	Site	49/49	100%	D	34-330	--	0%	140	159.18	78.73	No	Yes	4.94	.536	139.7	1.71
Zinc	Bkgd	19/19	100%	D	6.2-120	--	0%	45	51.6	31.6	Yes	Yes	3.732	.732	41.767	2.078
	Site	61/61	100%	D	14-500	--	0%	110	134.7	90.77	No	Yes	4.688	.692	108.62	1.998

[1] Background Arithmetic summaries, distribution (W) tests, and lognormal data summaries used datasets with ½ values for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.
[2] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects.
[3] For FOD Category "C" rows, two summary sets were calculated since the background guidance document said that "descriptive statistics were also calculated using a truncated data set". In "Bkgd detects only" rows only the detected values were used and in the "Bkgd" rows, all the values were used, (with ½ the detected value used as a surrogate for non-detects). For consistency, the same procedure was applied to FOD Category C Site data.
[4] With over 50% non-detects, evaluations to determine distribution and other characteristics will result in a high level of uncertainty.

Table 2: Summary of Step 2 Statistical Testing Plan based on Figure 5-2 Flowchart: **Surface Soil (mg/kg)**

Metal	Loc.[1]	Only 1 DL[2] and <15%ND?		Any >50%?	Largest Values[3]			W-Test Results[4]			More than 1 DL? [1]	Any >40% Non-detects?	Equal Variance?[5]			Test
		%	Both <15%?		Bckd ND	Site Detect	Any Site > Largest Bkgd ND?	Normal?	Lognormal?	Normal or Lognormal?			Relevant SD	Relevant Variance	Equal Variance?	
Arsenic	Bkgd	28.6%	N	N							N	N				Wilcoxon Rank Sum
	Site	13.3%														
Barium	Bkgd	0%	Y					Yes	Yes	Y – Lognormal			.602	.362	Y	Student's T-test
	Site	0%						No	Yes				.633	.401		
Beryllium	Bkgd	10.5%	Y					Yes	No	Y – Normal			.152	.023	Y	Student's T-test
	Site	0%%						Yes	Yes				.123	.015		
Cadmium	Bkgd	66.7%	N	Y	1.2	19	Y									Two Sample Proportion
	Site	37.8%														
Chromium	Bkgd	0%	Y					Yes	No	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						No	No							
Cobalt	Bkgd	0%	Y					No	Yes	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						No	No							
Copper	Bkgd	0%	Y					Yes	Yes	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						No	No							
Cyanide	Bkgd	95.0%	N	Y	1.2	.37	N									Do not perform
	Site	77.8%														
Lead	Bkgd	0%	Y					No	No	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						No	Yes							
Mercury	Bkgd	14.3%	Y					Yes	No	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	7.0%						No	Yes							
Nickel	Bkgd	0%	Y					No	Yes	Y – Lognormal			.536	.287	Y	Student's T-test
	Site	0%						No	Yes				.541	.293		
Selenium	Bkgd	76.2%	N	Y	2.1	1.8	N									Do not perform
	Site	75.0%														
Silver	Bkgd	100%	N	Y	1.2	.38	N									Do not perform
	Site	95.6%														

Sulfide	Bkgd	80.0%	N	Y	33	34	Y									Two Sample Proportion
	Site	88.9%														
Thallium	Bkgd	95.0%	N	Y	1.2	.51	N									Do not perform
	Site	94.4%														
Tin	Bkgd	35.0%	N	N							N	N				Wilcoxon Rank Sum
	Site	0%														
Vanadium	Bkgd	0%	Y					Yes	Yes	Y – Lognormal			.501	.251	Y	Student's T-test
	Site	0%						No	Yes				.536	.287		
Zinc	Bkgd	0%	Y					Yes	Yes	Y – Lognormal			.732	.536	Y	Student's T-test
	Site	0%						No	Yes				.692	.479		

[1] Statistical flowchart done only with full data sets for FOC Category "C" datasets. No truncated (detects only) sets were used.
[2] Analysis assumed only 1 detection limit.
[3] Compared largest background non-detect to largest **detected** site value.
[4] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.
[5] Performed in ProUCL Software.

Table 3: Summary of Step 3 Right Tail Testing Plan based on Figure 5-2 Flowchart and Statistical Testing Results[1] – **Surface Soil (mg/kg)**

Metal	Background ND		Number of Detected Samples			Step 3 Results[2]		Step 2 Results		
	%	+100%?	In Bkdg	In Site	At least 10 in each?	Test	Test Result H_0 = right tails of site and background data have same distribution	Test	Test Result H_0 = mean/median/prop of detects of site is <= mean/median/prop of detects of background	P-Value
Arsenic	28.6%	N	15	39	Y	Quantile Test Slippage Test	Reject H_0 Reject H_0	Wilcoxon Rank Sum	Reject H_0; Conclude Site > Background	<.001
Barium	0%	N	20	45	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Student's T-test	Do not reject H_0; Conclude Site <= Background	.284
Beryllium	10.5%	N	17	9	N	Slippage Test	Do not reject H_0	Student's T-test	Do not reject H_0; Conclude Site <= Background	.420
Cadmium	66.7%	N	7	28	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Reject H_0; Conclude Site > Background	.014
Chromium	0%	N	21	51	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.274
Cobalt	0%	N	19	51	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.697
Copper	0%	N	19	55	Y	Quantile Test Slippage Test	Reject H_0 Reject H_0	Wilcoxon Rank Sum	Reject H_0; Conclude Site > Background	<.001
Cyanide	95.0%	N	1	2	N	Slippage Test	Cannot perform – small sample	Do not perform		
Lead	0%	N	19	45	Y	Quantile Test[3] Slippage Test	Reject H_0 Reject H_0	Wilcoxon Rank Sum	Reject H_0; Conclude Site > Background	<.001
Mercury	14.3%	N	18	53	Y	Quantile Test Slippage Test	Reject H_0 Reject H_0	Wilcoxon Rank Sum	Reject H_0; Conclude Site > Background	.005
Nickel	0%	N	20	47	Y	Quantile Test[3] Slippage Test	Reject H_0 Reject H_0	Student's T-test	Reject H_0; Conclude Site > Background	<.001
Selenium	76.2%	N	5	6	N	Slippage Test	Do not reject H_0	Do not perform		
Silver	100%	Y				Do not perform		Do not perform		
Sulfide	80.0%	N	4	1	N	Slippage Test	Cannot perform – small sample	Two Sample Proportion	Do not reject H_0; Conclude Site <= Background	.27
Thallium	95.0%	N	1	2	N	Slippage Test	Cannot perform – small sample	Do not perform		
Tin	35.0%	N	13	9	N	Slippage Test	Do not reject H_0;	Wilcoxon Rank Sum	Reject H_0 Conclude Site > Background	<.001
Vanadium	0%	N	18	49	Y	Quantile Test[3] Slippage Test	Reject H_0 Reject H_0	Student's T-test	Do not reject H_0; Conclude Site <= Background	.271
Zinc	0%	N	19	61	Y	Quantile Test Slippage Test	Reject H_0 Reject H_0	Student's T-test	Reject H_0; Conclude Site > Background	<.001

[1] All statistical tests performed with ProUCL software Version 4.00.05 except two-sample proportion (of detects) and slippage tests. These tests were not available in the software and were performed by hand. Slippage methods followed the EPA guidance in their G-9S document (2006) with extended critical value table from the Navy in their Handbook of Statistical Analysis of Environmental Background Data (1999).

[2] Slippage and Quantile tests focus on the right tail; large values will bias results. These tests should be used in combination with a location test like a t-test or Wilcoxon Rank Sum.

[3] Using the Quantile test method in the EPA's G-9S guidance on .75 quantile yielded a different conclusion, however, the p=value of the nickel non-rejection was .058 (very close to being rejected). The p-value of vanadium non-rejection was .25.

Table 4: Summary of Descriptive and Distributional Statistics for Step 1 of the Figure 5-2 Flowchart: **Subsurface Soil (mg/kg)**

Metal	Loc.	Frequency of Detection			Range		Freq. (%) of Non-Detects[4]	Arithmetic Summaries[1]			W-Test Results[1,2]		Lognormal Data Summaries[1]			
		#	%	Cat.	Detects	Non-Detects		Median	Mean	Standard Deviation	Normal?	Lognormal?	Mean of transformed data	SD of transformed data	Geo Mean	Geo SD
Arsenic	Bkgd	19/34	55.9%	D	.28-3.4	.16-1.3	44.1%	.6	.867	.790	N	Y	-.477	.857	.620	2.356
	Site	4/9	44.4%	C	.63-1.4	.39-.99	55.6%	.495	.563	.418	Y	Y	-.823	.757	.439	2.132
	Site detects only	4/4	---	--	--	--	--	.850	.933	.341	Not enough data to determine distribution					
Barium	Bkgd	34/34	100%	D	3.5-246	--	0%	54	78.42	69.27	N	Y	3.854	1.167	47.161	3.211
	Site	10/10	100%	D	61-210	--	0%	110	134.1	57.28	Y	Y	4.812	.447	122.9	1.563
Beryllium	Bkgd	27/32	84.4%	D	.052-.87	.05-.06	15.6%	.235	.285	.237	N	N	(na)	(na)	(na)	(na)
	Site	4/5	80.0%	D	.14-1	.285-.285	20.0%	.18	.351	.367	N	Y	-1.367	.813	.255	2.254
Cadmium	Bkgd	10/35	28.6%	C	.099-.62	.061-.97	71.4%	.265	.237	.156	N	N	(na)	(na)	(na)	(na)
	Bkgd detects only	10/10	--	--	--	--	--	.390	.384	.138	Y	N	(na)	(na)	(na)	(na)
	Site	5/10	50.0%	C	.15-.75	.098-.57	50.0%	.22	.274	.231	N	Y	-1.627	.902	.197	2.464
	Site detects only	5/5	---	--	--	--	--	.190	.370	.288	Y	Y	-1.247	.791	.287	2.206
Chromium	Bkgd	33/33	100%	D	2.7-148	--	0%	19.1	30.18	30.48	N	Y	3.028	.895	20.649	2.446
	Site	10/10	100%	D	7.4-46	--	0%	26	26.54	12.50	Y	Y	3.152	.572	23.380	1.772
Cobalt	Bkgd	31/32	96.9%	D	.83-73.4	1.2-1.2	3.1%	10.35	16.01	16.11	N	Y	2.270	1.119	9.682	3.063
	Site	10/10	100%	D	13-55	--	0%	23	24.9	11.26	N	N	(na)	(na)	(na)	(na)
Copper	Bkgd	30/30	100%	D	18-260	--	0%	58.9	85.11	60.55	N	Y	4.218	.686	67.930	1.985
	Site	12/12	100%	D	100-460	--	0%	175	202.50	116.16	N	Y	5.195	.472	180.36	1.604
Lead	Bkgd	32/33	97.0%	D	.27-7.8	.5-.5	3.0%	2.1	2.682	1.821	Y	Y	.702	.860	2.017	2.364
	Site	10/10	100%	D	.74-56	--	0%	1.95	7.549	17.085	N	N	(na)	(na)	(na)	(na)
Mercury	Bkgd	9/35	25.7%	C	.013-.17	.0051-.18	74.3%	.015	.0266	.0329	N	N	(na)	(na)	(na)	(na)
	Bkgd detects only	9/9	--	--	--	--	--	.029	.0529	.0508	N	Y	-3.259	.804	.038	2.235
	Site	7/12	58.3%	D	.0048-.15	.013-.032	41.7%	.0145	.0343	.0442	N	Y	-3.999	1.128	.018	3.090

Nickel	Bkgd	32/32	100%	D	1.1-35.6	--	0%	7.7	10.18	8.01	N	Y	1.983	.901	7.625	2.462
	Site	8/10	80.0%	D	7-18	4.9-5	20.0%	12.5	10.87	5.648	Y	N	(na)	(na)	(na)	(na)
Selenium	Bkgd	8/33	24.2%	C	.21-3.8	.15-2.1	75.8%	.485	.581	.696	N	Y	-1.027	1.106	.358	2.763
	Bkgd detects only	8/8	--	--	--	--	--	.685	1.114	1.226	N	Y	-.392	1.070	.406	11.76
	Site	2/8	25.0%	C	1.1-5.94	.98-2.8	75.0%	.8	1.459	1.851	N	N	(na)	(na)	(na)	(na)
	Site detects only	2/2	--	--	--	--	--	3.52	3.52	3.422	Not enough data to determine distribution					
Silver	Bkgd	2/35	5.7%	C	.1-.16	.063-1.3	94.3%	.16	.237	.208	N	N	(na)	(na)	(na)	(na)
	Bkgd detects only	2/2	--	--	--	--	--	.130	.130	.042	Not enough data to determine distribution					
	Site	2/10	20.0%	C	.12-.13	.2-1	80.0%	.11	.179	.132	N	N	(na)	(na)	(na)	(na)
	Site detects only	2/2	--	--	--	--	--	.125	.125	.007	Not enough data to determine distribution					
Sulfide	Bkgd	1/20	5.7%	B	37-37	25.6-40	95.0%	Not enough data to determine level – consider metal "potentially present" in background								
	Site	1/3	33.3%	B	28-28	27-28	66.7%	Not enough data to determine level – consider metal "potentially present" in site								
Thallium	Bkgd	2/33	6.1%	C	.21-.29	.11-2.4	93.9%	.195	.307	.286	N	N	(na)	(na)	(na)	(na)
	Bkgd detects only	2/2	--	--	--	--	--	.250	.250	.057	Not enough data to determine distribution					
	Site	1/8	12.5%	B	.92-.92	.39-.57	87.5%	Not enough data to determine level – consider metal "potentially present" in site								
Tin	Bkgd	21/33	63.6%	D	1.5-3.4	.76-1.9	36.4%	1.8	1.654	.946	N	N	(na)	(na)	(na)	(na)
	Site	3/5	60.0%	D	1.6-3	1.3-1.4	40.0%	1.6	1.75	1.118	Y	Y	.362	.732	1.436	2.680
Vanadium	Bkgd	33/33	100%	D	24-410	--	0%	141	173.4	103.0	N	Y	4.960	.689	142.58	1.991
	Site	10/10	100%	D	76-300	--	0%	150	161.6	68.34	Y	Y	5.009	.410	149.73	1.507
Zinc	Bkgd	30/31	96.8%	D	3.9-98.5	27-27	3.2%	36.1	39.85	24.72	N	Y	3.469	.729	32.116	2.073
	Site	12/12	100%	D	36-600	--	0%	83	129.58	154.28	N	Y	4.529	.738	92.708	2.091

[1] Background Arithmetic summaries, distribution (W) tests, and lognormal data summaries used datasets with ½ values for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.

[2] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects.

[3] For FOD Category "C" rows, two summary sets were calculated since the background guidance document said that "descriptive statistics were also calculated using a truncated data set". In "Bkgd detects only" rows only the detected values were used and in the "Bkgd" rows, all the values were used, (with ½ the detected value used as a surrogate for non-detects). For consistency, the same procedure was applied to FOD Category C Site data.

[4] With over 50% non-detects, evaluations to determine distribution and other characteristics will result in a high level of uncertainty.

Table 5: Summary of Step 2 Statistical Testing Plan based on Figure 5-2 Flowchart: **Subsurface Soil (mg/kg)**

Metal	Loc.[1]	Only 1 DL[2] and <15%ND?		Any >50%?	Largest Values[3]			W-Test Results[4]			More than 1 DL? [1]	Any >40% Non-detects?	Equal Variance?[5]			Test
		% ND	Both <15%?		Bkgd ND	Site Detect	Any Site > Largest Bkgd ND?	Normal?	Lognormal?	Normal or Lognormal?			Relevant SD	Relevant Variance	Equal Variance?	
Arsenic	Bkgd	44.1%	N	Y	1.3	1.4	Y									Two Sample Proportion
	Site	55.6%														
Barium	Bkgd	0%	Y					N	Y	Y – Lognormal					N	Satterthwaite's t-test
	Site	0%						Y	Y							
Beryllium	Bkgd	15.6%	N	N							N	N				Wilcoxon Rank Sum
	Site	20.0%														
Cadmium	Bkgd	71.4%	N	Y	.97	.75	N									Do not perform
	Site	50.0%														
Chromium	Bkgd	0%	Y					N	Y	Y – Lognormal					Y	Student's t-test
	Site	0%						Y	Y							
Cobalt	Bkgd	3.1%	Y					N	Y	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						N	N							
Copper	Bkgd	0%	Y					N	Y	Y – Lognormal					Y	Student's t-test
	Site	0%						N	Y							
Lead	Bkgd	3.0%	Y					Y	Y	N – Cannot Determine	N	N				Wilcoxon Rank Sum
	Site	0%						N	N							
Mercury	Bkgd	74.3%	N	Y	.18	.15	N									Do not perform
	Site	41.7%														
Nickel	Bkgd	0%	N	N							N	N				Wilcoxon Rank Sum
	Site	20%														
Selenium	Bkgd	75.8%	N	Y	2.1	.94	N									Do not perform
	Site	75.0%														
Silver	Bkgd	94.3%	N	Y	1.3	.13	N									Do not perform
	Site	80.0%														
Sulfide	Bkgd	95.0%	N	Y	40	28	N									Do not perform
	Site	66.7%														

Thallium	Bkgd	93.9%	N	Y	2.4	.92	N									Do not perform
	Site	87.5%														
Tin	Bkgd	36.4%	N	N							N	N				Wilcoxon Rank Sum
	Site	40.0%														
Vanadium	Bkgd	0%	Y					N	Y	Y – Lognormal					Y	Student's t-test
	Site	0%						Y	Y							
Zinc	Bkgd	3.2%	Y					N	Y	Y – Lognormal					Y	Student's t-test
	Site	0%						N	Y							

[1] Statistical flowchart done only with full data sets for FOC Category "C" datasets. No truncated (detects only) sets were used.

[2] Analysis assumed only 1 detection limit.

[3] Compared largest background non-detect to largest **detected** site value.

[4] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.

[5] Performed in ProUCL Software.

Table 6: Summary of Step 3 Right Tail Testing Plan based on Figure 5-2 Flowchart and Statistical Testing Results[1] – **Subsurface Soil (mg/kg)**

Metal	Background ND		Number of Detected Samples			Step 3 Results[2]		Step 2 Results		
	%	+100%?	In Bkgd	In Site	At least 10 in each?	Test	Test Result H_0 = right tails of site and background data have same distribution	Test	Test Result H_0 = mean/median/prop of detects of site is <= mean/median/prop of detects of background	P-Value
Arsenic	44.1%	N	19	4	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Do not reject H_0; Conclude Site <= Background[3]	.731
Barium	0%	N	34	10	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Satterthwaite's t-test	Reject H_0; Conclude Site > Background	<.001
Beryllium	15.6%	N	27	4	N	Slippage Test	Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.429
Cadmium	71.4%	N	10	5	N	Slippage Test	Do not reject H_0	Do not perform		
Chromium	0%	N	33	10	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Student's t-test	Do not reject H_0; Conclude Site <= Background	.5
Cobalt	3.1%	N	31	10	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Wilcoxon Rank Sum	Reject H_0; Conclude Site > Background	.004
Copper	0%	N	30	12	Y	Quantile Test Slippage Test	Reject H_0 Do not reject H_0	Student's t-test	Reject H_0; Conclude Site > Background	<.001
Lead	3.0%	N	32	10	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.597
Mercury	74.3%	N	9	7	N	Slippage Test	Do not reject H_0	Do not perform		
Nickel	0%	N	32	8	N	Slippage Test	Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.172
Selenium	75.8%	N	8	2	N	Slippage Test	Do not reject H_0	Do not perform		
Silver	94.3%	N	2	2	N	Slippage Test	Cannot perform – small sample	Do not perform		
Sulfide	95.0%	N	1	1	N	Slippage Test	Cannot perform – small sample	Do not perform		
Thallium	93.9%	N	2	1	N	Slippage Test	Cannot perform – small sample	Do not perform		
Tin	36.4%	N	21	3	N	Slippage Test	Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.398
Vanadium	0%	N	33	10	Y	Quantile Test Slippage Test	Do not reject H_0 Do not reject H_0	Student's t-test	Do not reject H_0; Conclude Site <= Background	.419
Zinc	3.2%	N	30	12	Y	Quantile Test Slippage Test	Reject H_0 Do not reject H_0	Student's t-test	Reject H_0; Conclude Site > Background	<.001

[1] All statistical tests performed with ProUCL software Version 4.00.05 except two-sample proportion (of detects) and slippage tests. These tests were not available in the software and were performed by hand. Slippage methods followed the EPA guidance in their G-9S document (2006) with extended critical value table from the Navy in their Handbook of Statistical Analysis of Environmental Background Data (1999).

[2] Slippage and Quantile tests focus on the right tail; large values will bias results. These tests should be used in combination with a location test like a t-test or Wilcoxon Rank Sum.

[3] A two sample proportion test is only valid if there are at least 5 'successes' (in our case, detects) and 5 'failures' (in our case, non-detects) in each of the two samples. (some texts say at least 10). That was not true for this metal. While the flowchart indicated a two sample proportion test was valid, and the results are reported, it is not actually a valid test.

Table 7: Summary of Descriptive and Distributional Statistics for Step 1 of the Figure 5-2 Flowchart: **Groundwater (µg/L)**

Metal	Loc.	Frequency of Detection			Range		Freq. (%) of Non-Detects[4]	Arithmetic Summaries[1]			W-Test Results[1,2]		Lognormal Data Summaries[1]			
		#	%	Cat.	Detects	Non-Detects		Median	Mean	Standard Deviation	Normal?	Lognormal?	Mean of transformed data	SD of transformed data	Geo Mean	Geo SD
Antimony	Bkgd	4/14	28.6%	C	1.3-3.8	1.9-80	71.4%	5.275	8.314	10.28	No	Yes	1.502	1.177	4.49	3.25
	Bkgd detects only	4/4	--	--	--	--	--	1.85	2.2	1.158	Not enough data to determine distribution					
	Site	2/5	40.0%	C	5-5	5-5	60.0%	2.5	3.5	1.369	No	No	(na)	(na)	(na)	(na)
	Site detects only	2/2	--	--	--	--	--	5	5	0	Not enough data to determine distribution					
Arsenic	Bkgd	5/13	38.5%	C	2.5-17.7	1.2-2.6	61.5%	1.3	3.83	5.10	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	5/5	--	--	--	--	--	8.7	8.36	6.026	Yes	Yes	1.893	.787	6.638	2.197
	Site	6/7	85.7%	D	2.2-35.1	4-4	14.3%	21	19.76	13.26	Yes	No	(na)	(na)	(na)	(na)
Barium	Bkgd	15/15	100%	D	19.8-271	--	0%	114	109.8	75.24	Yes	Yes	4.424	.836	83.402	2.307
	Site	8/8	100%	D	.01-154	--	0%	82.5	68.38	61.6	Yes	No	(na)	(na)	(na)	(na)
Beryllium	Bkgd	2/14	14.3%	C	.1-1.1	.1-2	85.7%	.225	.393	.336	No	Yes	-1.298	.921	.273	2.511
	Bkgd detects only	2/2	--	--	--	--	--	.15	.375	.484	Not enough data to determine distribution					
	Site	1/5	20.0%	B	.45-.45	1-2	80.0%	Not enough data to determine level – consider metal "potentially present" in site								
Cadmium	Bkgd	5/15	33.3%	C	1.7-36	.3-2.9	66.7%	1.45	8.607	13.91	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	5/5	--	--	--	--	--	33.6	24.1	15..028	Yes	No	(na)	(na)	(na)	(na)
	Site	3/5	60.0%	D	9-15	.5-2	40.0%	9	7.61	6.733	Yes	Yes	1.214	1.818	3.366	6.158
Chromium	Bkgd	5/15	33.3%	C	1.3-8	.7-8.5	66.7%	1.3	2.23	2.11	No	Yes	.391	.970	1.478	2.638
	Bkgd detects only	5/5	--	--	--	--	--	3.7	4.1	2.453	Yes	Yes	1.254	.655	3.506	1.926
	Site	4/5	80.0%	D	2.4-9.4	2-2	20.0%	6.69	5.302	3.486	Yes	Yes	1.393	.935	4.027	2.546
Cobalt	Bkgd	9/14	64.3%	D	.93-591	.7-3.9	35.7%	9.05	131.15	224.7	No	Yes	2.388	2.812	10.889	16.642
	Site	5/8	62.5%	D	.002-277	.01-5	37.5%	2.25	80.19	117.9	No	Yes	-.0282	5.227	.972	186.14

Copper	Bkgd	6/14	42.9%	C	3.3-496	.5-7.5	57.1%	2.2	71.73	157.24	No	Yes	1.502	2.549	4.5	12.8
	Bkgd detects only	6/6	--	--	--	--	--	58.4	165.9	213.7	Yes	Yes	3.842	2.074	46.624	7.953
	Site	6/7	85.7%	D	3-140	5-5	14.3%	61	65.87	54.27	Yes	No	(na)	(na)	(na)	(na)
Nickel	Bkgd	8/14	57.1%	D	.91-80.1	.6-11.1	42.9%	5.55	25.03	29.55	No	Yes	1.873	2.094	6.511	8.120
	Site	7/10	70.0%	D	.003-140	.04-10	30.0%	26	51.61	59.46	No	No	(na)	(na)	(na)	(na)
Selenium	Bkgd	3/12	25.0%	C	13-27.3	1.4-17	75.0%	1.1	6.225	8.845	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	3/3	--	--	--	--	--	18.2	14.975	7.238	Not enough data to determine distribution					
	Site	5/5	100%	D	4-69	--	0%	61.6	43.28	29.67	Yes	Yes	3.364	1.228	28.893	3.145
Silver	Bkgd	3/15	20.0%	C	1.7-1.9	.6-9	80.0%	1.7	1.5	1.087	No	No	(na)	(na)	(na)	(na)
	Bkgd detects only	3/3	--	--	--	--	--	1.8	1.8	.1	Not enough data to determine distribution					
	Site	5/7	71.4%	D	1.1-5.98	1-2	28.6%	3.5	2.997	2.173	Yes	Yes	.771	.959	2.163	2.610
Vanadium	Bkgd	6/14	42.9%	C	8.1-265	.8-8.5	57.1%	2.9	32.81	70.17	No	Yes	1.631	2.12	5.11	8.327
	Bkgd detects only	6/6	--	--	--	--	--	37.4	74.72	95.45	No	Yes	3.757	1.146	42.806	3.147
	Site	4/8	50.0%	C	.003-6.3	5-5	50.0%	2.5	2.043	2.115	No	No	(na)	(na)	(na)	(na)
	Site detects only	4/4	--	--	-	--	--	.02	1.586	3.143	Not enough data to determine distribution					
Zinc	Bkgd	12/13	92.3%	D	1.6-492	2.4-2.4	7.7%	5.4	72.515	144.06	No	Yes	2.483	2.005	11.973	7.424
	Site	5/5	100%	D	5-190	--	0%	90	89.33	83.82	Yes	Yes	3.686	1.729	39.868	5.367

[1] Background Arithmetic summaries, distribution (W) tests, and lognormal data summaries used datasets with ½ values for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.
[2] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects.
[3] For FOD Category "C" rows, two summary sets were calculated since the background guidance document said that "descriptive statistics were also calculated using a truncated data set". In "Bkgd detects only" rows only the detected values were used and in the "Bkgd" rows, all the values were used, (with ½ the detected value used as a surrogate for non-detects). For consistency, the same procedure was applied to FOD Category C Site data.
[4] With over 50% non-detects, evaluations to determine distribution and other characteristics will result in a high level of uncertainty.

Table 8: Summary of Step 2 Statistical Testing Plan based on Figure 5-2 Flowchart: **Groundwater (µg/L)**

Metal	Loc.[1]	Only 1 DL[2] and <15%ND?		Any >50%?	Largest Values[3]			W-Test Results[4]			More than 1 DL?[1]	Any >40% Non-detects?	Equal Variance?[5]			Test
		% ND	Both <15%?		Bckd ND	Site Detect	Any Site > Largest Bkgd ND?	Normal?	Lognormal?	Normal or Lognormal?			Relevant SD	Relevant Variance	Equal Variance?	
Antimony	Bkgd	71.4%	N	Y	80	5	N									Do not perform
	Site	60.0%														
Arsenic	Bkgd	61.5%	N	Y	2.6	35.1	Y									Two sample proportion
	Site	14.3%														
Barium	Bkgd	0%	Y					Yes	Yes	Normal			75	5625	Y	Student's T-test
	Site	0%						Yes	No				61.604	3795.05		
Beryllium	Bkgd	85.7%	N	Y	2	.45	N									Do not perform
	Site	80.0%														
Cadmium	Bkgd	66.7%	N	Y	2.9	15	Y									Two sample proportion
	Site	40.0%														
Chromium	Bkgd	66.7%	N	Y	8.5	9.4	Y									Two sample proportion
	Site	20.0%														
Cobalt	Bkgd	35.7%	N	N							N	N				Wilcoxon Rank Sum
	Site	37.5%														
Copper	Bkgd	57.1%	N	Y	7.5	140	Y									Two sample proportion
	Site	14.3%														
Nickel	Bkgd	42.9%	N	N							N	Y				Gehan Test
	Site	30.0%														
Selenium	Bkgd	75.0%	N	Y	17	69	Y									Two sample proportion
	Site	0%														
Silver	Bkgd	80.0%	N	Y	9	5.98	N									Do not perform
	Site	28.6%														
Vanadium	Bkgd	57.1%	N	Y	8.5	6.3	N									Do not perform
	Site	50.0%														
Zinc	Bkgd	7.7%	Y					No	Yes	Lognormal			2.005	4.02	Y	Student's T-test
	Site	0%						Yes	Yes				1.729	2.99		

[1] Statistical flowchart done only with full data sets for FOC Category "C" datasets. No truncated (detects only) sets were used.
[2] Analysis assumed only 1 detection limit.
[3] Compared largest background non-detect to largest **detected** site value.

[4] Shapiro-Wilk Test with significance at p=.05 done with ProUCL software on data sets with the surrogate ½ value for non-detects. "Background" considered measures designated 'U' and 'UJ' as non-detects. "Site" considered 'ND' data points as non-detects.
[5] Performed in ProUCL Software.

Table 9: Summary of Step 3 Right Tail Testing Plan based on Figure 5-2 Flowchart and Statistical Testing Results[1] – **Groundwater (µg/L)**

Metal	Background ND		Number of Detected Samples			Step 3 Results[2]		Step 2 Results		
	%	+100%?	In Bkgd	In Site	At least 10 in each?	Test	Test Result H_0 = right tails of site and background data have same distribution	Test	Test Result H_0 = mean/median/prop of detects of site is <= mean/median/prop of detects of background	P-Value
Antimony	71.4%	N	4	2	N	Slippage Test	Cannot perform – small sample	Do not perform		
Arsenic	61.5%	N	5	6	N	Slippage Test	Reject H_0	Two Sample Proportion	Reject H_0; Conclude Site > Background	.022
Barium	0%	N	15	8	N	Slippage Test	Do not reject H_0	Student's T-test	Do not reject H_0; Conclude Site <= Background	.901
Beryllium	85.7%	N	2	1	N	Slippage Test	Cannot perform – small sample	Do not perform		
Cadmium	66.7%	N	5	3	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Do not reject H_0; Conclude Site <= Background	.145
Chromium	66.7%	N	5	4	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Reject H_0; Conclude Site > Background	.035
Cobalt	35.7%	N	9	5	N	Slippage Test	Do not reject H_0	Wilcoxon Rank Sum	Do not reject H_0; Conclude Site <= Background	.784
Copper	57.1%	N	6	6	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Reject H_0; Conclude Site > Background	.031
Nickel	42.9%	N	8	7	N	Slippage Test	Do not reject H_0	Gehan Test	Do not reject H_0; Conclude Site <= Background	.201
Selenium	75.0%	N	3	5	N	Slippage Test	Do not reject H_0	Two Sample Proportion	Reject H_0; Conclude Site > Background	.002
Silver	80.0%	N	3	5	N	Slippage Test	Reject H_0	Do not perform		
Vanadium	57.1%	N	6	4	N	Slippage Test	Do not reject H_0	Do not perform		
Zinc	7.7%	N	12	5	N	Slippage Test	Do not reject H_0	Student's T-test	Do not reject H_0; Conclude Site <= Background	.128

[1] All statistical tests performed with ProUCL software Version 4.00.05 except two-sample proportion (of detects) and Gehan test and slippage tests. These tests were not available in the software and were performed by hand. Slippage methods followed the EPA guidance in their G-9S document (2006) with extended critical value table from the Navy in their Handbook of Statistical Analysis of Environmental Background Data (1999).

[2] Slippage tests focus on the right tail; large values will bias results. These tests should be used in combination with a location test like a t-test or Wilcoxon Rank Sum.

APPENDIX F

HUMAN HEALTH RISK CALCULATION

Receptor	Adult Resident																												
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	$(ug/m^3)^{-1}$	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area avail soil	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)	Incidental Soil Ingestion Intake (nc)	Incidental Soil Ingestion Intake (c)	RfDo	CSFo	RfC	URF_a	Hqderms oil	CANC RISKdermsoil	Hqoralsoil	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
Acenaphthylene	0.34	100	350	24	1	70	8760	25550	0.1	0.07	5700	8.00E+05	2.35E-09	1.83E-07	6.29E-08	4.60E-07	1.58E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	100	350	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	8.23E-08	6.43E-06	2.20E-06	1.15E-05	3.95E-06	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	100	350	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	1.59E-08	1.24E-06	4.25E-07	2.22E-06	7.61E-07	2.00E-05	N/A	N/A	N/A	0.06	0.00E+00	0.11	0.00E+00	0.00	0.00E+00	0.17	0.00E+00
Aroclor-1260	1.63	100	350	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	1.59E-08	1.24E-06	4.26E-07	2.23E-06	7.63E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	100	350	24	1	70	8760	25550	0.03	0.07	5700	1.36E+09	1.38E-08	1.08E-06	3.69E-07	8.99E-06	3.08E-06	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.00	5.53E-07	0.03	4.62E-06	0.00	5.23E-09	0.03	5.18E-06
Benz(a)anthracene	0.46	100	350	24	1	70	8760	25550	0.13	0.07	5700	3.11E+07	4.17E-09	3.26E-07	1.12E-07	6.28E-07	2.15E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.34E-07	0.00	2.58E-07	0.00	5.33E-10	0.00	3.93E-07
Benzo(a)pyrene	0.67	100	350	24	1	70	8760	25550	0.13	0.07	5700	8.24E+07	6.09E-09	4.76E-07	1.63E-07	9.17E-07	3.14E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.96E-07	0.00	3.77E-07	0.00	2.94E-10	0.00	5.73E-07
Benzo(b)fluoranthene	0.59	100	350	24	1	70	8760	25550	0.13	0.07	5700	1.54E+07	5.38E-09	4.20E-07	1.44E-07	8.10E-07	2.78E-07	N/A	7.30E+00	N/A	1.10E-03	0.00	1.05E-06	0.00	2.03E-06	0.00	1.39E-08	0.00	3.09E-06
Benzo(g,h,i)perylene	0.41	100	350	24	1	70	8760	25550	0.1	0.07	5700	2.59E+08	2.87E-09	2.24E-07	7.69E-08	5.62E-07	1.93E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	100	350	24	1	70	8760	25550	0.13	0.07	5700	1.42E+08	4.31E-09	3.36E-07	1.15E-07	6.48E-07	2.22E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.38E-07	0.00	2.67E-07	0.00	1.21E-10	0.00	4.05E-07
Chlordane	2.24	100	350	24	1	70	8760	25550	0.04	0.07	5700	1.36E+09	6.28E-09	4.90E-07	1.68E-07	3.07E-06	1.05E-06	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.00	2.19E-07	0.01	1.37E-06	0.00	1.84E-10	0.01	1.59E-06
Chlordecone (Kepone)	9.63	100	350	24	1	70	8760	25550	0.1	0.07	5700	1.36E+09	6.74E-08	5.26E-06	1.80E-06	1.32E-05	4.52E-06	3.00E-04	1.00E+01	N/A	4.60E-03	0.02	1.80E-05	0.04	4.52E-05	0.00	1.07E-08	0.06	6.33E-05
Chrysene	0.51	100	350	24	1	70	8760	25550	0.13	0.07	5700	3.92E+07	4.64E-09	3.62E-07	1.24E-07	6.98E-07	2.39E-07	N/A	1.20E-01	N/A	1.10E-05	0.00	1.49E-08	0.00	2.87E-08	0.00	4.70E-11	0.00	4.37E-08
DDD	0.99	100	350	24	1	70	8760	25550	0.1	0.07	5700	7.64E+07	6.90E-09	5.38E-07	1.85E-07	1.35E-06	4.63E-07	N/A	2.40E-01	N/A	6.90E-05	0.00	4.43E-08	0.00	1.11E-07	0.00	2.93E-10	0.00	1.56E-07
DDE	2.45	100	350	24	1	70	8760	25550	0.1	0.07	5700	8.21E+07	1.72E-08	1.34E-06	4.59E-07	3.36E-06	1.15E-06	N/A	3.40E-01	N/A	9.70E-05	0.00	1.56E-07	0.00	3.91E-07	0.00	9.51E-10	0.00	5.48E-07
DDT	17.08	100	350	24	1	70	8760	25550	0.03	0.07	5700	1.01E+08	3.59E-08	2.80E-06	9.60E-07	2.34E-05	8.02E-06	5.00E-04	3.40E-01	N/A	9.70E-05	0.01	3.26E-07	0.05	2.73E-06	0.00	5.42E-09	0.05	3.06E-06
Dibenz[a,h]anthracene	0.12	100	350	24	1	70	8760	25550	0.13	0.07	5700	3.46E+08	1.13E-09	8.83E-08	3.03E-08	1.70E-07	5.84E-08	N/A	4.10E+00	N/A	1.20E-03	0.00	1.24E-07	0.00	2.39E-07	0.00	1.42E-10	0.00	3.64E-07
Dieldrin	0.23	100	350	24	1	70	8760	25550	0.1	0.07	5700	8.21E+05	1.59E-09	1.24E-07	4.26E-08	3.11E-07	1.07E-07	5.00E-05	1.60E+01	N/A	4.60E-03	0.00	6.81E-07	0.01	1.71E-06	0.00	4.18E-07	0.01	2.81E-06
Endosulfan sulfate	0.22	100	350	24	1	70	8760	25550	0.1	0.07	5700	2.58E+07	1.55E-09	1.21E-07	4.16E-08	3.04E-07	1.04E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	100	350	24	1	70	8760	25550	0.1	0.07	5700	2.62E+07	1.55E-09	1.21E-07	4.15E-08	3.04E-07	1.04E-07	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Heptachlor	0.11	100	350	24	1	70	8760	25550	0.1	0.07	5700	7.38E+06	7.94E-10	6.20E-08	2.13E-08	1.55E-07	5.33E-08	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	9.56E-08	0.00	2.40E-07	0.00	6.57E-09	0.00	3.42E-07
Heptachlor epoxide	0.11	100	350	24	1	70	8760	25550	0.1	0.07	5700	1.73E+07	7.62E-10	5.95E-08	2.04E-08	1.49E-07	5.11E-08	1.30E-05	9.10E+00	N/A	2.60E-03	0.00	1.86E-07	0.01	4.65E-07	0.00	5.38E-09	0.02	6.56E-07
Indeno(1,2,3-cd) pyrene	0.40	100	350	24	1	70	8760	25550	0.13	0.07	5700	2.34E+08	3.65E-09	2.85E-07	9.77E-08	5.49E-07	1.88E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.17E-07	0.00	2.26E-07	0.00	6.20E-11	0.00	3.43E-07
Methyl iodide	0.01	100	350	24	1	70	8760	25550	0.1	0.07	5700	1.68E+03	5.48E-11	4.28E-09	1.47E-09	1.07E-08	3.68E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	100	350	24	1	70	8760	25550	0.1	0.07	5700	1.36E+09	8.79E-10	6.86E-08	2.35E-08	1.72E-07	5.90E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.10	2.21E-05	0.26	6.03E-05	3.11E-04	4.68E-07	0.35	8.28E-05

Adult - GW Ingestion	mg/L	L/day	days/yr	years		kg	days	days						mg/kg-d	mg/kg-d			mg/kg-d	(mg/kg-d)-1									unitless	unitless
Compound	Groundwater EPC	Ingestion Rate	Exposure Frequency	Exposure Duration		body weight	averaging time (nc)	averaging time (canc)						Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)			RfDo	CSFo									HQ	Cancer Risk
Arsenic	0.04	2.00	350	24.00		70.00	8760	25550						9.62E-04	3.30E-04			3.00E-04	1.50E+00									3.21	4.95E-04
Di/Bis(2-ethylhexyl)phthalate (DEHP)	0.11	2.00	350	24.00		70.00	8760	25550						3.01E-03	1.03E-03			2.00E-02	1.40E-02									0.15	1.45E-05
4,4'-DDD	0.00	2.00	350	24.00		70.00	8760	25550						2.74E-06	9.39E-07			N/A	2.40E-01									-	2.25E-07
4,4'-DDE	0.00	2.00	350	24.00		70.00	8760	25550						3.01E-06	1.03E-06			N/A	3.40E-01									-	3.51E-07
4,4'-DDT	0.00	2.00	350	24.00		70.00	8760	25550						2.74E-06	9.39E-07			5.00E-04	3.40E-01									0.01	3.19E-07
Naphthalene	0.00	2.00	350	24.00		70.00	8760	25550						1.40E-06	4.79E-07			2.00E-02	N/A									0.00	
Phenanthrene	0.00	2.00	350	24.00		70.00	8760	25550						1.34E-06	4.60E-07			N/A	N/A									-	
																											sum -	3.36	5.10E-04

Receptor	Child Resident																												
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	$(ug/m^3)^{-1}$	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area avail soil	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)	Incidental Soil Ingestion Intake (nc)	Incidental Soil Ingestion Intake (c)	RfDo	CSFo	RfC	URF_a	Hqderms oil	CANC RISKdermsoil	Hqoralsoil	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
Acenaphthylene	0.34	200	350	6	1	15	2190	25550	0.1	0.2	2800	8.00E+05	6.71E-09	1.20E-06	1.03E-07	4.29E-06	3.68E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	200	350	6	1	15	2190	25550	0.14	0.2	2800	1.36E+09	2.35E-07	4.21E-05	3.61E-06	1.07E-04	9.21E-06	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	200	350	6	1	15	2190	25550	0.14	0.2	2800	1.36E+09	4.54E-08	8.12E-06	6.96E-07	2.07E-05	1.78E-06	2.00E-05	N/A	N/A	N/A	0.41	0.00E+00	1.04	0.00E+00	0.00	0.00E+00	1.44	0.00E+00
Aroclor-1260	1.63	200	350	6	1	15	2190	25550	0.14	0.2	2800	1.36E+09	4.55E-08	8.14E-06	6.98E-07	2.08E-05	1.78E-06	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	200	350	6	1	15	2190	25550	0.03	0.2	2800	1.36E+09	3.94E-08	7.05E-06	6.04E-07	8.39E-05	7.19E-06	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.02	9.06E-07	0.28	1.08E-05	0.00	1.31E-09	0.30	1.17E-05
Benz(a)anthracene	0.46	200	350	6	1	15	2190	25550	0.13	0.2	2800	3.11E+07	1.19E-08	2.13E-06	1.83E-07	5.86E-06	5.02E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	2.19E-07	0.00	6.03E-07	0.00	1.33E-10	0.00	8.22E-07
Benzo(a)pyrene	0.67	200	350	6	1	15	2190	25550	0.13	0.2	2800	8.24E+07	1.74E-08	3.12E-06	2.67E-07	8.56E-06	7.34E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	3.20E-07	0.00	8.80E-07	0.00	7.34E-11	0.00	1.20E-06
Benzo(b)fluoranthene	0.59	200	350	6	1	15	2190	25550	0.13	0.2	2800	1.54E+07	1.54E-08	2.75E-06	2.36E-07	7.56E-06	6.48E-07	N/A	7.30E+00	N/A	1.10E-03	0.00	1.72E-06	0.00	4.73E-06	0.00	3.47E-09	0.00	6.46E-06
Benzo(g,h,i)perylene	0.41	200	350	6	1	15	2190	25550	0.1	0.2	2800	2.59E+08	8.20E-09	1.47E-06	1.26E-07	5.24E-06	4.50E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	200	350	6	1	15	2190	25550	0.13	0.2	2800	1.42E+08	1.23E-08	2.20E-06	1.89E-07	6.05E-06	5.19E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	2.27E-07	0.00	6.22E-07	0.00	3.01E-11	0.00	8.49E-07
Chlordane	2.24	200	350	6	1	15	2190	25550	0.04	0.2	2800	1.36E+09	1.79E-08	3.21E-06	2.75E-07	2.87E-05	2.46E-06	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.01	3.58E-07	0.06	3.20E-06	0.00	4.61E-11	0.06	3.55E-06
Chlordecone (Kepone)	9.63	200	350	6	1	15	2190	25550	0.1	0.2	2800	1.36E+09	1.93E-07	3.45E-05	2.95E-06	1.23E-04	1.06E-05	3.00E-04	1.00E+01	N/A	4.60E-03	0.11	2.95E-05	0.41	1.06E-04	0.00	2.68E-09	0.53	1.35E-04
Chrysene	0.51	200	350	6	1	15	2190	25550	0.13	0.2	2800	3.92E+07	1.32E-08	2.37E-06	2.03E-07	6.52E-06	5.58E-07	N/A	1.20E-01	N/A	1.10E-05	0.00	2.44E-08	0.00	6.70E-08	0.00	1.18E-11	0.00	9.14E-08
DDD	0.99	200	350	6	1	15	2190	25550	0.1	0.2	2800	7.64E+07	1.97E-08	3.53E-06	3.02E-07	1.26E-05	1.08E-06	N/A	2.40E-01	N/A	6.90E-05	0.00	7.25E-08	0.00	2.59E-07	0.00	7.31E-11	0.00	3.32E-07
DDE	2.45	200	350	6	1	15	2190	25550	0.1	0.2	2800	8.21E+07	4.90E-08	8.77E-06	7.52E-07	3.13E-05	2.68E-06	N/A	3.40E-01	N/A	9.70E-05	0.00	2.56E-07	0.00	9.13E-07	0.00	2.38E-10	0.00	1.17E-06
DDT	17.08	200	350	6	1	15	2190	25550	0.03	0.2	2800	1.01E+08	1.02E-07	1.83E-05	1.57E-06	2.18E-04	1.87E-05	5.00E-04	3.40E-01	N/A	9.70E-05	0.04	5.35E-07	0.44	6.36E-06	0.00	1.35E-09	0.47	6.90E-06
Dibenz[a,h]anthracene	0.12	200	350	6	1	15	2190	25550	0.13	0.2	2800	3.46E+08	3.23E-09	5.78E-07	4.96E-08	1.59E-06	1.36E-07	N/A	4.10E+00	N/A	1.20E-03	0.00	2.03E-07	0.00	5.58E-07	0.00	3.54E-11	0.00	7.62E-07
Dieldrin	0.23	200	350	6	1	15	2190	25550	0.1	0.2	2800	8.21E+05	4.54E-09	8.13E-07	6.97E-08	2.90E-06	2.49E-07	5.00E-05	1.60E+01	N/A	4.60E-03	0.02	1.11E-06	0.06	3.98E-06	0.00	1.05E-07	0.07	5.20E-06
Endosulfan sulfate	0.22	200	350	6	1	15	2190	25550	0.1	0.2	2800	2.58E+07	4.44E-09	7.94E-07	6.81E-08	2.84E-06	2.43E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	200	350	6	1	15	2190	25550	0.1	0.2	2800	2.62E+07	4.43E-09	7.94E-07	6.80E-08	2.83E-06	2.43E-07	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.01	0.00E+00	0.00	0.00E+00	0.01	0.00E+00
Heptachlor	0.11	200	350	6	1	15	2190	25550	0.1	0.2	2800	7.38E+06	2.27E-09	4.06E-07	3.48E-08	1.45E-06	1.24E-07	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	1.57E-07	0.00	5.59E-07	0.00	1.64E-09	0.00	7.17E-07
Heptachlor epoxide	0.11	200	350	6	1	15	2190	25550	0.1	0.2	2800	1.73E+07	2.18E-09	3.89E-07	3.34E-08	1.39E-06	1.19E-07	1.30E-05	9.10E+00	N/A	2.60E-03	0.03	3.04E-07	0.11	1.09E-06	0.00	1.35E-09	0.14	1.39E-06
Indeno(1,2,3-cd) pyrene	0.40	200	350	6	1	15	2190	25550	0.13	0.2	2800	2.34E+08	1.04E-08	1.87E-06	1.60E-07	5.13E-06	4.39E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.92E-07	0.00	5.27E-07	0.00	1.55E-11	0.00	7.19E-07
Methyl iodide	0.01	200	350	6	1	15	2190	25550	0.1	0.2	2800	1.68E+03	1.57E-10	2.80E-08	2.40E-09	1.00E-07	8.58E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	200	350	6	1	15	2190	25550	0.1	0.2	2800	1.36E+09	2.51E-09	4.50E-07	3.85E-08	1.61E-06	1.38E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.64	3.62E-05	2.40	1.41E-04	3.11E-04	1.17E-07	3.03	1.77E-04

Child - GW Ingestion	mg/L	L/day	days/yr	years		kg	days	days						mg/kg-d	mg/kg-d			mg/kg-d	(mg/kg-d)-1									unitless	unitless
Compound	Groundwater EPC	Ingestion Rate	Exposure Frequency	Exposure Duration		body weight	averaging time (nc)	averaging time (canc)						Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)			RfDo	CSFo									HQ	Cancer Risk
Arsenic	0.04	1.00	350	6.00		15.00	2190	25550						2.24E-03	1.92E-04			3.00E-04	1.50E+00									7.48	2.88E-04
Di/Bis(2-ethylhexyl)phthalate (DEHP)	0.11	1.00	350	6.00		15.00	2190	25550						7.03E-03	6.03E-04			2.00E-02	1.40E-02									0.35	8.44E-06
4,4'-DDD	0.00	1.00	350	6.00		15.00	2190	25550						6.39E-06	5.48E-07			N/A	2.40E-01									-	1.32E-07
4,4'-DDE	0.00	1.00	350	6.00		15.00	2190	25550						7.03E-06	6.03E-07			N/A	3.40E-01									-	2.05E-07
4,4'-DDT	0.00	1.00	350	6.00		15.00	2190	25550						6.39E-06	5.48E-07			5.00E-04	3.40E-01									0.01	1.86E-07
Naphthalene	0.00	1.00	350	6.00		15.00	2190	25550						3.26E-06	2.79E-07			2.00E-02	N/A									0.00	
Phenanthrene	0.00	1.00	350	6.00		15.00	2190	25550						3.13E-06	2.68E-07			N/A	N/A									-	
																											sum -	7.84	2.97E-04

Receptor	Adult Trespasser																											
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	(ug/m^3)^-1	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal	Absorbed Dose (c) (Dermal	Incidental Soil Ingestion	Incidental Soil Ingestion	RfDo	CSFo	RfC	URF_a	Hqdermsoil	CANC RISKdermsoil	Hqoralsoil	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
Acenaphthylene	0.34	100	52	24	1	70	8760	25550	0.1	0.07	5700	8.00E+05	2.35E-09	2.72E-08	9.34E-09	6.83E-08	2.34E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	100	52	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	8.23E-08	9.55E-07	3.27E-07	1.71E-06	5.86E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	100	52	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	1.59E-08	1.84E-07	6.31E-08	3.30E-07	1.13E-07	2.00E-05	N/A	N/A	N/A	0.01	0.00E+00	0.02	0.00E+00	0.00	0.00E+00	0.03	0.00E+00
Aroclor-1260	1.63	100	52	24	1	70	8760	25550	0.14	0.07	5700	1.36E+09	1.59E-08	1.85E-07	6.33E-08	3.31E-07	1.13E-07	N/A	N/A	N/A	N/A	0.01	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	100	52	24	1	70	8760	25550	0.03	0.07	5700	1.36E+09	1.38E-08	1.60E-07	5.48E-08	1.34E-06	4.58E-07	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.00	8.22E-08	0.00	6.87E-07	0.00	7.78E-10	0.01	7.70E-07
Benz(a)anthracene	0.46	100	52	24	1	70	8760	25550	0.13	0.07	5700	3.11E+07	4.17E-09	4.84E-08	1.66E-08	9.33E-08	3.20E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	1.99E-08	0.00	3.84E-08	0.00	7.92E-11	0.00	5.83E-08
Benzo(a)pyrene	0.67	100	52	24	1	70	8760	25550	0.13	0.07	5700	8.24E+07	6.09E-09	7.07E-08	2.42E-08	1.36E-07	4.67E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	2.91E-08	0.00	5.61E-08	0.00	4.36E-11	0.00	8.52E-08
Benzo(b)fluoranthene	0.59	100	52	24	1	70	8760	25550	0.13	0.07	5700	1.54E+07	5.38E-09	6.24E-08	2.14E-08	1.20E-07	4.13E-08	N/A	7.30E+00	N/A	1.10E-03	0.00	1.56E-07	0.00	3.01E-07	0.00	2.06E-09	0.00	4.60E-07
Benzo(g,h,i)perylene	0.41	100	52	24	1	70	8760	25550	0.1	0.07	5700	2.59E+08	2.87E-09	3.33E-08	1.14E-08	8.35E-08	2.86E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	100	52	24	1	70	8760	25550	0.13	0.07	5700	1.42E+08	4.31E-09	5.00E-08	1.71E-08	9.63E-08	3.30E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	2.06E-08	0.00	3.96E-08	0.00	1.79E-11	0.00	6.02E-08
Chlordane	2.24	100	52	24	1	70	8760	25550	0.04	0.07	5700	1.36E+09	6.28E-09	7.29E-08	2.50E-08	4.57E-07	1.57E-07	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.00	3.25E-08	0.00	2.03E-07	0.00	2.74E-11	0.00	2.36E-07
Chlordecone (Kepone)	9.63	100	52	24	1	70	8760	25550	0.1	0.07	5700	1.36E+09	6.74E-08	7.82E-07	2.68E-07	1.96E-06	6.72E-07	3.00E-04	1.00E+01	N/A	4.60E-03	0.00	2.68E-06	0.01	6.72E-06	0.00	1.59E-09	0.01	9.40E-06
Chrysene	0.51	100	52	24	1	70	8760	25550	0.13	0.07	5700	3.92E+07	4.64E-09	5.38E-08	1.84E-08	1.04E-07	3.56E-08	N/A	1.20E-01	N/A	1.10E-05	0.00	2.21E-09	0.00	4.27E-09	0.00	6.98E-12	0.00	6.49E-09
DDD	0.99	100	52	24	1	70	8760	25550	0.1	0.07	5700	7.64E+07	6.90E-09	8.00E-08	2.74E-08	2.00E-07	6.87E-08	N/A	2.40E-01	N/A	6.90E-05	0.00	6.58E-09	0.00	1.65E-08	0.00	4.35E-11	0.00	2.31E-08
DDE	2.45	100	52	24	1	70	8760	25550	0.1	0.07	5700	8.21E+07	1.72E-08	1.99E-07	6.82E-08	4.99E-07	1.71E-07	N/A	3.40E-01	N/A	9.70E-05	0.00	2.32E-08	0.00	5.81E-08	0.00	1.41E-10	0.00	8.15E-08
DDT	17.08	100	52	24	1	70	8760	25550	0.03	0.07	5700	1.01E+08	3.59E-08	4.16E-07	1.43E-07	3.48E-06	1.19E-06	5.00E-04	3.40E-01	N/A	9.70E-05	0.00	4.85E-08	0.01	4.05E-07	0.00	8.05E-10	0.01	4.55E-07
Dibenz[a,h]anthracene	0.12	100	52	24	1	70	8760	25550	0.13	0.07	5700	3.46E+08	1.13E-09	1.31E-08	4.50E-09	2.53E-08	8.67E-09	N/A	4.10E+00	N/A	1.20E-03	0.00	1.84E-08	0.00	3.56E-08	0.00	2.11E-11	0.00	5.40E-08
Dieldrin	0.23	100	52	24	1	70	8760	25550	0.1	0.07	5700	8.21E+05	1.59E-09	1.84E-08	6.32E-09	4.62E-08	1.58E-08	5.00E-05	1.60E+01	N/A	4.60E-03	0.00	1.01E-07	0.00	2.54E-07	0.00	6.21E-08	0.00	4.17E-07
Endosulfan sulfate	0.22	100	52	24	1	70	8760	25550	0.1	0.07	5700	2.58E+07	1.55E-09	1.80E-08	6.18E-09	4.52E-08	1.55E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	100	52	24	1	70	8760	25550	0.1	0.07	5700	2.62E+07	1.55E-09	1.80E-08	6.17E-09	4.51E-08	1.55E-08	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Heptachlor	0.11	100	52	24	1	70	8760	25550	0.1	0.07	5700	7.38E+06	7.94E-10	9.21E-09	3.16E-09	2.31E-08	7.91E-09	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	1.42E-08	0.00	3.56E-08	0.00	9.76E-10	0.00	5.08E-08
Heptachlor epoxide	0.11	100	52	24	1	70	8760	25550	0.1	0.07	5700	1.73E+07	7.62E-10	8.84E-09	3.03E-09	2.21E-08	7.59E-09	1.30E-05	9.10E+00	N/A	2.60E-03	0.00	2.76E-08	0.00	6.91E-08	0.00	7.99E-10	0.00	9.75E-08
Indeno(1,2,3-cd) pyrene	0.40	100	52	24	1	70	8760	25550	0.13	0.07	5700	2.34E+08	3.65E-09	4.23E-08	1.45E-08	8.16E-08	2.80E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	1.74E-08	0.00	3.36E-08	0.00	9.21E-12	0.00	5.10E-08
Methyl iodide	0.01	100	52	24	1	70	8760	25550	0.1	0.07	5700	1.68E+03	5.48E-11	6.36E-10	2.18E-10	1.59E-09	5.46E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	100	52	24	1	70	8760	25550	0.1	0.07	5700	1.36E+09	8.79E-10	1.02E-08	3.50E-09	2.56E-08	8.76E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.01	3.28E-06	0.04	8.96E-06	0.00	6.95E-08	0.05	1.23E-05

Receptor	Youth Trespasser																											
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	(ug/m^3)^-1	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal	Absorbed Dose (c) (Dermal	Incidental Soil Ingestion	Incidental Soil Ingestion	RfDo	CSFo	RfC	URF_a	Hqdermsoil	CANC RISKdermsoil	Hqoralsoil	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
Acenaphthylene	0.34	100	52	11	1	45	3285	25550	0.1	0.2	3200	8.00E+05	6.71E-09	8.31E-08	1.07E-08	1.30E-07	1.67E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	100	52	11	1	45	3285	25550	0.14	0.2	3200	1.36E+09	2.35E-07	2.91E-06	3.74E-07	3.25E-06	4.18E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	100	52	11	1	45	3285	25550	0.14	0.2	3200	1.36E+09	4.54E-08	5.62E-07	7.22E-08	6.27E-07	8.06E-08	2.00E-05	N/A	N/A	N/A	0.03	0.00E+00	0.03	0.00E+00	0.00	0.00E+00	0.06	0.00E+00
Aroclor-1260	1.63	100	52	11	1	45	3285	25550	0.14	0.2	3200	1.36E+09	4.55E-08	5.63E-07	7.24E-08	6.29E-07	8.08E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	100	52	11	1	45	3285	25550	0.03	0.2	3200	1.36E+09	3.94E-08	4.87E-07	6.27E-08	2.54E-06	3.26E-07	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.00	9.40E-08	0.01	4.90E-07	0.00	3.56E-10	0.01	5.84E-07
Benz(a)anthracene	0.46	100	52	11	1	45	3285	25550	0.13	0.2	3200	3.11E+07	1.19E-08	1.48E-07	1.90E-08	1.77E-07	2.28E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	2.28E-08	0.00	2.74E-08	0.00	3.63E-11	0.00	5.01E-08
Benzo(a)pyrene	0.67	100	52	11	1	45	3285	25550	0.13	0.2	3200	8.24E+07	1.74E-08	2.16E-07	2.77E-08	2.59E-07	3.33E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	3.32E-08	0.00	4.00E-08	0.00	2.00E-11	0.00	7.32E-08
Benzo(b)fluoranthene	0.59	100	52	11	1	45	3285	25550	0.13	0.2	3200	1.54E+07	1.54E-08	1.90E-07	2.45E-08	2.29E-07	2.94E-08	N/A	7.30E+00	N/A	1.10E-03	0.00	1.79E-07	0.00	2.15E-07	0.00	9.46E-10	0.00	3.94E-07
Benzo(g,h,i)perylene	0.41	100	52	11	1	45	3285	25550	0.1	0.2	3200	2.59E+08	8.20E-09	1.02E-07	1.31E-08	1.59E-07	2.04E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	100	52	11	1	45	3285	25550	0.13	0.2	3200	1.42E+08	1.23E-08	1.52E-07	1.96E-08	1.83E-07	2.35E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	2.35E-08	0.00	2.83E-08	0.00	8.21E-12	0.00	5.18E-08
Chlordane	2.24	100	52	11	1	45	3285	25550	0.04	0.2	3200	1.36E+09	1.79E-08	2.22E-07	2.86E-08	8.68E-07	1.12E-07	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.00	3.71E-08	0.00	1.45E-07	0.00	1.26E-11	0.00	1.82E-07
Chlordecone (Kepone)	9.63	100	52	11	1	45	3285	25550	0.1	0.2	3200	1.36E+09	1.93E-07	2.38E-06	3.07E-07	3.73E-06	4.79E-07	3.00E-04	1.00E+01	N/A	4.60E-03	0.01	3.07E-06	0.01	4.79E-06	0.00	7.29E-10	0.02	7.86E-06
Chrysene	0.51	100	52	11	1	45	3285	25550	0.13	0.2	3200	3.92E+07	1.32E-08	1.64E-07	2.11E-08	1.97E-07	2.54E-08	N/A	1.20E-01	N/A	1.10E-05	0.00	2.53E-09	0.00	3.04E-09	0.00	3.20E-12	0.00	5.58E-09
DDD	0.99	100	52	11	1	45	3285	25550	0.1	0.2	3200	7.64E+07	1.97E-08	2.44E-07	3.14E-08	3.81E-07	4.90E-08	N/A	2.40E-01	N/A	6.90E-05	0.00	7.53E-09	0.00	1.18E-08	0.00	1.99E-11	0.00	1.93E-08
DDE	2.45	100	52	11	1	45	3285	25550	0.1	0.2	3200	8.21E+07	4.90E-08	6.07E-07	7.80E-08	9.48E-07	1.22E-07	N/A	3.40E-01	N/A	9.70E-05	0.00	2.65E-08	0.00	4.14E-08	0.00	6.48E-11	0.00	6.80E-08
DDT	17.08	100	52	11	1	45	3285	25550	0.03	0.2	3200	1.01E+08	1.02E-07	1.27E-06	1.63E-07	6.61E-06	8.50E-07	5.00E-04	3.40E-01	N/A	9.70E-05	0.00	5.55E-08	0.01	2.89E-07	0.00	3.69E-10	0.02	3.45E-07
Dibenz[a,h]anthracene	0.12	100	52	11	1	45	3285	25550	0.13	0.2	3200	3.46E+08	3.23E-09	4.00E-08	5.15E-09	4.81E-08	6.18E-09	N/A	4.10E+00	N/A	1.20E-03	0.00	2.11E-08	0.00	2.54E-08	0.00	9.65E-12	0.00	4.65E-08
Dieldrin	0.23	100	52	11	1	45	3285	25550	0.1	0.2	3200	8.21E+05	4.54E-09	5.62E-08	7.23E-09	8.79E-08	1.13E-08	5.00E-05	1.60E+01	N/A	4.60E-03	0.00	1.16E-07	0.00	1.81E-07	0.00	2.85E-08	0.00	3.25E-07
Endosulfan sulfate	0.22	100	52	11	1	45	3285	25550	0.1	0.2	3200	2.58E+07	4.44E-09	5.50E-08	7.07E-09	8.59E-08	1.10E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	100	52	11	1	45	3285	25550	0.1	0.2	3200	2.62E+07	4.43E-09	5.49E-08	7.06E-09	8.58E-08	1.10E-08	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Heptachlor	0.11	100	52	11	1	45	3285	25550	0.1	0.2	3200	7.38E+06	2.27E-09	2.81E-08	3.61E-09	4.39E-08	5.64E-09	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	1.62E-08	0.00	2.54E-08	0.00	4.47E-10	0.00	4.21E-08
Heptachlor epoxide	0.11	100	52	11	1	45	3285	25550	0.1	0.2	3200	1.73E+07	2.18E-09	2.69E-08	3.46E-09	4.21E-08	5.41E-09	1.30E-05	9.10E+00	N/A	2.60E-03	0.00	3.15E-08	0.00	4.93E-08	0.00	3.66E-10	0.01	8.11E-08
Indeno(1,2,3-cd) pyrene	0.40	100	52	11	1	45	3285	25550	0.13	0.2	3200	2.34E+08	1.04E-08	1.29E-07	1.66E-08	1.55E-07	1.99E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	1.99E-08	0.00	2.39E-08	0.00	4.22E-12	0.00	4.39E-08
Methyl iodide	0.01	100	52	11	1	45	3285	25550	0.1	0.2	3200	1.68E+03	1.57E-10	1.94E-09	2.49E-10	3.03E-09	3.90E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	100	52	11	1	45	3285	25550	0.1	0.2	3200	1.36E+09	2.51E-09	3.11E-08	4.00E-09	4.86E-08	6.25E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.04	3.75E-06	0.07	6.39E-06	0.00	3.19E-08	0.12	1.02E-05

Receptor	Adult Worker																												
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	(ug/m^3)^-1	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area avail.soil	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)	Incidental Soil Ingestion Intake (nc)	Incidental Soil Ingestion Intake (c)	RfDo	CSFo	RfC	URF_a	Hqdermsoil	CANC RISKdermsoil	HqoralSoil	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
Acenaphthylene	0.34	100	250	25	1	70	9125	25550	0.1	0.2	3300	8.00E+05	6.71E-09	2.17E-07	7.74E-08	3.28E-07	1.17E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	100	250	25	1	70	9125	25550	0.14	0.2	3300	1.36E+09	2.35E-07	7.59E-06	2.71E-06	8.22E-06	2.94E-06	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	100	250	25	1	70	9125	25550	0.14	0.2	3300	1.36E+09	4.54E-08	1.46E-06	5.23E-07	1.59E-06	5.66E-07	2.00E-05	N/A	N/A	N/A	0.07	0.00E+00	0.08	0.00E+00	0.00	0.00E+00	0.15	0.00E+00
Aroclor-1260	1.63	100	250	25	1	70	9125	25550	0.14	0.2	3300	1.36E+09	4.55E-08	1.47E-06	5.25E-07	1.59E-06	5.68E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	100	250	25	1	70	9125	25550	0.03	0.2	3300	1.36E+09	3.94E-08	1.27E-06	4.54E-07	6.42E-06	2.29E-06	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.00	6.81E-07	0.02	3.44E-06	0.00	3.89E-09	0.03	4.12E-06
Benz(a)anthracene	0.46	100	250	25	1	70	9125	25550	0.13	0.2	3300	3.11E+07	1.19E-08	3.85E-07	1.37E-07	4.48E-07	1.60E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.65E-07	0.00	1.92E-07	0.00	3.96E-10	0.00	3.57E-07
Benzo(a)pyrene	0.67	100	250	25	1	70	9125	25550	0.13	0.2	3300	8.24E+07	1.74E-08	5.62E-07	2.01E-07	6.55E-07	2.34E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	2.41E-07	0.00	2.81E-07	0.00	2.19E-10	0.00	5.22E-07
Benzo(b)fluoranthene	0.59	100	250	25	1	70	9125	25550	0.13	0.2	3300	1.54E+07	1.54E-08	4.97E-07	1.77E-07	5.79E-07	2.07E-07	N/A	7.30E+00	N/A	1.10E-03	0.00	1.29E-06	0.00	1.51E-06	0.00	1.03E-08	0.00	2.81E-06
Benzo(g,h,i)perylene	0.41	100	250	25	1	70	9125	25550	0.1	0.2	3300	2.59E+08	8.20E-09	2.65E-07	9.46E-08	4.01E-07	1.43E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	100	250	25	1	70	9125	25550	0.13	0.2	3300	1.42E+08	1.23E-08	3.97E-07	1.42E-07	4.63E-07	1.65E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.70E-07	0.00	1.98E-07	0.00	8.97E-11	0.00	3.69E-07
Chlordane	2.24	100	250	25	1	70	9125	25550	0.04	0.2	3300	1.36E+09	1.79E-08	5.79E-07	2.07E-07	2.19E-06	7.84E-07	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.00	2.69E-07	0.00	1.02E-06	0.00	1.37E-10	0.01	1.29E-06
Chlordecone (Kepone)	9.63	100	250	25	1	70	9125	25550	0.1	0.2	3300	1.36E+09	1.93E-07	6.22E-06	2.22E-06	9.42E-06	3.37E-06	3.00E-04	1.00E+01	N/A	4.60E-03	0.02	2.22E-05	0.03	3.37E-05	0.00	7.97E-09	0.05	5.59E-05
Chrysene	0.51	100	250	25	1	70	9125	25550	0.13	0.2	3300	3.92E+07	1.32E-08	4.28E-07	1.53E-07	4.99E-07	1.78E-07	N/A	1.20E-01	N/A	1.10E-05	0.00	1.83E-08	0.00	2.14E-08	0.00	3.50E-11	0.00	3.97E-08
DDD	0.99	100	250	25	1	70	9125	25550	0.1	0.2	3300	7.64E+07	1.97E-08	6.36E-07	2.27E-07	9.64E-07	3.44E-07	N/A	2.40E-01	N/A	6.90E-05	0.00	5.45E-08	0.00	8.26E-08	0.00	2.18E-10	0.00	1.37E-07
DDE	2.45	100	250	25	1	70	9125	25550	0.1	0.2	3300	8.21E+07	4.90E-08	1.58E-06	5.65E-07	2.40E-06	8.56E-07	N/A	3.40E-01	N/A	9.70E-05	0.00	1.92E-07	0.00	2.91E-07	0.00	7.08E-10	0.00	4.84E-07
DDT	17.08	100	250	25	1	70	9125	25550	0.03	0.2	3300	1.01E+08	1.02E-07	3.31E-06	1.18E-06	1.67E-05	5.97E-06	5.00E-04	3.40E-01	N/A	9.70E-05	0.01	4.02E-07	0.03	2.03E-06	0.00	4.03E-09	0.04	2.44E-06
Dibenz[a,h]anthracene	0.12	100	250	25	1	70	9125	25550	0.13	0.2	3300	3.46E+08	3.23E-09	1.04E-07	3.73E-08	1.22E-07	4.34E-08	N/A	4.10E+00	N/A	1.20E-03	0.00	1.53E-07	0.00	1.78E-07	0.00	1.05E-10	0.00	3.31E-07
Dieldrin	0.23	100	250	25	1	70	9125	25550	0.1	0.2	3300	8.21E+05	4.54E-09	1.47E-07	5.24E-08	2.22E-07	7.94E-08	5.00E-05	1.60E+01	N/A	4.60E-03	0.00	8.38E-07	0.00	1.27E-06	0.00	3.11E-07	0.01	2.42E-06
Endosulfan sulfate	0.22	100	250	25	1	70	9125	25550	0.1	0.2	3300	2.58E+07	4.44E-09	1.43E-07	5.12E-08	2.17E-07	7.75E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	100	250	25	1	70	9125	25550	0.1	0.2	3300	2.62E+07	4.43E-09	1.43E-07	5.11E-08	2.17E-07	7.75E-08	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Heptachlor	0.11	100	250	25	1	70	9125	25550	0.1	0.2	3300	7.38E+06	2.27E-09	7.32E-08	2.62E-08	1.11E-07	3.96E-08	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	1.18E-07	0.00	1.78E-07	0.00	4.89E-09	0.00	3.01E-07
Heptachlor epoxide	0.11	100	250	25	1	70	9125	25550	0.1	0.2	3300	1.73E+07	2.18E-09	7.03E-08	2.51E-08	1.06E-07	3.80E-08	1.30E-05	9.10E+00	N/A	2.60E-03	0.01	2.28E-07	0.01	3.46E-07	0.00	4.00E-09	0.01	5.78E-07
Indeno(1,2,3-cd) pyrene	0.40	100	250	25	1	70	9125	25550	0.13	0.2	3300	2.34E+08	1.04E-08	3.37E-07	1.20E-07	3.92E-07	1.40E-07	N/A	1.20E+00	N/A	1.10E-04	0.00	1.44E-07	0.00	1.68E-07	0.00	4.61E-11	0.00	3.12E-07
Methyl iodide	0.01	100	250	25	1	70	9125	25550	0.1	0.2	3300	1.68E+03	1.57E-10	5.06E-09	1.81E-09	7.66E-09	2.74E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	100	250	25	1	70	9125	25550	0.1	0.2	3300	1.36E+09	2.51E-09	8.11E-08	2.90E-08	1.23E-07	4.39E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.11	2.72E-05	0.18	4.49E-05	2.22E-04	3.48E-07	0.30	7.24E-05

Receptor	Adult Worker																													
	mg/kg	mg/day	days/yr	years	events/day	kg	days	days	unitless	mg/cm2	cm2/day	m^3/kg	mg/cm^2-event	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	mg/kg-d	(mg/kg-d)-1	mg/m^3	(ug/m^3)^-1	unitless	unitless	unitless	unitless	unitless	unitless	unitless	unitless
Compound	Soil EPC	Ingestion Rate	Exposure Frequency	Exposure Duration	Event Frequency	body weight	averaging time (nc)	averaging time (canc)	Absorbtion Factor	Adherence Factor	skin surface area avail.soil	Particulate Emis Factor (or VF)	DA_{event}	Absorbed Dose (nc) (Dermal Intake)	Absorbed Dose (c) (Dermal Intake)	Incidental Soil Ingestion Intake (nc)	Incidental Soil Ingestion Intake (c)	RfDo	CSFo	RfC	URF_a	Hqderms oil	CANC RISKdermsoil	Hqoralsoi l	CANC RISKoralsoil	Hqinhsoil	CANC RISKinhsoil	Total HQ	Total CANC RISK
SURFACE SOIL																														
Acenaphthylene	0.34	330	250	1	1	70	365	25550	0.1	0.3	3300	8.00E+05	1.01E-08	3.25E-07	4.64E-09	1.08E-06	1.55E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1248	8.40	330	250	1	1	70	365	25550	0.14	0.3	3300	1.36E+09	3.53E-07	1.14E-05	1.63E-07	2.71E-05	3.87E-07	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Aroclor-1254	1.62	330	250	1	1	70	365	25550	0.14	0.3	3300	1.36E+09	6.80E-08	2.20E-06	3.14E-08	5.23E-06	7.47E-08	2.00E-05	N/A	N/A	N/A	0.11	0.00E+00	0.26	0.00E+00	0.00	0.00E+00	0.37	0.00E+00
Aroclor-1260	1.63	330	250	1	1	70	365	25550	0.14	0.3	3300	1.36E+09	6.83E-08	2.20E-06	3.15E-08	5.25E-06	7.50E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Arsenic	6.56	330	250	1	1	70	365	25550	0.03	0.3	3300	1.36E+09	5.90E-08	1.91E-06	2.72E-08	2.12E-05	3.03E-07	3.00E-04	1.50E+00	1.50E-05	3.30E-03	0.01	4.09E-08	0.07	4.54E-07	0.00	1.56E-10	0.08	4.95E-07
Benz[a]anthracene	0.46	330	250	1	1	70	365	25550	0.13	0.3	3300	3.11E+07	1.79E-08	5.77E-07	8.24E-09	1.48E-06	2.11E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	9.89E-09	0.00	2.54E-08	0.00	1.59E-11	0.00	3.53E-08
Benzo[a]pyrene	0.67	330	250	1	1	70	365	25550	0.13	0.3	3300	8.24E+07	2.61E-08	8.43E-07	1.20E-08	2.16E-06	3.09E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	1.45E-08	0.00	3.71E-08	0.00	8.74E-12	0.00	5.15E-08
Benzo(b)fluoranthene	0.59	330	250	1	1	70	365	25550	0.13	0.3	3300	1.54E+07	2.31E-08	7.45E-07	1.06E-08	1.91E-06	2.73E-08	N/A	7.30E+00	N/A	1.10E-03	0.00	7.77E-08	0.00	1.99E-07	0.00	4.13E-10	0.00	2.77E-07
Benzo(g,h,i)perylene	0.41	330	250	1	1	70	365	25550	0.1	0.3	3300	2.59E+08	1.23E-08	3.97E-07	5.68E-09	1.32E-06	1.89E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benzo(k)fluoranthene	0.47	330	250	1	1	70	365	25550	0.13	0.3	3300	1.42E+08	1.85E-08	5.96E-07	8.51E-09	1.53E-06	2.18E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	1.02E-08	0.00	2.62E-08	0.00	3.59E-12	0.00	3.64E-08
Chlordane	2.24	330	250	1	1	70	365	25550	0.04	0.3	3300	1.36E+09	2.69E-08	8.69E-07	1.24E-08	7.24E-06	1.03E-07	5.00E-04	1.30E+00	7.00E-04	3.40E-04	0.00	1.61E-08	0.01	1.35E-07	0.00	5.49E-12	0.02	1.51E-07
Chlordecone (Kepone)	9.63	330	250	1	1	70	365	25550	0.1	0.3	3300	1.36E+09	2.89E-07	9.33E-06	1.33E-07	3.11E-05	4.44E-07	3.00E-04	1.00E+01	N/A	4.60E-03	0.03	1.33E-06	0.10	4.44E-06	0.00	3.19E-10	0.13	5.78E-06
Chrysene	0.51	330	250	1	1	70	365	25550	0.13	0.3	3300	3.92E+07	1.99E-08	6.42E-07	9.17E-09	1.65E-06	2.35E-08	N/A	1.20E-01	N/A	1.10E-05	0.00	1.10E-09	0.00	2.82E-09	0.00	1.40E-12	0.00	3.92E-09
DDD	0.99	330	250	1	1	70	365	25550	0.1	0.3	3300	7.64E+07	2.96E-08	9.54E-07	1.36E-08	3.18E-06	4.54E-08	N/A	2.40E-01	N/A	6.90E-05	0.00	3.27E-09	0.00	1.09E-08	0.00	8.71E-12	0.00	1.42E-08
DDE	2.45	330	250	1	1	70	365	25550	0.1	0.3	3300	8.21E+07	7.35E-08	2.37E-06	3.39E-08	7.91E-06	1.13E-07	N/A	3.40E-01	N/A	9.70E-05	0.00	1.15E-08	0.00	3.84E-08	0.00	2.83E-11	0.00	5.00E-08
DDT	17.08	330	250	1	1	70	365	25550	0.03	0.3	3300	1.01E+08	1.54E-07	4.96E-06	7.09E-08	5.52E-05	7.88E-07	5.00E-04	3.40E-01	N/A	9.70E-05	0.01	2.41E-08	0.11	2.68E-07	0.00	1.61E-10	0.12	2.92E-07
Dibenz[a,h]anthracene	0.12	330	250	1	1	70	365	25550	0.13	0.3	3300	3.46E+08	4.85E-09	1.57E-07	2.24E-09	4.01E-07	5.73E-09	N/A	4.10E+00	N/A	1.20E-03	0.00	9.17E-09	0.00	2.35E-08	0.00	4.22E-12	0.00	3.27E-08
Dieldrin	0.23	330	250	1	1	70	365	25550	0.1	0.3	3300	8.21E+05	6.81E-09	2.20E-07	3.14E-09	7.33E-07	1.05E-08	5.00E-05	1.60E+01	N/A	4.60E-03	0.00	5.03E-08	0.01	1.68E-07	0.00	1.24E-08	0.02	2.30E-07
Endosulfan sulfate	0.22	330	250	1	1	70	365	25550	0.1	0.3	3300	2.58E+07	6.66E-09	2.15E-07	3.07E-09	7.17E-07	1.02E-08	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Endrin aldehyde	0.22	330	250	1	1	70	365	25550	0.1	0.3	3300	2.62E+07	6.65E-09	2.15E-07	3.07E-09	7.16E-07	1.02E-08	3.00E-04	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Heptachlor	0.11	330	250	1	1	70	365	25550	0.1	0.3	3300	7.38E+06	3.40E-09	1.10E-07	1.57E-09	3.66E-07	5.23E-09	5.00E-04	4.50E+00	N/A	1.30E-03	0.00	7.06E-09	0.00	2.35E-08	0.00	1.96E-10	0.00	3.08E-08
Heptachlor epoxide	0.11	330	250	1	1	70	365	25550	0.1	0.3	3300	1.73E+07	3.26E-09	1.05E-07	1.51E-09	3.51E-07	5.02E-09	1.30E-05	9.10E+00	N/A	2.60E-03	0.01	1.37E-08	0.03	4.57E-08	0.00	1.60E-10	0.04	5.95E-08
Indeno(1,2,3-cd) pyrene	0.40	330	250	1	1	70	365	25550	0.13	0.3	3300	2.34E+08	1.56E-08	5.05E-07	7.21E-09	1.29E-06	1.85E-08	N/A	1.20E+00	N/A	1.10E-04	0.00	8.66E-09	0.00	2.22E-08	0.00	1.84E-12	0.00	3.09E-08
Methyl iodide	0.01	330	250	1	1	70	365	25550	0.1	0.3	3300	1.68E+03	2.35E-10	7.58E-09	1.08E-10	2.53E-08	3.61E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Phenanthrene	0.13	330	250	1	1	70	365	25550	0.1	0.3	3300	1.36E+09	3.77E-09	1.22E-07	1.74E-09	4.06E-07	5.79E-09	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.17	1.63E-06	0.61	5.92E-06	2.22E-04	1.39E-08	0.78	7.57E-06
SUBSURFACE SOIL																														
Acenaphthylene	0.00	330	250	1	1	70	365	25550	0.1	0.3	3300	8.00E+05	8.60E-11	2.78E-09	3.97E-11	9.26E-09	1.32E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Benz[a]anthracene	0.03	330	250	1	1	70	365	25550	0.13	0.3	3300	3.11E+07	9.75E-10	3.15E-08	4.50E-10	8.07E-08	1.15E-09	N/A	1.20E+00	N/A	1.10E-04	0.00	5.40E-10	0.00	1.38E-09	0.00	8.65E-13	0.00	1.92E-09
Benzo[a]pyrene	0.02	330	250	1	1	70	365	25550	0.13	0.3	3300	8.24E+07	7.41E-10	2.39E-08	3.42E-10	6.14E-08	8.76E-10	N/A	7.30E+00	N/A	1.10E-03	0.00	2.50E-09	0.00	6.40E-09	0.00	2.48E-12	0.00	8.90E-09
Benz[b]fluoranthene	0.03	330	250	1	1	70	365	25550	0.13	0.3	3300	1.54E+07	1.25E-09	4.03E-08	5.76E-10	1.03E-07	1.48E-09	N/A	1.20E+00	N/A	1.10E-04	0.00	6.91E-10	0.00	1.77E-09	0.00	2.24E-12	0.00	2.46E-09
Benzo(g,h,i)perylene	0.01	330	250	1	1	70	365	25550	0.1	0.3	3300	2.59E+08	2.61E-10	8.43E-09	1.20E-10	2.81E-08	4.01E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
Chromium compounds	33.10	330	250	1	1	70	365	25550	0.1	0.3	3300	1.36E+09	9.93E-07	3.21E-05	4.58E-07	1.07E-04	1.53E-06	3.00E-03	N/A	1.00E-04	1.20E-02	0.01	0.00E+00	0.04	0.00E+00	0.00	2.86E-09	0.05	2.86E-09
Cobalt compounds	29.35	330	250	1	1	70	365	25550	0.1	0.3	3300	1.36E+09	8.81E-07	2.84E-05	4.06E-07	9.48E-05	1.35E-06	3.00E-04	0.00E+00	6.00E-06	9.00E-03	0.09	0.00E+00	0.32	0.00E+00	0.00	1.90E-09	0.41	1.90E-09
DDD	1.10	330	250	1	1	70	365	25550	0.1	0.3	3300	7.64E+07	3.30E-08	1.07E-06	1.52E-08	3.55E-06	5.07E-08	N/A	2.40E-01	N/A	6.90E-05	0.00	3.65E-09	0.00	1.22E-08	0.00	9.72E-12	0.00	1.58E-08
DDE	3.10	330	250	1	1	70	365	25550	0.1	0.3	3300	8.21E+07	9.30E-08	3.00E-06	4.29E-08	1.00E-05	1.43E-07	N/A	3.40E-01	N/A	9.70E-05	0.00	1.46E-08	0.00	4.86E-08	0.00	3.58E-11	0.00	6.32E-08
DDT	14.00	330	250	1	1	70	365	25550	0.03	0.3	3300	1.01E+08	1.26E-07	4.07E-06	5.81E-08	4.52E-05	6.46E-07	5.00E-04	3.40E-01	N/A	9.70E-05	0.01	1.98E-08	0.09	2.20E-07	0.00	1.32E-10	0.10	2.39E-07
Dibenzo(a,h)anthracene	0.01	330	250	1	1	70	365	25550	0.13	0.3	3300	3.46E+08	2.18E-10	7.04E-09	1.01E-10	1.81E-08	2.58E-10	N/A	4.10E+00	N/A	1.20E-03	0.00	4.12E-10	0.00	1.06E-09	0.00	1.90E-13	0.00	1.47E-09
Methyl iodide	0.01	330	250	1	1	70	365	25550	0.1	0.3	3300	1.68E+03	3.08E-10	9.93E-09	1.42E-10	3.31E-08	4.73E-10	N/A	N/A	N/A	N/A	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00
																					Total -	0.11	4.21E-08	0.44	2.91E-07	0.00	4.94E-09	0.56	3.38E-07

Receptor	Adult Worker - Groundwater dermal																						
Risk	mg/cm3	mg/cm2-event	cm2	events/day	days/year	years	kg	Days	Days		cm/hr						mg/kg-d	(mg/kg-d)-1	mg/kg-day				
Compound	Cw	DAevent	SA	EV	EF	ED	BW	AT (nc)	AT (canc)	FA	Kp	τ_{event}	t_{event}	t*	B		RfDo	CSFo	DAD (nc)	DAD (canc)	HQ	Risk	
Arsenic	3.51E-05	1.40E-07	3300	1	250	1	70	365	25550		1.00E-03	2.76E-01	4.00E+00		3.33E-03		3.00E-04	1.50E+00	4.53E-06	6.48E-08	0.02	9.71E-08	
Di/Bis(2-ethylhexyl)phthalate (DEHP)	1.10E-04	4.91E-05	3300	1	250	1	70	365	25550	0.8	2.50E-02	1.63E+01	4.00E+00	3.91E+01	1.90E-01		2.00E-02	1.40E-02	1.58E-03	2.26E-05	0.08	3.17E-07	
4,4'-DDD	1.00E-07	NA	3300	1	250	1	70	365	25550	0.8	1.80E-01	6.51E+00	4.00E+00		1.24E+00		N/A	2.40E-01	NA	NA	0.00	0.00E+00	
4,4'-DDE	1.10E-07	NA	3300	1	250	1	70	365	25550	0.8	1.60E-01	6.35E+00	4.00E+00		1.10E+00		N/A	3.40E-01	NA	NA	0.00	0.00E+00	
4,4'-DDT	1.00E-07	NA	3300	1	250	1	70	365	25550	0.7	2.70E-01	1.02E+01	4.00E+00		1.96E+00		5.00E-04	3.40E-01	NA	NA	0.00	0.00E+00	
Naphthalene	5.10E-08	1.11E-08	3300	1	250	1	70	365	25550	1.0	4.70E-02	5.49E-01	4.00E+00	1.32E+00	2.05E-01		2.00E-02	N/A	3.59E-07	5.13E-09	0.00	0.00E+00	
Phenanthrene	4.90E-08	NA	3300	1	250	1	70	365	25550		1.40E-01	1.05E+00	4.00E+00		7.19E-01		N/A	N/A	NA	NA	0.00	0.00E+00	
																				Total -	0.09	4.14E-07	

	Dermal Parameters								
	MW	Kp	B	Dsc	Isc	τevent	tevent	t*	DAevent (nc)
Arsenic	74.90	1.00E-03	3.33E-03	6.03E-07	1.00E-03	2.76E-01	4.00E+00		1.40E-07
Di/Bis(2-ethylhexyl)phthalate (DEHP)	391.00	2.50E-02	1.90E-01	1.02E-08	1.00E-03	1.63E+01	4.00E+00	3.91E+01	4.91E-05
4,4'-DDD	320	0.18	1.24E+00	2.56E-08	1.00E-03	6.51E+00	4.00E+00		NA
4,4'-DDE	318	0.16	1.10E+00	2.63E-08	1.00E-03	6.35E+00	4.00E+00		NA
4,4'-DDT	355	0.27	1.96E+00	1.63E-08	1.00E-03	1.02E+01	4.00E+00		NA
Naphthalene	128.2	0.047	2.05E-01	3.03E-07	1.00E-03	5.49E-01	4.00E+00	1.32E+00	1.11E-08
Phenanthrene	178.2	0.14	7.19E-01	1.59E-07	1.00E-03	1.05E+00	4.00E+00		NA

NA = The abbreviation NA (not applicable) in the "DAevent" column here reflects OSWER's recommendation against quantifying exposure and risk in the body of the risk assessment because these contaminants are outside the effective predictive domain.

APPENDIX G

JOHNSON AND ETTINGER
VAPOR INTRUSION MODEL OUTPUT

SL-SCREEN
Version 3.1; 02/04

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
205992		Benzo(b)fluoranthene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top contaminatio L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type sed to estima soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	100	25	SIC		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone oil water-fille porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic arbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SIC	1.38	0.481	0.216	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for oncarcinogen AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for oncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Benzo(b)fluoranthene

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (mg/kg)	Indoor exposure soil conc., noncarcinoge (mg/kg)	Risk-based indoor exposure soil conc., (mg/kg)	Soil saturation conc., Csat (mg/kg)	Final indoor exposure soil conc., (mg/kg)
8.85E+03	NA	8.85E+03	3.69E+03	NOC

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The contaminant is a solid at the soil temperature and not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

SL-SCREEN
Version 3.1; 02/04

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
115297		Endosulfan

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top contamination, L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	100	25	SIC		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SIC	1.38	0.481	0.216	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

Endosulfan

RISK-BASED SOIL CONCENTRATION CALCULATIONS: INCREMENTAL RISK CALCULATIONS:

Indoor exposure soil conc., carcinogen (mg/kg)	Indoor exposure soil conc., noncarcinoge (mg/kg)	Risk-based indoor exposure soil conc., (mg/kg)	Soil saturation conc., Csat (mg/kg)	Final indoor exposure soil conc., (mg/kg)	Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	4.00E+05	4.00E+05	2.26E+03	NOC	NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.
NOC = NOT OF CONCERN. The contaminant is a solid at the soil temperature and not of concern for this pathway.
MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

4,4'-DDE

SL-SCREEN
Version 3.1; 02/04

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES [X]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES [ ]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial soil conc., C_R (µg/kg)	Chemical
72559		DDE

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to top contaminatio L_t (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type sed to estima soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	100	25	SIC		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone oil water-fille porosity, θ_w^V (cm^3/cm^3)	ENTER Vadose zone soil organic arbon fraction, f_{oc}^V (unitless)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SIC	1.38	0.481	0.216	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for oncarcinogen AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for oncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

4,4'-DDE

RISK-BASED SOIL CONCENTRATION CALCULATIONS:

Indoor exposure soil conc., carcinogen (mg/kg)	Indoor exposure soil conc., noncarcinog (mg/kg)	Risk-based indoor exposure soil conc., (mg/kg)	Soil saturation conc., Csat (mg/kg)	Final indoor exposure soil conc., (mg/kg)
4.60E+05	NA	4.60E+05	1.07E+06	4.60E+05

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE SUMMARY BELOW:
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation

END