DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON
4551 LLEWELLYN AVENUE
FORT GEORGE G. MEADE, MARYLAND 20755-5000

REPLY TO ATTENTION OF:

Directorate of Public Works

24 October 2008

Mr. Robert Stroud
US Environmental Protection Agency
Environmental Science Center
701 Mapes Road
Fort Meade, Maryland 20755

Re: Former Trap and Skeet Range

Dear Mr. Stroud:

Please find enclosed for your records the October 2008 *Revised Final Memorandum Human Health Risk Assessment, Former Trap and Skeet Range (FGGM-83) Operable Unit1* for the Former Trap and Skeet Range at Fort George G. Meade.

If you have any questions, please feel free to contact me at (301) 677-9365, fax: (301) 677-9001, or paul.v.fluck@us.army.mil.

Sincerely,

Paul V. Fluck, P.G., REP (ASIS)
Restoration Manager, Environmental Division
Directorate of Public Works

Encl
as

DISTRIBUTION:

Michael Butler (Fort George G. Meade, Environmental Division) (w/o encl.)
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Fort George G. Meade Administrative Record
Fort George G. Meade Installation Restoration Program Information Repository
Fort George G. Meade Restoration Advisory Board (electronic copy only)

Revision 03
REVISED FINAL MEMORANDUM
HUMAN HEALTH RISK ASSESSMENT
FORMER TRAP AND SKEET RANGE (FGGM-83)
Operable Unit 1 (OU 1)

FORT MEADE, MARYLAND

Prepared for:

United States Army Environmental Command
5179 Hoadley Road
Aberdeen Proving Ground, MD 21010-5401

Prepared by:

KEMRON Environmental Services, Inc.
1595 Spring Hill Road, Suite 310
Vienna, VA 22182

October 24, 2008

REVISED Responses to EPA Comments to the Final Memorandum Human Health Risk Assessment for the Former Trap and Skeet Range (FGGM-83), also known as Operable Unit 1 (OU-1)
October 16, 2008

Below are revised responses to EPA Region III comments to the document titled, "Final Risk Assessment Memorandum Human Health Risk Assessment Former Trap and Skeet Range (FGGM-83) Operable Unit 1 (OU 1) for the Performance Based Contract Environmental Work for 11 Sites at Fort Meade". The document was submitted to EPA Region 3 and MDE on November 19, 2007. Mr. Paul Fluck, Restoration Manager, Environmental Division at the U.S. Army Garrison Fort George G. Meade received US EPA comments on the document via email on April 11, 2008. The Army Responses to the EPA are found in the following table.

Item Number and Bullet	EPA Comment	Response
Specific Comment # 4	Please provide the CLP form 1 or equivalent to determine whether the antimony result was a non-detect. NOTE: This comment is based upon EPA Specific Comment #4 to the Draft Final HHRA Memo. "There was confusion with respect to some high detections that were flagged "U," non-detect. The highest antimony result in sediment, 11.7 mg/kg in sample FGGM-83-SD-7, is flagged UL on Table 3-3, indicating it is a non-detect, but it is treated as a positive detection on, e.g., Table 2.3. The highest antimony result in soil, 457 mg/kg in sample FGGM83-SB-C8, is flagged UL on Table 3-1A, but is treated as a positive detection on, e.g., Table 2.1. It is suspicious that these high numbers would represent non-detects, and this makes a huge difference in the antimony risks. Antimony would drive the non-cancer risk for unrestricted soil use if present at 457 mg/kg. The data validation report should be examined to determine the true status of these data points.	A review of the data validation report by Laboratory Data Consultants (LDC) confirmed that the "UL" (non-detect due to low bias) data qualifier associated with antimony (Sb) laboratory sediment and soil data is due to low antimony recovery in associated QA/QC (matrix spike / matrix spike duplicate) samples, indicating matrix interference. To reflect this, a footnote is added to Tables 2.1 (Occurrence and Distribution of Metals in Soil) and Table 2.3 (Occurrence and Distribution of Metals in Sediment). Additionally, the significance of this is discussed in detail in Section 3.2.1.1 (Data Validation). Where a "UL" qualifier is given for a sample result; the reporting limit (RL) for that sample is used to calculate risk in order to provide a conservative estimate of risk associated with exposure to Sb in sediment and soil. Using this conservative approach, a health index (HI) of < 1 is indicated for all identified receptors for unrestricted soil and sediment exposure. As the reviewer notes, Sb is the primary contributor of non-cancer risk in soils.
Specific Comment # 14	If a land use restriction prohibiting residential use of the site is not acquired then the possibility of vapor intrusion of naphthalene will remain an issue.	The Army has determined that the reasonably anticipated future land use of the OU-1 as "military/commercial". Current site improvement plans call for up to ten commercial office buildings. The Army anticipates that an appropriate mechanism

Item Number and Bullet	EPA Comment	Response
		for designating this future land use will be implemented. This is consistent with OSWER Directive Number 9355.7-04. The Army will institute appropriate controls on the site to ensure that use of the government owned and controlled parcel remains consistent with this designated future land use.

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LIST of ACRONYMS

ARAR	Applicable or relevant and appropriate requirement
Army	Department of the Army
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Chemical of Potential Concern
CSA	Comprehensive Site Assessment
EMD	Environmental Management Division
EPC	Exposure Point Concentration
FFS	Focused Feasibility Study
FDWS	Federal Drinking Water Standard
GFPR	Guaranteed Fixed Price Remediation
HHRA	Human Health Risk Assessment
KEMRON	KEMRON Environmental Services, Inc.
MCL	Water Maximum Contaminant Level
Mg/kg	Milligrams per Kilogram
Mg/L	Milligrams per Liter
NCP	National Contingency Plan
NRCC	North Regional Contracting Center
NPL	National Priorities List
OU-1	Operable Unit 1 (FGGM-83 - Former Trap and Skeet Range)
PAH	Polycyclic Aromatic Hydrocarbons
PBC	Performance Based Contract
PbB	Blood Lead
PbSw	Time Weighted Lead Concentration
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RA	risk assessment
RAIS	Risk Assessment Information System
RI	Remedial Investigation
RCRA	Resource Conservation and Recovery Act
RG	Remedial Goal
RmAO	Removal Action Objectives
SB	Soil Boring
TBC	To Be Considered (guidance)
Ug/kg	Micrograms per Kilogram
Ug/L	Micrograms per Liter
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

Fort Meade operated a recreational trap and skeet firing range (FGGM-83) at the site from the mid 1970s through 1994. The range consisted of a firing line, skeet houses, and manmade pond. A Site location map of the area is provided as Figure 1-1. An aerial photograph depicting the former range layout is provided as Figure 1-2. An aerial photograph depicting the present condition of the former range is provided as Figure 1-3.

Results of previous investigations at the former Trap and Skeet Range (Site) indicate that lead shot, total metals, and polyaromatic hydrocarbons (from clay targets) have affected significant portions of the surface soils on the Site, and PAHs have affected pond sediments at the Site. Previous investigations concluded that carcinogenic risk to human health (combined child and adult) was estimated to be 2.8E-04 for the residential scenario. This value exceeds the upper threshold (1E-04) value under the NCP. The human health risks are driven by the presence of PAHs in the surface soils.

As a “Risk Assessment Memo”, this document is intended to:

- .Determine current and predict future potential risks to human health as a result of contaminated media at the site based upon current and anticipated future “military/industrial” land use.

1.1 Management and Organization

KEMRON Environmental Services, Inc. (KEMRON) was awarded the Fort Meade Performance Based Contract (PBC) for environmental services at 11 Sites located at Fort Meade, Maryland. The contract was issued by the ACA Aberdeen Proving Ground KO Directorate of Contracting office located at 4118 Susquehanna Avenue in Aberdeen Proving Ground, Maryland. The contract number is W91ZLK-05-C-0018 and the award date is May 25, 2005. The US Army Environmental Command (USAEC) has provided the contracting authority for the performance of services under a Performance Based Contract. All project related activities are conducted pursuant to the Comprehensive Environmental Response, and Compensation Liability Act (CERCLA), and the National Contingency Plan (NCP).

1.2 Risk Assessment Document Organization

The remainder of this document is organized as follows:

- Section 2 provides a physical description of the former Trap and Skeet Range and a summary of previous investigations and results. Site characterization includes a discussion of the sampling activities conducted, media investigated (soil, sediment, surface water, and groundwater), and media quality. The vertical and horizontal extent of the affected media is also presented.
- Section 3 provides a summary of the human health risk assessment (HHRA). Site characterization data is used to evaluate the quantitative risk posed by the affected media to current and future Site occupants and uses.

2.0 SITE DESCRIPTION AND HISTORY

The Trap and Skeet Range consisted of a firing line, skeet houses, and manmade pond. The topography of the Site is characterized by land that gently slopes to the east. A relatively small (1 acre), shallow pond is located in the center of the Site. The pond was created by Fort Meade in the mid-1970s by damming an intermittent stream that traversed the Site. A sand berm built along the eastern portion of the Site allowed an excavation to fill with surface water. The sand used for the berm is believed to have been obtained from the excavation completed for the pond. Based on the findings of past environmental studies conducted at the Site, the pond is approximately 10 feet deep at its deepest point but is shallower in most locations.

The remaining portion of the stream, east of the large sand berm, once discharged into Severn Run, located approximately 3,000 feet east of the Site. That portion of the stream bed is now dry.

The firing line on the range was located approximately 150 feet northwest of the pond. Clay targets were thrown into the air from skeet houses located on both ends of the firing line and the trap house located between the firing line and the pond. The trajectories of the clay targets were diagonal over the clear area between the firing range and the pond (skeet) or toward and over the pond (trap). The vast majority of the clay target fragments fell between the firing line and pond, into the pond, or western face of the berm. The clay target fragments are readily visible on the surface of all the aforementioned features. Clay targets are manufactured of fine clay mixed with petroleum tar. After forming the targets, the targets are heated (baked or fired) to make a light, brittle target that easily shatters when struck with pellets from a shotgun.

The Site is bounded to the north and south by undeveloped, wooded Fort Meade land; east by undeveloped, wooded Fort Meade land, beyond which is the Former Nike Missile Control Site (FGGM-87), and west by undeveloped, wooded Fort Meade land, beyond which is numerous active Fort Meade facilities and housing.

2.1 Current and Anticipated Future Land Use

Since the range was closed in 1994, the Site has not been used by Fort Meade for military purposes; however, local residents occasionally use the Site for recreational purposes (e.g., fishing, picnics, and hiking).

Although at one time, the Army anticipated a possible residential land-use scenario in the future site use, more recent plans stipulate that the site will be designated for military/industrial future land use. Over a phased-approach; up to ten commercial / office buildings with associated surface parking will be constructed on the site. Some restrictions in access may be imposed.

2.2 Site Geology / Hydrogeology

Fort Meade is located in the Atlantic Coastal Plain physiographic province and is underlain by a thick wedge of unconsolidated sediments that dip and thicken to the southeast. The sediments beneath the installation are Early Cretaceous in age and belong to the Potomac Group (Geologic Map of Maryland, 1968). The Potomac Group consists, from youngest to oldest, of the Patapsco, Arundel, and the Patuxent Formations, comprising a total thickness of more than

600 feet. These formations are characterized as fluvial and lacustrine deposits consisting of interbedded sand, silt, and clay that are limited in extent.

Boring logs obtained from past environmental studies show that the improved portions of the Site (i.e., grassy areas and gravel road) were found to be underlain by fill material, consisting of reworked native silty sand with little to some clay, to a depth of 4 feet below existing grade (beg). Beneath the fill, sand with varying amounts of silt, clay, and gravel was encountered to a maximum explored depth of 45 feet beg. In the wooded areas of the Site, silty sand with little to some clay was encountered to the maximum explored depth of 2 feet bgs. The berm was found to be composed entirely of coarse to medium-grained, well sorted sand. The native sediments encountered at the Site are consistent with those described for the lower Patapsco unit of the Patapsco Formation.

Three distinct aquifers are present in the unconsolidated sediments beneath the installation. The aquifers are known locally as the upper and lower Patapsco and the Patuxent aquifers. Two confining layers, an unnamed unit corresponding to the middle Patapsco unit (herein referred to as the middle Patapsco confining unit) and the Arundel Formation, separate the three aquifers. The lower Patapsco and Patuxent aquifers are under confining conditions except where the aquifers outcrop and are unconfined.

The upper Patapsco aquifer is an unconfined aquifer. Regional groundwater flow is to the southeast; however, based on topography influences and published documents for the Fort Meade area, groundwater flow beneath the Site is most likely to the east-southeast. According to Mack and Achmad (1986) the transmissivity of the upper Patapsco aquifer ranges from 100 to 10,000 Fort/day. In 1992, EA Engineering, Science, and Technology (EA) measured the hydraulic conductivity of this aquifer between 3×10^{-5} to 6×10^{-3} cm/sec.

During past environmental studies, shallow groundwater was encountered at the Site at depths ranging from approximately 20 to 50 feet bgs. The depth to groundwater was shallowest near the pond and increased in borings completed away from the pond.

2.3 Previous Investigations and Results

Fort Meade has conducted assessments and investigations of this Site and the surrounding area since 1998. This section discusses those investigations and results.

2.3.1 Environmental Baseline Survey

In 1998, the EMO conducted an Environmental Baseline Survey (EBS) of 200 acres of Fort Meade land (a total of five parcels), including the former trap and skeet range. The survey concluded that further assessment was necessary to evaluate environmental conditions at the former trap and skeet range Site because significant deposits of lead shot and clay target fragments were observed at the Site. These deposits were observed along the shoreline and within the pond.

2.3.2 Comprehensive Site Assessment (Versar, 1999)

As a follow up to the EBS, a comprehensive Site assessment (CSA) was conducted at the Site from January 1999 to 2000. The CSA was conducted for the purposes of delineating the extent of surficial deposits of lead shot and clay target fragments; assessing shallow soil, sediment, and surface water quality. The CSA was also conducted because Fort Meade was aware that trespassers to the Site were using the Site for recreational purposes. Fort Meade wanted to establish what the human health risk was to the immediately exposed population and the potential future exposed population; determining the general risk to potential Site and nearby human receptors.

Fifteen PAHs (acenaphthene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, fluorene, indeno[l,2,3-cdlpyrene, naphthalene, phenanthrene, and pyrene) were detected in soil collected from 13 out of 25 locations. The highest concentrations of PAHs were detected in soil from one sample where 15 PAHs were detected at concentrations ranging from 9.1 mg/kg for naphthalene to 190 mg/kg for fluoranthene.

Lead was detected in all analyzed soil samples for the CSA, which is not unusual because lead naturally occurs in soils. Concentrations of lead detected in the surface soils at 0-0.5 feet bgs (25 samples and 2 duplicates) ranged from 10 mg/kg to 310 mg/kg. Concentrations of lead detected in shallow surface soils at 0.5-1.5 feet bgs (13 samples) ranged from 10 mg/kg to 36 mg/kg.

PAHs were not detected in the background samples or outlying sampling areas; however, lead was detected in all of these soil samples at concentrations ranging from 62 mg/kg to 470 mg/kg.

The CSA concluded that the highest risk at the Site is associated with affected soil resulting in a carcinogenic risk to human health (combined child and adult) estimated to be 2.8E-04 for the residential scenario. This value exceeds the upper threshold for carcinogenic risk (1 E-04) under the NCP. Dermal absorption and incidental ingestion of benzo(a)pyrene contributed to the majority of the risk. The human health risks are driven by the presence of PAHs in the surface soils.

2.3.3 Corrective Action Plan (Versar, 1999)

Results from the CSA revealed that PAHs and lead were present in soil and sediment. Versar conducted additional subsurface investigation activities in October and November 1999 to assess soil and groundwater quality and evaluate the risk posed by the affected media to Site workers and visitors. The subsurface sampling and analysis activities were conducted for the purposes of delineating the extent of PAH and lead constituents in soil; assessing groundwater quality; determining the quantitative risk to potential Site and nearby human receptors; establishing Site cleanup goals; and recommending a preferred remediation method in order to minimize the risks to human health posed by the affected media.

A CAP was prepared (Versar, 2000) based on the additional soil and groundwater investigation and information obtained during the CSA. The CAP presented the results of the additional subsurface investigation, performed a quantitative human health risk assessment, and

established remediation protocols and cleanup goals for affected media. The CAP recommendations included limiting access to the Site (e.g., installation of a security fence) and proposed that areas of heavy deposits of clay target fragments and elevated PAH concentrations be removed. In addition, the recommendations included draining the pond on Site to remove the sediments containing clay target fragments and lead shot. Excavation and removal of soils and sediments from the Site were deemed the most efficient means of mitigating exposure to risks posed by PAHs and lead on Site.

2.3.4 FGGM-87 Draft Data Report (Versar, 2005)

Results of previous investigations show that the principal constituents of concern at the Site are lead (from lead shot) and PAHs (from clay targets). Although lead shot is composed primarily of lead, up to 6.8% antimony and 0.42% arsenic may also be present as hardening agents. In addition, shell casings contain brass, an alloy of copper and zinc. Therefore, the investigation targeted a constituent list of 18 PAHs, antimony, arsenic, copper, lead, and zinc.

Based upon previous investigations, a field investigation was conducted August through December 2004. The objective of this investigation was to expand the area of investigation to include the shot-fall zone, analyze the soil for antimony, arsenic, copper, and zinc in addition to lead and PAHs, and to determine if the surface water and groundwater had been affected by contamination in surface and shallow surface soils at the Site. The investigation was also conducted in order to prepare an EE/CA to support a non-time critical removal action (NTCRA) to remove soils and sediments contaminated with PAHs and metals. Earlier investigations had shown risk to human health under a residential land use scenario.

Ten sediment samples and a duplicate were collected form the Site during this investigation and analyzed for lead shot count, metals, and PAHs. Eight surface water samples were collected and analyzed for metals and PAHs. Five groundwater wells were installed and sampled for PAHs and metals. Two hundred eight (208) soil samples, including nine (9) duplicates were collected from 95 sample locations (SB-A1 through SB-H9. Samples were also screened for lead shot, and analyzed for PAHs and metals). See Figure 2-1 for a sampling grid.

2.4 Sources, Nature, and Extent of Contamination

Because wind and shot may cause clay targets to travel greater distances, it is possible that some targets could have traveled a distance of 375 feet. Beyond 375 feet, the risk contributions were expected to be driven by metals, primarily lead, because the flight of the clay pigeons would not carry this distance. Appendix A provides analytical results are provided for PAH and metals samples collected less than 375 feet (A, B and C rings) and greater than 375 feet (D,E,F, and G rings). The following sections summarize the investigation data used to characterize contaminated media at the Site.

2.4.1 Characterization of Lead Shot in Soils

The lead shot maximum shot fall zone is between 300 and 525 feet from the firing line. During the 2004 investigation, the amount of lead shot was detected in 73% of the sample locations and concentrations ranged from zero to 4,800 counts/foot^2 at location SB-D6. Figure 2-2

depicts the concentration of lead shot per square foot (counts/foot^2). The lead shot is primarily located in the layer of decomposing leaves and organic O-horizon soil layer.

2.4.2 Characterization of Metals in Surface and Shallow Surface Soils

Elevated concentrations of antimony, arsenic, copper, lead, and zinc were detected in surface soils (0 to 0.5 feet below ground surface bgs) and shallow surface soils (0.5 to 1.5 feet bgs) across the Site. Each metal was consistently detected in surface soils across the Site. As expected, much lower concentrations of arsenic, copper, and lead were detected in shallow surface soils Site wide. Table 2.1 provides a summary of the frequency and range of detection of the principal metal constituents in soil within 375 feet and greater than 375 feet from the firing line.

Table 2.1 – Occurrence and Distribution of Metals in Soil

Metal	<375'		>375'	
	Frequency of Detection	Range of Detections (mg/kg)	Frequency of Detection	Range of Detections (mg/kg)
Antimony*	16/93	0.78-457	28/94	0.72-32.1
Arsenic	93/93	0.7-50.5	93/94	1-25.4
Copper	93/93	4-42.2	94/94	4.8-25.3
Lead	93/93	2.7-22800	94/94	1.7-4880
Zinc	93/93	2.7-227	94/94	10.7-61.8

*Data Validation indicated a low bias in antimony soil data as a result of low surrogate recovery in matrix spike / matrix spike duplicate QA/QC samples.

Figure 2-3 depicts elevated levels of antimony in surface soil located southeast of the pond, an area that is coincidental with elevated levels of arsenic, lead, and zinc. The highest concentration of antimony in surface soil was detected in shallow soil sample FGGM-83-SB at a concentration of 457 mg/kg. Several antimony soil sample results are qualified "UL" due to low surrogate recoveries in matrix spike / matrix spike duplicate (MS/MSD) QA/QC samples. Refer to Section 3.2.1.1 (Data Validation) for additional information.

Figure 2-4 depicts an arc of continuous elevated metals of arsenic in the surface soils that extend from just north of the former firing line to south of the pond. The highest levels of arsenic in surface soil were detected southeast of the pond. Figure 2-5 depicts the lower concentrations of arsenic found in the shallow surface soils. Relatively high concentrations of arsenic in shallow surface soils were detected at sample locations SB-D3 and SB-D7.

Figure 2-6 depicts elevated levels of copper in surface soils. Figure 2-7 depicts elevated levels of copper in the shallow surface soils. the highest concentrations of copper and zinc were detected in surface soils collected from samples located near the former firing line and are associated with the expended brass shotgun shell casings.

Figure 2-8 depicts an arc of continuous elevated levels of lead detected in the surface soils. The arc is situated on the west side of the pond and the highest concentrations are located around sample location SB-C8. An isolated, elevated level of lead was detected in the shallow surface soil collected from sample location SB-C6 (Figure 2-9).

Figure 2-10 depicts elevated levels of zinc in the surface soils located across the Site. With the exception of the elevated levels located around the former firing line, these levels show no pattern and are likely indicative of background levels. Shallow surface concentrations (Figure 2-11) detected from sample locations around the former firing line are likely indicative of background levels.

2.4.3 Characterization of PAHs in Surface and Shallow Surface Soils

As expected, based upon trajectory of the clay target flight and lead shot impact, PAHs were detected in both surface and shallow surface soil within 375 feet of the former firing line. Only trace amounts of PAHs were detected at the Site outside of 375 feet of the former firing line. Benzo(a)pyrene (an indicator of PAH) was detected in 50% of the surface soil samples and 25% of shallow surface soil samples. The highest concentrations were detected in sample SB-A located to the front of the firing line. Table 2.2 provides a summary of the range of PAHs detections in the surface and shallow surface soils within 375 feet and greater than 375 feet from the firing line.

Table 2.2 – Occurrence and Distribution of PAHs in Soil

PAH	<375’		>375’	
	Frequency of Detection	Range of Detections (mg/kg)	Frequency of Detection	Range of Detections (mg/kg)
Acenaphthene	15/94	0.0247-7.61	0/14	n/a
Anthracene	18/94	0.03-13.3	0/14	n/a
Benzo(a)anthracene	34/94	0.0232-30.9	1/14	0.0252-0.0252
Benzo(a)pyrene	37/94	0.0199-42.6	1/14	0.026-0.026
Benzo(b)fluoranthene	32/94	0.0216-35.2	0/14	n/a
Benzo(g,h,i)perylene	23/93	0.0335-28.3	0/14	n/a
Benzo(k)fluoranthene	25/94	0.0298-20.4	0/14	n/a
Chrysene	37/94	0.0239-48.8	1/14	0.028-0.028
Dibenzo(a,h)anthracene	18/94	0.0231-9.48	0/14	n/a
Fluoranthene	41/93	0.0192-46.5	4/14	0.0238-0.048
Fluorene	14/94	0.0217-3.72	0/14	n/a
Indeno(1,2,3-cd)pyrene	18/94	0.0491-25.7	0/14	n/a
Naphthalene	11/94	0.0212-4.7	0/14	n/a
Phenanthrene	36/94	0.0202-27.7	2/14	0.0228-0.0447
Pyrene	34/93	0.0419-44.7	0/14	n/a

Figure 2-12 shows elevated concentrations of PAHs in surface soils immediately in front of and northeast of the former firing line and Figure 2-13 shows total PAH concentrations in the shallow surface soil in the same area. The benzo(a)pyrene concentrations (Figures 2-14 and 2-15) show an identical pattern to the total PAHs pattern.

2.4.4 Characterization of Sediment Samples

Lead shot was encountered in one pond sediment sample (SD-4) at 340 count/ft^2 and two stream sediment samples (SD-7 and SD-8), located just south of the pond at 430 counts/ft^2 and 1,600 counts/ft^2, respectively. Refer to Figure 2-1 for sediment sample locations.

2.4.4.1 Characterization of Metals in Sediment Samples

Table 2.3 provides a summary of metal target constituents detected in sediment.

Table 2.3 – Occurrence and Distribution of Metals in Sediment

Metal	< 375'		> 375'	
	Frequency of Detection	Range of Detections (mg/kg)	Frequency of Detection	Range of Detections (mg/kg)
Antimony*	1/6	ND-5.0	1/4	1-11.7
Arsenic	6/6	1.2-4.3	4/4	2.2-15
Copper	6/6	7.1-15.3	4/4	8.6-20.1
Lead	6/6	37.6-159	4/4	23.5-2550
Zinc	6/6	11.2-73.5	4/4	13.6-129

*Data Validation indicated a low bias in antimony soil data as a result of low surrogate recovery in matrix spike / matrix spike duplicate QA/QC samples.

Several antimony sediment sample results are qualified "UL" due to low surrogate recovery in matrix spike / matrix spike duplicate (MS/MSD) QA/QC samples. Refer to Section 3.2.1.1 (Data Validation) for additional information.

Sediment sample SD-7 is located in the dry stream bed northeast of the firing line where most of the non-lead metals contamination at the site is located. As a result this sample is grouped with the soils to determine risk from exposure to metals in soil < 375'.

2.4.4.2 Characterization of PAHs in Sediment Samples

PAHs were detected at low concentrations in 7 of the 10 sediment samples. The concentrations of individual PAHs were relatively low. Table 2.4 provides a summary of PAH target constituents detected in sediment.

Table 2.4 – Occurrence and Distribution of PAHs in Sediment				
PAH	**< 375'**		**> 375'**	
	Frequency of Detection	**Range of Detections (mg/kg)**	**Frequency of Detection**	**Range of Detections (mg/kg)**
Acenaphthene	0/7	ND	0/4	ND
Acenaphthylene	0/7	ND	0/4	ND
Anthracene	1/7	ND-0.026	0/4	ND
Benzo(a)anthracene	5/7	0.0347 – 0.181	1/4	ND-0.0352
Benzo(a)pyrene	5/7	0.0340-0.233	2/4	0.0269-0.039
Benzo(b)fluoranthene	5/7	0.0271-0.262	2/4	0.0349-0.0582
Benzo(g,h,i)perylene	2/7	0.105-0.140	0/4	ND
Benzo(k)fluoranthene	4/7	0.0415-0.214	0/4	ND
Chrysene	5/7	0.0358-0.238	1/4	ND-0.0402
Dibenzo(a,h)anthracene	0/7	ND	0/4	ND
Fluoranthene	5/7	0.0502-0.281	2/4	0.0384-0.0736
Fluorene	0/7	ND	0/4	ND
Indeno(1,2,3-cd)pyrene	2/7	0.0949-0.115	0/4	ND
Naphthalene	0/7	ND	0/4	ND
Phenanthrene	4/7	0.0275-0.127	1/4	ND-0.0319
Pyrene	5/7	0.0635-0.297	1/4	ND-0.0669

2.4.5 Results of Surface Water Investigation

2.4.5.1 Surface Water PAHs Characterization

No PAHs were detected in any surface water samples collected during the investigation of the former Trap and Skeet range. Refer to Figure 2-1 for surface water sample locations.

2.4.5.2 Surface Water Metals Characterization

Three metals (copper, lead, and zinc) were detected in 7 out of the 10 surface water samples. No antimony or arsenic was detected. None of the concentrations of copper, lead, or zinc exceeded any human health ARARs/TBCs.

2.4.6 Groundwater Characterization

No PAHs were detected in the seven groundwater samples. In the dissolved phase, no metal results exceeded any ARARs/TBC. In the total metal analyses, the arsenic concentration exceeded its RBC in three of seven wells. The EPA Region III Tap-Water RBC for arsenic is 0.045 ug/L; however this value lacks relevance in light of the federally-promulgated Federal Drinking Water Standard (FDWS) maximum contaminant level (MCL) of 10 ug/L. The data validation qualified the arsenic data with a "B" to indicate that arsenic was also detected in the associated laboratory blank and the data results were less than 5 times the blank result.

Total lead was detected in two monitoring wells at concentrations exceeding the FDWS of 15 ug/L. These results were from samples taken from wells that were not developed and the suspended solids contributed to the elevated concentrations. This fact is confirmed by the fact that dissolved lead was not detected in groundwater samples collected from these two wells.

3.0 RISK ASSESSMENT

This section presents the results of a property-specific human health risk assessment (HHRA) conducted at the site. The HHRA was conducted using soil, sediment, surface water, and groundwater sample data collected by Versar from October to December 2004.

3.1 Risk Assessment Objective

This human health risk assessment was conducted to determine current potential risks to human health and to predict future potential risks to public health as a result of contaminated media at the site based upon current and anticipated future land use. This risk assessment will be used to aid in the determination of remedial alternatives, if any, required for the site by identifying potential hazards and quantifying associated risks from exposures to on-site contaminated media.

3.2 Steps For Conducting A Site-Specific HHRA

There are four major steps involved in conducting a human health risk assessment: 1) data collection and evaluation, 2) exposure assessment, 3) toxicity assessment, and 4) risk characterization. Each step is briefly described below.

1) Data collection and evaluation involve gathering and evaluating site data relevant to human health and identifying those chemicals of potential concern (COPCs) present at the site that should be the focus of the risk assessment process.

2) The exposure assessment is conducted to estimate the magnitudes of actual and/or potential human exposures, the frequencies and durations of these exposures, and the pathways by which humans may be exposed. In the exposure assessment, reasonable maximum estimates of exposure are developed for both current and anticipated future land-use assumptions. Current exposure estimates are used to determine potential doses based on existing exposure conditions at the site. Future exposure estimates are used to provide the Army with an understanding of potential future exposures and quantitative estimates of the likelihood of such exposures occurring.

3) The toxicity assessment considers: (1) the types of adverse health effects associated with chemical exposures; (2) the relationships between magnitudes of exposures and potential adverse effects; and (3) related uncertainties such as the weight of evidence of a particular chemical's carcinogenicity in humans. Toxicity assessments are generally accomplished in two steps. The first step, hazard identification, is the process of determining whether exposure to an agent can cause an increase in the incidence of an adverse health effect (e.g., cancer, birth defects). Hazard identification also involves characterizing the nature and strength of the evidence of causation. The second step, dose-response evaluation, is the process of quantitatively evaluating the toxicity information and characterizing the relationships between the doses of the chemicals administered or received and the incidence of adverse health effects in the exposed population. From those quantitative dose-

response relationships, toxicity values have been derived that use the estimated incidence of adverse effects occurring in humans at different exposure levels.

4) Risk characterization summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risks, both in quantitative expressions and qualitative statements. During risk characterization, exposure estimates are combined with chemical specific toxicity information to determine whether current or future concentrations at the site may be of potential concern.

3.2.1 Data Collection and Evaluation

All media at the Site was sampled from October to December 2004 (Draft Data Report - Versar, 2005). Substantial data was generated during the investigation that was used in performing this risk assessment for the Site using conservative screening guidelines for human health risks. The analytical results of this investigation are presented in Appendix A of this document.

3.2.1.1 Data Validation

Upon completion of field investigation and laboratory analyses, the analytical data was subjected to validation by an independent third party, Laboratory Data Consultants of Carlsbad, CA. The data generated was Level IV, which is pertinent for use in human heath risk assessments, statistical analysis, and regulatory compliance.

Data validation was performed using the guidance in the Superfund Functional Guidelines for the Contract Laboratory Program (CLP) for IM2 (inorganic) and TM3 (organic) data packages. In addition, the data validation included the EPA Region III Modifications to the National Functional Guidelines for Organic Data Review (1993), Region III Modifications to the Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (1993), and Innovative Approaches to Data Validation, Region III (1995).

The data validation process determined that with respect to antimony, some high detections were flagged "UL" (non-detect / low sample bias); due to low matrix spike / matrix spike duplicate surrogate recovery. The highest antimony result in sediment, 11.7 mg/kg in sample FGGM-83-SD-7, and the highest antimony result in soil, 457 mg/kg in sample FGGM83-SB-C8, are flagged “UL” indicating it is a non-detect. However, in order to not under estimate risk associated with exposure to antimony, these results are treated as positive detections.

3.2.1.2 Selection of Chemicals of Potential Concern

The risk assessment addresses site-related chemicals that are considered to pose potential threats to human health. These chemicals are selected based on a combination of their intrinsic toxicities and their levels of occurrence. Based upon the evaluation of the previous site investigation data using the above criteria; PAHs and metals in soil and sediment at the site are considered because they provide viable sources for potential routes of exposure from ingestion, inhalation, or dermal contact.. **T**he EPA/903/R-93-001 (January 1993) technical guidance recommends a re-ordering of the eliminating steps described in Chapter 5 of "RAGS IA" (*Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)*;

EPA, 1989) and suggests changing from a relative concentration toxicity screening to an absolute comparison of risk by means of comparison to a table of risk-based concentrations.

Based upon this Region III screening, the following chemicals are considered to be chemicals of potential concern (COPCs):

Soil within 375': antimony, arsenic, lead, benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenz[a,h]anthracene, indeno[1,2,3-c,d]pyrene, chrysene
Soil beyond 375': antimony, arsenic, lead, benzo[a]pyrene
Sediment within 375': benzo[a]pyrene
Sediment beyond 375': arsenic, lead

3.2.2 Exposure Assessment

Exposure bridges the gap between a potential hazard (i.e., presence of a toxic chemical) and a risk. Exposures to chemicals may occur via inhalation, ingestion, or by dermal absorption routes. The objectives of an exposure assessment are to: (1) identify populations that may potentially be exposed to chemicals of concern; (2) identify the pathways by which such exposures may occur; and (3) quantify chemical intakes, or potential dose, based on the magnitudes, frequencies, and durations of these potential exposures. The exposure assessment thus provides pathway-specific intakes for current and future exposures to site related chemicals of concern.

Conducting an exposure assessment involves analyzing chemical releases; identifying exposed populations; estimating exposure point concentrations for specific pathways, based on both environmental monitoring data and predictive chemical modeling results; and estimating chemical intakes for specific pathways. The results of this exposure assessment are pathway-specific intakes for current and future exposures to individual substances.

3.2.2.1 Potentially Exposed Populations

Baseline risk assessments are site-specific and based on the activity patterns of a population, there may be more than one exposure pathway for any given individual. Therefore, the exposure assessment must include an evaluation of the activity patterns of the potential receptors to determine what combination, if any, of exposure pathways could affect an individual. This evaluation results in the generation of exposure scenarios. Exposure scenarios represent the combination (if applicable) of exposure pathways for an individual based on his/her activity patterns.

At the OU-1 site, activities patterns and potential exposures vary for each identified receptor (trespasser, recreational user, construction worker, and industrial worker), Therefore, risk to a given receptor from exposure to both soil and sediment are discretely evaluated in this risk assessment. This approach provides an overly conservative exposure estimate than when an assumed ingestion rate (e.g., 40 soil / 60 sediment) is considered, resulting in an actualized ingestion rate of 100 mg/day (adult) or 200 mg/day (youth). Refer to Section 3.3 for additional information regarding identifying reasonable exposure pathway combinations.

The following subsections address the identification of potentially exposed populations, the identification of pathways of exposure, and the calculations and assumptions used to quantify potential exposures. Appendix C presents the potentially exposed populations and the pathways/routes by which they may be exposed for the exposure scenarios evaluated.

3.2.2.1.1 Current Land Use

The site is not currently used by Fort Meade personnel for military purposes; however, Fort Meade personnel and local residents regularly use the site for recreational activities (e.g., fishing, picnics, and hiking). No fences or locked gates prevent pedestrian access to the site. In fact, numerous foot paths cross the site and surround the pond. Groundwater at the site and surrounding areas has not been developed as a drinking water source. Potable water is supplied to the property from production wells located approximately 0.25 mile west of the site on Fort Meade base..

Under the current land use scenario; potential receptors include youth (age < 7 years) and adult (age > 7 years) trespassers who could contact soil while walking across the site or who could contact sediment and surface water while wading or swimming in the pond areas. Based upon the results of the Versar 2004 investigation; and under the current land use scenario, the following potential exposure pathways were considered complete and evaluated for risk:

Soil:

- Incidental ingestion of PAHs and metals in soil by trespasser (youth and adult)
- Dermal absorption of PAHs and metals in soil by trespasser (youth and adult)
- Inhalation of PAHs and metals particulates in soil by trespasser (youth and adult)

Sediment:

- Incidental ingestion of PAHs and metals in sediment by trespasser (youth and adult)
- Dermal absorption of PAHs and metals in sediment by trespasser (youth and adult)

3.2.2.1.2 Reasonably Anticipated Future Land Use

At this time, the reasonably anticipated future land use is military/industrial. Under the intended future land use scenario, potential receptors are identified as the commercial/industrial (office) worker and construction worker.

Under the current proposed land use plan, it is expected that the pond and surrounding buffer will remain and may be used by recreational visitors. Under this scenario, the following potential pathways are identified and associated risk evaluated:

Soil:

- Incidental ingestion of PAHs and metals in soil by recreational visitor (youth and adult)

- Dermal absorption of PAHs and metals in soil by recreational visitor (youth and adult)
- Inhalation of PAHs and metals particulates in soil by recreational visitor (youth and adult)
- Incidental ingestion of PAHs and metals in soil by commercial/industrial worker
- Dermal absorption of PAHs and metals in soil by commercial/industrial worker
- Inhalation of PAHs and metals particulates in soil by commercial/industrial worker
- Incidental ingestion of PAHs and metals in soil by construction worker
- Dermal absorption of PAHs and metals in soil by construction worker
- Inhalation of PAHs and metals particulates in soil by construction worker

Sediment:

- Incidental ingestion of PAHs and metals in sediment by recreational visitor (youth and adult)
- Dermal absorption of PAHs and metals in sediment by recreational visitor (youth and adult)
- Incidental ingestion of PAHs and metals in sediment by construction worker
- Dermal absorption of PAHs and metals in sediment by construction worker

3.2.3 Calculation of Chemical Intakes

The chemical intakes for potential receptors were estimated using the formulas recommended by EPA in RAGS, Part A (EPA, 1989). For the dermal and ingestion exposure routes, chronic daily intakes (CDIs) were calculated in units of milligrams of chemical per kilogram of body weight per day.

$$\text{CDI/SDI} = \frac{\text{C x CR x EF x ED}}{\text{BW x AT}}$$

where:

CDI/SDI = Chronic or subchronic daily intake (mg/kg-day),
C = Chemical concentration at exposure point (mg/kg),
CR = Contact rate (kg/day),
EF = Exposure frequency (days/month or days/year),
ED = Exposure duration (month or year),
B W = Body weight of exposed individual (kg), and
AT = Period of time over which exposure is averaged (days).

For all exposure scenarios, the concentration terms were chemical-specific for each COPC. For each COPC , the 95 percent upper confidence limit (UCL) of the arithmetic mean was derived using ProUCL© Version 3.0 (April, 2004). Refer to Appendix B for a summary of the 95% UCL calculation results for each COPC. In the event that the 95 percent UCL exceeded the maximum concentration detected in the site samples for a particular medium, then the

maximum concentration in that medium was used to represent the concentration term. The maximum concentration of a medium was also used as the concentration term in cases where limited numbers of samples were collected. Route and chemical-specific variables were incorporated into the equation, where appropriate, to account for other factors such as the percent of a chemical dermally absorbed by the body; site soil characteristics, and skin surface areas.

Conservative default values for most of the variables used in the intake equations were recommended by EPA in various guidance documents. Refer to Appendix D for a summary of default and user defined values used in intake / risk assessment calculations.

The remainder of this section presents the intake equations and discusses the exposure variable values used for each exposure scenario in the following order:

- Incidental ingestion of soil,
- Incidental ingestion of sediment,
- Dermal absorption of soil,
- Dermal absorption of sediment, and
- Inhalation of volatile emissions and fugitive dust.

Incidental Ingestion of Soil. The equation used to estimate intakes of chemicals via incidental soil and sediment ingestion is:

$$\text{Intake} = \frac{C_{SOIL} \times IR \times CF \times EF \times ED}{BW \times AT}$$

where:

C_{soil} = Chemical concentration in soil (mg/kg soil)
IR = Ingestion rate (mg soil/day),
CF = Conversion factor 10E-06 kg soil/mg soil)
EF = Exposure frequency (days/year),
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The ingestion rates for soil (IR) were assumed to be 330 mg/day for construction workers; 100 mg/day for commercial/industrial workers. For recreational users, an age adjusted 100 mg/day and 200 mg/day for adult and youth recreational users, respectively (EPA, 2002). The exposure frequency for construction workers and commercial/industrial workers was assumed to be 250 days/year. The exposure duration was assumed to be 1 year for construction workers and 25 years for indoor commercial/industrial workers (EPA, 2002). For recreational scenarios, the exposure frequency was assumed to be 39 days/year for both adults and youth. For recreational scenarios, the exposure duration was assumed to be 11 years and 30 years for children and adults; respectively.

Body weight was assumed to be 70 kg for adults and 42 kg for youth for all scenarios. Averaging times for scenarios involving noncarcinogens were 365 days (1 year) for construction workers; 9,125 days (25 years) for commercial/industrial workers, 4,015 days (11 years) for recreational youth and 10,950 days (30 years) for recreational adults. The averaging time for all scenarios involving carcinogens was 25,550 days (70 years).

Incidental Ingestion of Sediment. The equation and assumptions used to address exposure to chemicals via incidental ingestion of sediments for adults and children were the same as those used to assess recreational ingestion of surface soils among adults and children, respectively, with the following exceptions for children: ingestion rate was assumed to be 100 milligrams per day; the exposure frequency was assumed to be 39 days per year; exposure duration was assumed to be 11 years for children and 30 years for adults. The body weight was assumed to be 42 kilograms for children and 70 kg for adults (EPA, 2001).

Dermal Absorption of Chemicals from Soil. The equation for estimating dose via dermal absorption from soil and sediment is:

$$\text{Intake} = \frac{C_{SOIL} \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

where:

C_{soil} = Chemical concentration in soil (mg/kg soil)
CF = Conversion factor 10E-06 (convert kg soil/mg soil)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg soil/cm^2)
ABS = Absorption factor (unitless)
EF = Exposure frequency (days/year),
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

It was assumed that construction, commercial/industrial and recreational dermal exposure scenarios occur at the same frequency as incidental ingestion; therefore, all the variables corresponding to exposure durations, frequencies, and averaging times were identical. Body weights for adults (70 kg) and child (42 kg) were identical to the soil ingestion scenario. The skin surface areas (SA) exposed were assumed to be 5700 cm^2 for recreational adults (EPA,2002). Construction workers and commercial/industrial workers were assumed to have 3300 and 5700 cm^2 of skin surface area exposed; respectively (EPA, 2001). The exposed skin surface area for children was assumed to be 2800 cm^2 for both the trespasser and recreational scenarios (EPA,2002). These values represent surface areas of approximately 25 percent of the total body surface areas for the 95th percentile of these population classes. Exposures are also affected by the soil-to-skin adherence. For the purpose of this risk assessment, a soil-to-skin adherence factor (AF) recommended by EPA, RAGS, Part E (EPA, 2001) were assumed.

For recreational adults and commercial/industrial workers an AF of 0.07 mg/cm^2-event was used (EPA, 2001) An AF of 0.3 and 0.2 mg/cm^2-event were assumed for construction workers and children, respectively (EPA, 2002). Once soil particles have adhered to the skin, it is unlikely that all of the COPCs will be sorbed from the soil into the bloodstream. Absorption factors available for the COPCs were taken from EPA (2002). PAHs were assumed to have an absorption fraction of 0.13, based on the absorption fraction for benzo(a)pyrene. Lead and arsenic was assumed to have an absorption fraction of 0.01.

Dermal Absorption of Chemicals from Sediments. The equation and assumptions for estimating dermal contact with the sediments for adults and children were the same as for recreational dermal absorption for soils among adults and youth, respectively, presented previously. In addition, assumptions for exposure frequency, exposure duration, and body weight were the same as those for the sediment ingestion scenario.

Inhalation of Volatile Emissions and Fugitive Dust. Risk from inhalation of volatiles and particulates, was evaluated for each of the appropriate COPCs. All COPCs were evaluated for inhalation of particulates from soil, but inhalation of volatiles from soil or sediment was not calculated because the COPCs are not expected to readily volatilize.

Inhalation of nonvolatiles in fugitive dust as a result of soil agitation was estimated using the Particulate Emission Factor (PEF) model. The PEF represents an estimate of the relationship between soil contaminant concentrations and the concentration of these contaminants in air as a consequence of particle suspension.

The mean annual wind speed is site-specific to Fort Meade, and the dispersion factors (Q/Cwind) are calculated using regional factors for Philadelphia. The PEFs are dependant on the amount of vegetation cover at the site under the assumed exposure scenarios. For industrial and construction workers exposed to suspended soil, dust emission estimates were based on the following equation from EPA's *Soil Screening Guidance* (EPA, 2001a):

$$PEF\left(\frac{m^3}{kg}\right) = Q/C \times \frac{3{,}600\ s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$$

where:

PEF = Particulate Emission Factor (m^3/kg)
Q/C = Inverse of mean concentration at center of square source (g/m^2-s per kg/m^3)
0.036 = Respirable fraction (g/m^2-hr)
V = Fraction of vegetative cover (unitless)
U_m = Mean annual wind speed (m/s)
Ut = Equivalent threshold value of wind speed at 7 meters (m/s)
F(x) = Function dependent of U_m/Ut derived using Cowherd et al. (1985) unitless.

A value for PEF of 1.81E+10^9 m^3/kg was used to calculate the exposure resulting from inhalation of particulate dust using the following equation:

$$\text{Intake} = \frac{C_{SOIL} \times EF \times ED \times IR \times ET \times (1 / VF + 1 / PEF)}{BW \times AT}$$

where:

C_{soil} = Chemical concentration in soil (mg/kg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
IR = Inhalation rate (m_3/hr)
ET = Exposure time (hr/day)
PEF = Particulate Emission Factor (m^3/kg)
VF = Volatilization Factor (m^3/kg) (not calculated)
BW = Body weight (kg)
AT = Averaging time (days)

The exposure frequency for construction and commercial indoor workers was assumed to be 250 days. The exposure frequency for the trespasser and recreational visitor is 39 days. The exposure duration is 1 year for the construction worker; 25 years for the commercial indoor worker and 30 years for the adult recreational visitor and adult trespasser. The exposure duration both the child trespasser and youth recreational visitor is 11 years. The inhalation rate of 20 m^3/day is the inhalation rate used for the adults and youth. The exposure time is the typical amount of time an individual spends outside during a day (e.g., construction worker/8 hours). Body weight was assumed to be 70 kg. For carcinogens, AT = 25,550 days (70 years x 365 days); for noncarcinogens, AT=ED.

3.2.4 Toxicity Assessment

The objective of the toxicity assessment is to describe the nature and extent of potential health and environmental hazards that may be associated with soils and sediment at the site. Carcinogenic slope factors and reference doses oral, dermal, and inhalation routes of exposure were obtained from EPA's Integrated Risk Information System (IRIS) (EPA, 2002c), EPA-NCEA Regional Support Provisional values, as cited in the Region 3 RBC Table (EPA, 2006), and Risk Assessment Information System (RAIS, 2005).

3.2.4.1 Carcinogen Toxicity Assessment

Carcinogenic slope factors frequently are used to help compare the carcinogenic effects among various chemicals. These values also are used to determine risks to individuals. The slope values (or unit risks) are upper 95 percent confidence limits on the slope of the dose response curve. Assuming low-dose linearity, the slope value represents the excess lifetime risk resulting from a continuous lifetime exposure of one unit of carcinogen concentration. Typical exposure units are mg/kg of body weight per day.

3.2.4.2 Non Cancer Hazard Toxicity Assessment

EPA also has developed acceptable intake toxicity values for noncarcinogens. The acceptable toxicity values are chronic and subchronic RfDs for oral and inhalation exposures. The RfD is the toxicity value most used in evaluating noncarcinogenic effects resulting from exposure to contaminants at Superfund sites, and has replaced the acceptable daily intake (ADI) as the EPA preferred value. These values are expressed in units of mg/kg of body weight per day. A chronic RfD is an estimate of a lifetime daily exposure level that is not expected to present an appreciable risk.

3.2.4.3 Lead Toxicity Assessment

In the long term, lead shot weathers into mineral forms depending upon many factors: the original form which the lead is in, the type of soil, soil pH (acidity) and moisture content of the soil, and water infiltration from rainfall or other drainage which have low solubility in water. Soil constitutes a sink for lead which has a strong tendency to be adsorbed on to particles of clay or organic matter, and in this form is largely immobile, biologically inert, and generally have low solubility in water.

Lead has a strong tendency to bind to clay particles or organic matter. Soils with a neutral pH (between 6.5 and 8.5) and clay content help to bind the lead to the soil so that it is less likely to move vertically (*Prevention of Lead Migration and Erosion from Small Arms Firing Ranges* - USAEC, 1998). Samples collected from OU-1 during a pilot study conducted by KEMRON in February 2006 indicated such conditions exist at OU-1 as evidenced by the significant drop in lead concentrations greater than 1.5'. Refer to Figures 2-8 and 2-9.

Leaching of lead can be relatively rapid from some soils, especially at highly contaminated sites or landfills (Kayser et al., 1982). Lead is most available from acidic sandy soils which contain little material capable of binding lead (NRCC, 1978). Concentrations of lead in soil solution reach a minimum between pH 5 and 6 because metal-organic complexes form in this pH range. Only a small fraction of lead in lead-contaminated soil appears to be in water soluble form (0.2-1%) (http://toxnet.nlm.nih.gov).

When released to soil, lead is normally converted from soluble lead compounds to relatively insoluble sulfate or phosphate derivatives. It also forms complexes with organic matter and clay minerals which limits its mobility. The efficient fixation of lead in soils limits the transfer of lead to aquatic systems.

There were no toxicity values available to calculate a carcinogenic risk or noncarcinogenic hazard for lead.

The directive from the EPA Region 3 recommends that where soil lead levels are greater than 800 mg/kg; further analysis is warranted. EPA Region 3 evaluates lead exposure by using blood-lead modeling procedures such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK) and the Adult Lead Model (ALM).

3.2.5 Risk Characterization

The objective of this portion of the risk assessment is to integrate information in the human exposure evaluation and the toxicity evaluation in order to evaluate potential human health impacts associated with ingestion, dermal absorption, and inhalation of dust at the site.

3.2.5.1 Carcinogenic Risk Characterization

For carcinogens, risks are estimated as the probability of increased cancer incidence. A carcinogenic SF represents the 95 percent upper confidence limit of the probability of response per unit intake of a chemical over a lifetime, and converts estimated intakes directly to incremental risk (EPA, 1989). Carcinogenic risk is computed as follows:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where:

CDI = Chronic daily intake (mg/kg-day)
SF = Carcinogenic slope factor [l/(mg/kg-day)]

Evaluation of carcinogenic risks determines if chemicals on the site pose sufficient risk to human health. Carcinogenic risk refers to the probability of injury, disease, or death resulting from exposure to proven or suspected carcinogenic chemicals identified in this study. Carcinogenic risk generally is expressed in scientific notation (e.g., an individual lifetime risk of one in 10,000 is represented as 1.0E-04).

The level of total cancer risk that is of concern is a matter of personal, community, and regulatory judgment. In general, the USEPA considers excess cancer risks that are below about 1 chance in 1,000,000 (1×10^{-6} or 1E-06) to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1E-06 and 1E-04 are generally considered to be acceptable (see *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, Memorandum from D. R. Clay, OSWER 9355.0-30, April 1991).

3.2.5.2 Noncarcinogenic Hazard Characterization

Potential noncarcinogenic health effects may be identified by computing hazard indices from daily intake levels. Noncarcinogenic risks are addressed using a hazard quotient computed by dividing the daily intake level by the RfD. The RfD represents the dose at which there is no observable adverse effect. Subsequently, if the daily intake level is less than the RfD, the resulting hazard quotient will be less than one. If the daily intake level is greater than the RfD, the resulting hazard quotient will be greater than one, an indication of potential hazard. The hazard index (HI) is the sum of all chemical-specific hazard quotients for an exposure route.

A HI is a simple means of comparing site-specific chronic daily intake levels (CDI) to acceptable chronic daily intake levels. A HI is computed as follows:

$$\text{HI} = \frac{\text{CDI}_1}{\text{RfD}_1} + \frac{\text{CDI}_2}{\text{RfD}_2} + \ldots + \frac{\text{CDI}_n}{\text{RfD}_n}$$

If the HI is less than one, deleterious health effects are unlikely. If the HI is greater than one, then the individual effects of each chemical should be considered to determine the likelihood of ill effects, and potential pathways must be considered. RfDs are not available for any of the PAHs COPCs evaluated in this assessment; thus, HIs are not computed for PAHs.

Due to the lack of toxicity values for lead, hazard risk (HI) associated with exposure to lead in media is not characterized into the HI for other metals (Pb and As).

3.2.6 Results of the Human Health Risk Assessment

The potential carcinogenic and noncarcinogenic risks were calculated for all identified receptor populations, exposure routes, and COPCs. Appendix E -1 provides spreadsheets showing results of calculations of chemical intakes and estimates of carcinogenic and noncarcinogenic risks for each pathway for the exposure scenarios for both soil and sediment. The following sections discuss the potential carcinogenic and noncarcinogenic risks for both current and future land use scenarios for the risk assessment.

As mentioned earlier, there were no toxicity values available to calculate noncarcinogenic risks for lead. Assessment of lead-specific risk associated with exposure to lead in soil and sediment at the Site is discussed in Section 3.2.6.3.

As previously stated, soil and sediment exposures for site receptors could have been evaluated in a combined manner for all COPCs except lead. In evaluating the soil and sediment separately, the maximum concentration detected in the sediments was used as the Exposure Point Concentration (EPC), while the 95% Upper Confidence Limit (95UCL) was used as the EPC to calculate the risk associated with the soils. Refer to Section 3.2.2.1 for a complete list of the potential soil and sediment exposure pathways.

3.2.6.1 Current Land Use Scenario Risk Assessment Results

Soil:

Under the current land use scenario, the following potential soil exposure pathways were considered complete and evaluated for risk:

- Incidental ingestion of PAHs and metals in soil by trespasser (youth and adult)
- Dermal absorption of PAHs and metals in soil by trespasser (youth and adult)
- Inhalation of PAHs and metals in soil by trespasser (youth and adult)

Results of the soil risk assessment identified COPCs at the OU-1 site for the current land use scenario are discussed below. Results do not include a quantitative or qualitative risk analysis associated exposure to lead. Risk associated with exposure to lead in soil and sediment is discussed in Section 3.2.6.3.

Assessment of risk to the youth trespasser from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 2E-5 and a HI of 0.6.

Assessment of risk to the youth trespasser from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 3E-6 and a HI of 0.06.

Assessment of risk to the adult trespasser from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 9E-5 and a HI of 0.05.

Assessment of risk to the adult trespasser from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 4E-6 and a HI of 0.04.

Sediment:

Under the current land use scenario, the following potential sediment exposure pathways were considered complete and evaluated for risk:

- Incidental ingestion of PAHs and metals in sediment by trespasser (youth and adult)
- Dermal absorption of PAHs and metals in sediment by trespasser (youth and adult)

Results of the sediment risk assessment for the current land use scenario are discussed below:

Sediments samples were collected in areas less than 375 feet from the firing line (Samples 1-6), and in areas greater than 375 feet from the firing line (Samples 7-10). Benzo(a)pyrene was the only COPC identified in sediments collected less than 375 feet from the firing line. Arsenic and lead were identified as COPCs in sediments samples collected greater than 375 feet from the firing line.

Assessment of risk to the youth trespasser from ingestion and dermal exposure to PAHs in sediment less than 375 feet from the firing line resulted in a carcinogenic risk level of 1E-5.

Assessment of risk to the youth trespasser from ingestion and dermal exposure to metals in sediment greater than 375 feet resulted in a carcinogenic risk level of 6E-6 and a HI of 0.08.

Assessment of risk to the adult trespasser from ingestion and dermal exposure to PAHs in sediment less than 375 feet from the firing line resulted in carcinogenic risk level of 3E-6.

Assessment of risk to the adult trespasser from ingestion and dermal exposure to metals in sediment greater than 375 feet resulted in carcinogenic risk level of 9E-6 and a HI of 0.05.

3.2.6.2 Future Land Use Scenario Risk Assessment Results

Refer to Section 3.2.2.1.2 for a complete list of the potential soil and sediment exposure pathways evaluated for the future land use scenario.

Soil:

Under the reasonably anticipated future commercial/military land use scenario, the following potential soil exposure pathways were considered complete and evaluated for risk:

- Incidental ingestion of PAHs and metals in soil by recreational visitor (youth and adult)
- Dermal absorption of PAHs and metals in soil by recreational visitor (youth and adult)
- Inhalation of PAHs and metals particulates in soil by recreational visitor (youth and adult)
- Incidental ingestion of PAHs and metals in soil by commercial/industrial worker
- Dermal absorption of PAHs and metals in soil by commercial/industrial worker
- Inhalation of PAHs and metals particulates in soil by commercial/industrial worker
- Incidental ingestion PAHs and metals in soil by construction worker
- Dermal absorption of PAHs and metals in soil by construction worker
- Inhalation of PAHs and metals particulates in soil by construction worker

Risks associated with exposure to identified COPCs at the OU-1 site for the anticipated future land use scenario are discussed below. Results do not include a quantitative risk analysis associated exposure to lead. Risk associated with exposure to lead in soil and sediment is discussed in Section 3.2.6.3.

Assessment of risk to the youth recreational visitor from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 2E-5 and a HI of 0.6.

Assessment of risk to the youth recreational visitor from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 3E-6 and a HI of 0.06.

Assessment of risk to the adult recreational visitor from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 9E-5 and a HI of 0.05.

Assessment of risk to the adult recreational visitor from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 4E-6 and a HI of 0.04.

Assessment of risk to the commercial/industrial worker from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 2E-5 and a HI of 0.3.

Assessment of risk to the commercial/industrial worker from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 8E-5 and a HI of 0.01.

Assessment of risk to the construction worker from ingestion, dermal, and inhalation exposure to PAHs and metals in soil less than 375 feet from the firing line resulted in a carcinogenic risk level of 4E-5 and a HI of 0.9.

Assessment of risk to the construction worker from ingestion, dermal, and inhalation exposure to PAHs and metals in soil greater than 375 feet from the firing line resulted in a carcinogenic risk level of 3E-7 and a HI of 0.2.

Sediment:

Under the reasonably anticipated future land use scenario, the following potential sediment exposure pathways were considered complete and evaluated for risk:

- Incidental ingestion PAHs and metals in sediment by recreational visitor (youth and adult)
- Dermal absorption of PAHs and metals in sediment by recreational visitor (youth and adult)
- Incidental ingestion of PAHs and metals in sediment by construction worker
- Dermal absorption of PAHs and metals in sediment by construction worker

Results of the sediment risk assessment for the future land use scenario are discussed below:

Assessment of risk to the youth recreational visitor from ingestion and dermal exposure to PAHs in pond sediment resulted in a RME carcinogenic risk level of 1E-5.

Assessment of risk to the youth recreational visitor from ingestion and dermal exposure to PAHs and metals in the fall zone sediment resulted in a RME carcinogenic risk level of 6E-6 and a HI of 0.08.

Assessment of risk to the adult recreational visitor from ingestion and dermal exposure to PAHs in pond sediment resulted in a RME carcinogenic risk level of 3E-6.

Assessment of risk to the adult trespasser from ingestion and dermal exposure to PAHs and metals in fall zone sediment resulted in a RME carcinogenic risk level of 5E-6 and a HI of 0.05.

Assessment of risk to the construction worker from ingestion and dermal exposure to PAHs in pond sediment resulted in a RME carcinogenic risk level of 7E-8.

Assessment of risk to the construction worker from ingestion and dermal exposure to PAHs and metals in the fall zone sediment resulted in a RME carcinogenic risk level of 1E-6 and a HI of 0.2.

3.2.6.3 Lead Risk Assessment Results

Results of the soil lead-specific risk assessment for the current and future land use scenarios are provided in this section. As mentioned earlier, there were no toxicity values available to calculate noncarcinogenic risks for lead.

EPA Region 3 evaluates lead exposure by using blood-lead modeling procedures such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK) and the Adult Lead Model (ALM). Another model, the All-Ages Lead Model (AALM) is a preliminary draft (Version 1.05) and has not been formally released for use by the EPA.

Lead is assessed using in these models using the arithmetic mean lead soil concentration. At OU-1, the mean concentrations of sediment 7-10, soil within 375', and soil beyond 375' were 666 mg/kg, 495 mg/kg, and 473 mg/kg, respectively. It is clear that these concentrations are

below the industrial lead soil screening level of 750 ppm, which is identified as the concentration of concern using the Adult Lead Model for the maximally exposed receptor (commercial indoor worker), under the intended future land use scenario.

These mean lead concentrations are above the residential soil screening level of 400 mg/kg. Therefore, land use restrictions should be implemented which would require a re-evaluation of risk from exposure to lead if the site is designated for residential land use.

3.3 Summary of Additive Carcinogenic and Non Cancer Risks

In some scenarios, it is possible that an exposed individual may be exposed to a substance or substances through several pathways. In that case, the total exposure to various chemicals will equal the sum of the exposures by all pathways (additive). These cases represent a "reasonable maximum exposure" (RME). The RME estimate for each exposure pathway includes many conservative and upper-bound parameter values and assumptions (EPA, 1989) .

3.3.1 Summation of Carcinogenic Risks

The equation below represents an estimate of the increased cancer incidence (i.e., probability) that results from exposure to all chemicals reaching a receptor over all routes. This value is often called an estimate of "total carcinogenic risk" (EPA, 1989).

$$ELCR_{total} = \sum_{p=1}^{n} ELCR_p$$

Where:

$ELCR_{total}$ = The total excess cancer incidence posed by all chemicals over all routes; and.

$ELCR_p$ = The pathway-specific excess cancer incidence

3.3.2 Summation of Non Cancer Hazard Indices

The following equation is a numeric estimate of the systemic toxicity potential posed to a receptor by exposure to all chemicals over all routes. This value is often called an estimate of "total noncarcinogenic risk"(EPA 1989), although hazard as opposed to risk is being calculated.

$$HI_{total} = \sum_{p=1}^{n} HI_p$$

Where:

HI_{total} = The total hazard index, an estimate of the systemic toxicity posed by all chemicals over all routes.

HI_p = The pathway hazard index, an estimate of the systemic toxicity posed by all chemicals within a single exposure route.

Carcinogenic risks and noncarcinogenic hazards (hazard indices) were added across exposure pathways for each identified receptor. This summary of additive risk does not include pathway exposure additive risk associated with lead. Lead risk from exposure to lead in soil and sediment at the Site is summarized in Section 3.2.6.3.

Current Land Use

Additive carcinogenic risk to the youth trespasser from exposure to PAHs and metals in soils and sediment at OU-1 is 4E-5, and the additive HI is 0.75.

Additive carcinogenic risk to the adult trespasser from exposure to PAHs and metals in soils and sediment at OU-1 is 1E-5, and the additive HI is 0.14.

Future Land Use

Additive carcinogenic risk to the youth recreational visitor from exposure to PAHs and metals in soils and sediment at OU-1 is 4E-5, and the additive HI is 0.75.

Additive carcinogenic risk to the adult recreational visitor from exposure to PAHs and metals in soils and sediment at OU-1 is 5E-6, and the additive HI is 0.14.

Additive carcinogenic risk to the commercial/industrial worker from exposure to PAHs and metals in soils at OU-1 is 2E-5, and the additive HI is 0. 73.

Additive carcinogenic risk to the construction worker from exposure to PAHs and metals in soils and sediment at OU-1 is 4E-5, and the additive HI is 1.

3.4 Assessment and Presentation of Uncertainty

Since the risk estimates generated in a risk assessment are based on exposure and toxicity assumptions, it is necessary to specify the assumptions and uncertainties inherent in the risk assessment process. The risk assessment is not a fully probabilistic estimate of risk; but is based on numerous assumptions, most intended to be protective of human health (i.e., conservative).

There are several categories of uncertainties associated with risk assessments. The following bullets identify key site-related variables and assumptions that contribute most to the uncertainty:

- Likelihood of land use and exposure pathways actually occurring;
- Selection of COPCs based upon representative sampling data ;
- Toxicity values for each substance used to characterize risk;
- Uncertainties inherent in population intake parameters; and,

- Summation of error when exposure to several substances are added across multiple pathways.

The following paragraphs discuss the site-specific exposure uncertainties and the more general toxicity assessment uncertainties.

3.4.1 Physical Setting and Land Use

A large part of the estimation of risks is conditional based upon the exposure conditions analyzed. Risk estimates provided in this Risk Assessment Memo are based upon the actual current and future assumed land use conditions and population exposure pathways.

3.4.2 Representativeness of Samples Collected

Concentration levels of chemicals in the environmental media are often quite variable as a function of location and time. Thus, samples collected during a field sampling program may or may not fully characterize the spatial and temporal variability in actual concentration levels. At this site, a large number of soil samples were collected in accord with sampling and analysis plans that specifically sought to ensure that samples were representative of the range of conditions across each exposure area. Since the data are plentiful and inter-sample variability is not large, the 95UCL is used in exposure calculations, since it may be only slightly higher than the statistic of interest, and the degree of overestimation may be minor.

However, the number of sediment samples collected was relatively small ($n < 15$). Thus, without the collection of very large numbers of sediment samples over both space and time, some uncertainty remains as to whether the samples collected provide an accurate representation of the distribution of concentration values actually present. In this case, when data are sparse or are highly variable, the higher of the maximum detected concentration or 95UCL is used in exposure calculations, but it may be far greater than the statistic of interest, and the degree of uncertainty and the extent of overestimation may be substantial.

3.4.3 Absence of Toxicity Data for Some Chemicals

For a number of chemicals that were detected in one or more samples of site media, no reliable toxicity benchmark could be located for one or more receptor types. The inability to evaluate hazard from these chemicals is expected to result in an underestimation of risk, but it is suspected that the magnitude of the error is usually likely to be low. This is because the absence of a toxicity benchmark for a chemical is most often because toxicological concern over that chemical is low.

Site-specific uncertainties are associated with the evaluation of the inhalation route of exposure. The majority of COPCs in the medium for which inhalation is evaluated (soil and sediment) do not have noncarcinogenic toxicity values, which possibly leads to an underestimation of hazard by this route. In some cases, carcinogenic and noncarcinogenic toxicity values are published as reference concentrations (RfCs) and unit risks, both of which are air concentrations.

In the case of lead, the consequence of missing toxicity information represents a significant source of uncertainty in the final quantitative risk assessment. In this case, use of the IEUBK

and ALM model provides a sensitivity analysis to identify influential model input variables in order to develop a semi-quantitative analysis to compare with EPA developed bounds on the distribution of exposure or risk.

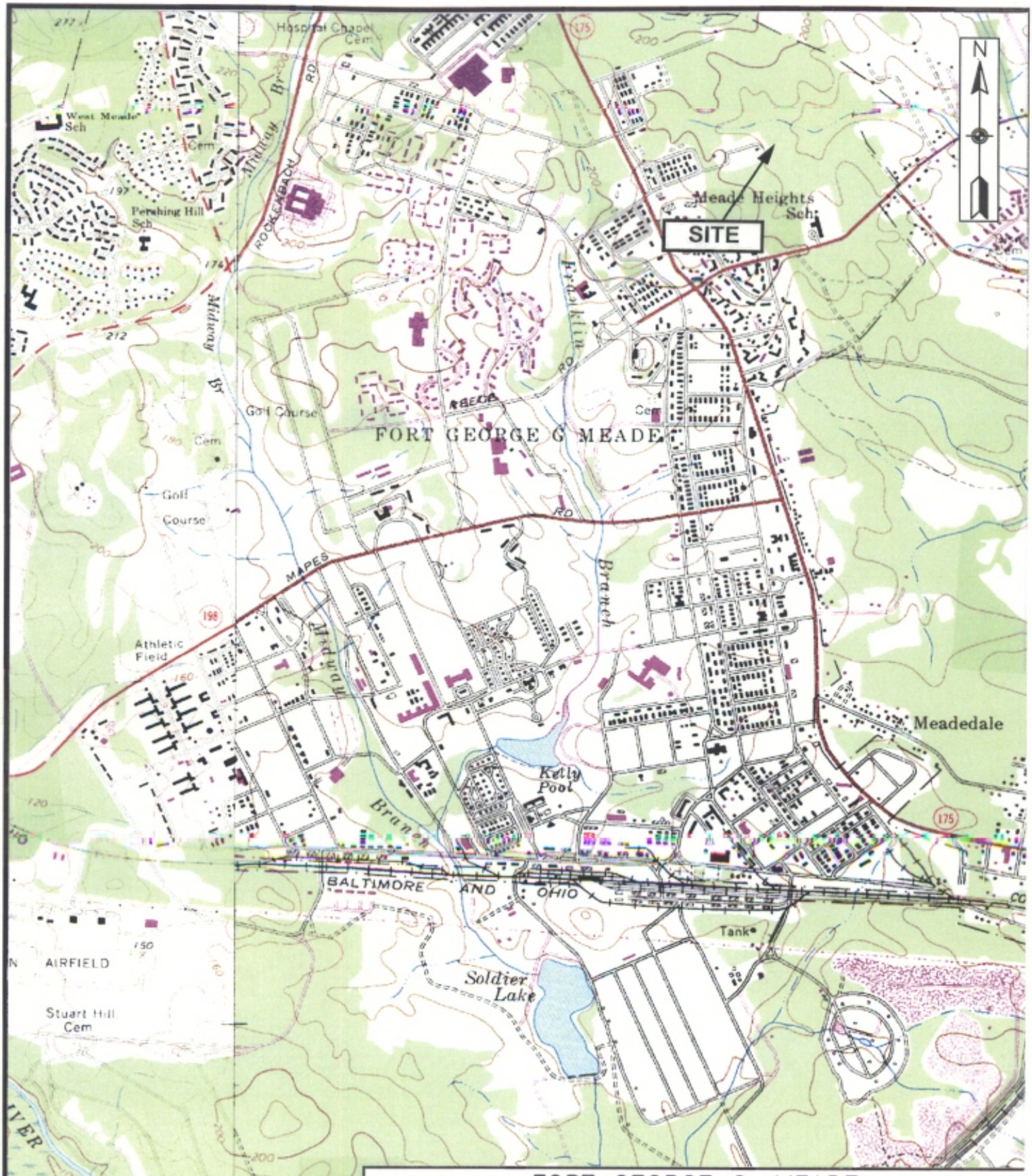
3.4.4 Uncertainties Inherent In Population Intake Parameters

Uncertainty exists regarding exposure to which a population may be exposed over the duration of the exposure period, and uncertainty about the exposed population, including the characteristics of that population and the activities that bring its members into contact with contaminated environmental media. Estimating adverse effects on individuals and effects on the population is complex, depending on the life history characteristics of the receptor being considered as well as the nature, magnitude and frequency of the chemical stresses from activities and behavior patterns. For any site, true exposure durations can be expressed as chronic, subchronic, and even acute exposures.

3.4.5 Multiple Pathway Exposures

Uncertainties associated with summing risks or hazard indices across multiple pathways for several substances ignores possible synergisms or antagomisms among chemicals., and assumes similarity in mechanisms of action and metabolism. EPA guidelines indicate that carcinogenic risks and non cancer hazard indices should be treated as additive (EPA, 1989). These assumptions are made to help prevent an underestimation of risk effects at a site.

FIGURES



FORT GEORGE G. MEADE

DESIGNED M.F.H.	DATE 11/13/03
REVISED M.M.F.	DATE 11/13/03

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SITE LOCATION
USGS TOPOGRAPHIC MAP
TRAP AND SKEET EE/CA
FORT MEADE, MARYLAND

PROJECT NO. 110814.0001	SCALE 1:24,000
DRAWING NO. 1003-00244	FIGURE 1-1

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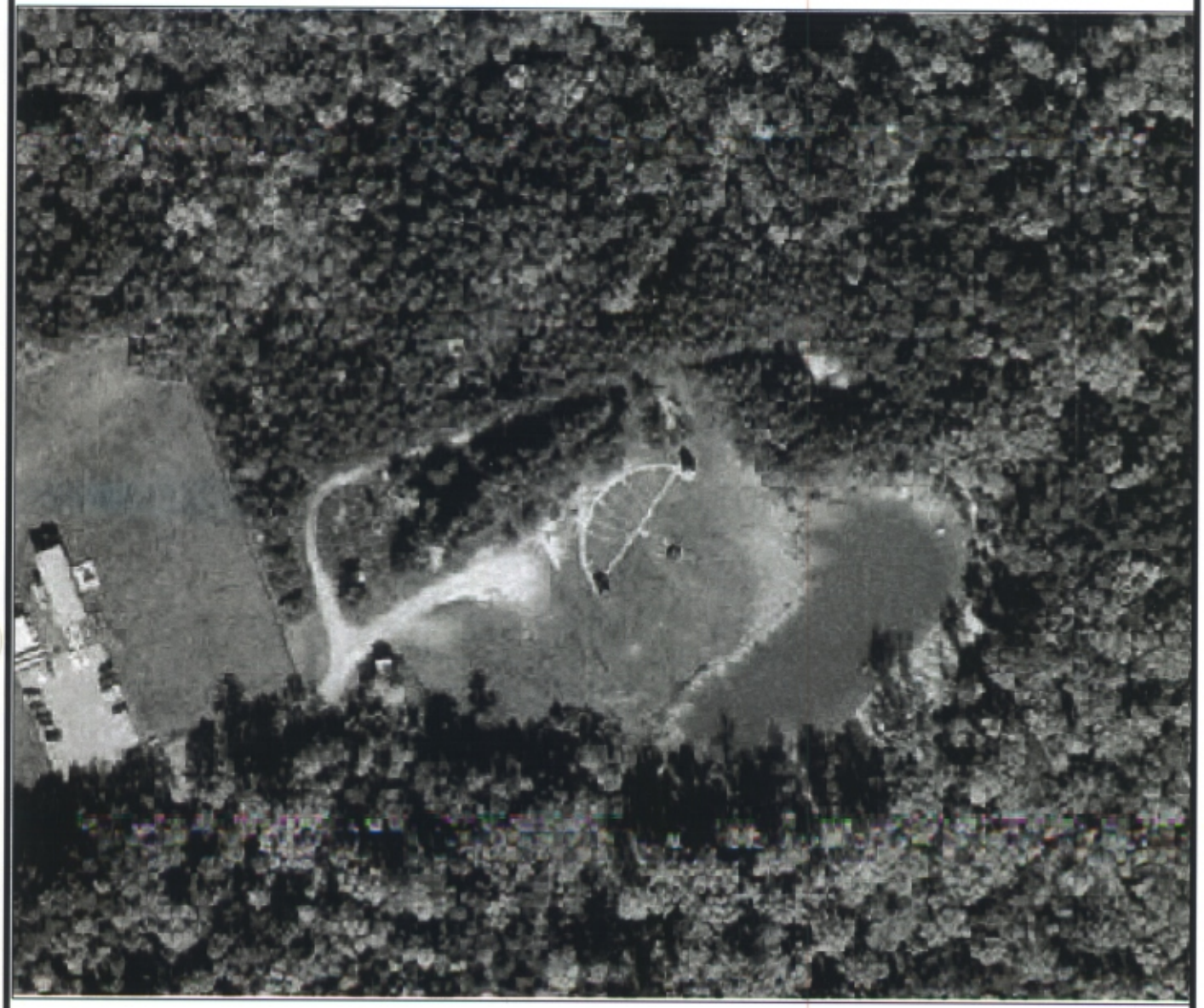

SOURCE: VERSAR INC.

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SCALE IN FEET

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FORT GEORGE G. MEADE

DESIGNED MFH	DATE 12/22/03
REVISED MFH	DATE 12/22/03

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AERIAL PHOTOGRAPH OF FORMER
RANGE LAYOUT
TRAP AND SKEET EE/CA
FORT MEADE, MARYLAND

PROJECT NO. 110814.0001	SCALE: 1"=150'
DRAWING NO. 1003-0245	FIGURE 1-2

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SOURCE: VERSAR INC.

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SCALE IN FEET

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DESIGNED MFH	DATE 12/22/03
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AERIAL PHOTOGRAPH, 2001
TRAP AND SKEET EE/CA
FORT MEADE, MARYLAND

PROJECT NO. 110814.0001	SCALE: 1"=150'
DRAWING NO. 1003-0243	FIGURE 1-3

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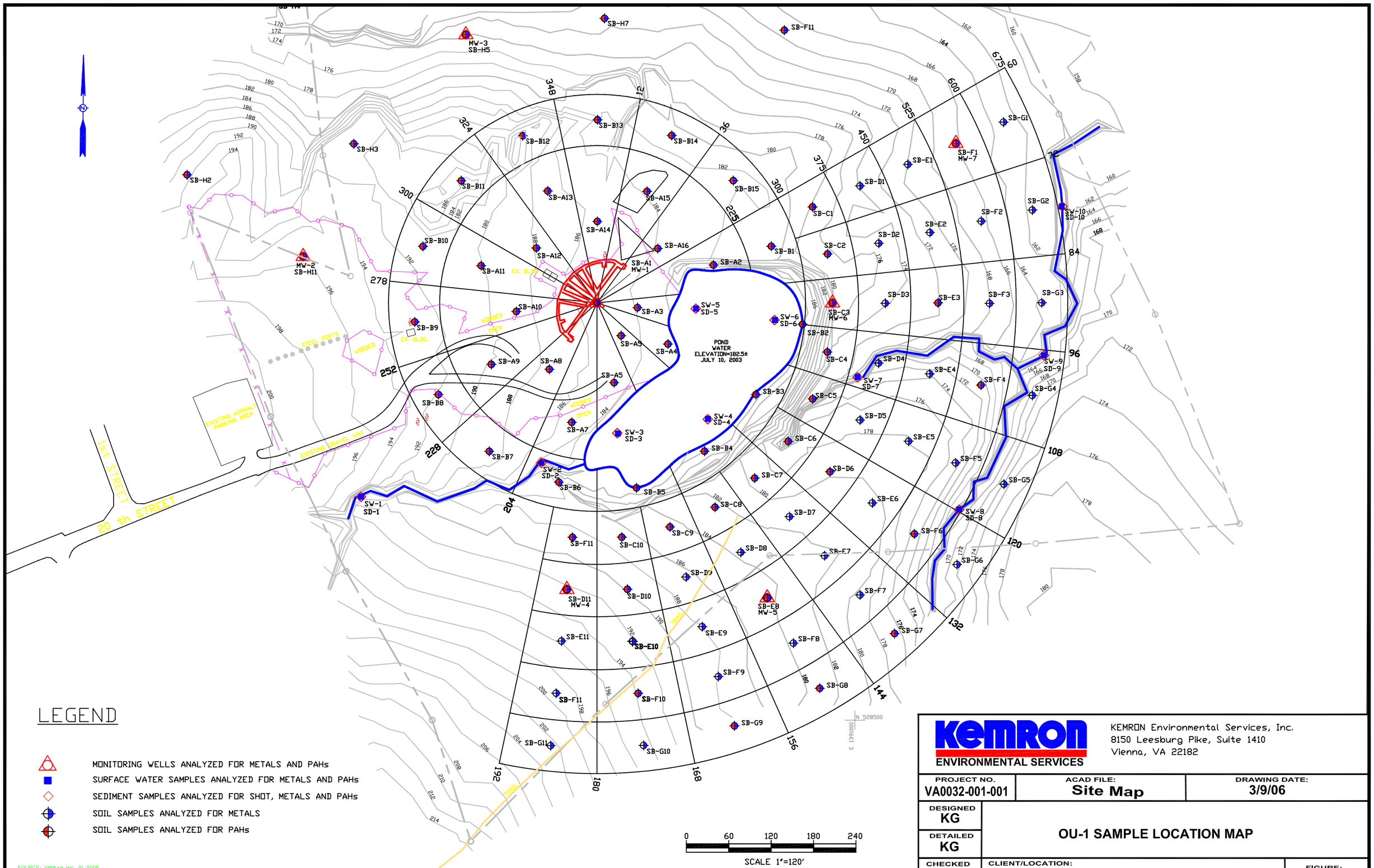

LEGEND

- MONITORING WELLS ANALYZED FOR METALS AND PAHs
- SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
- SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS AND PAHs
- SOIL SAMPLES ANALYZED FOR METALS
- SOIL SAMPLES ANALYZED FOR PAHs

SOURCE: VERSAR INC. 01-2005

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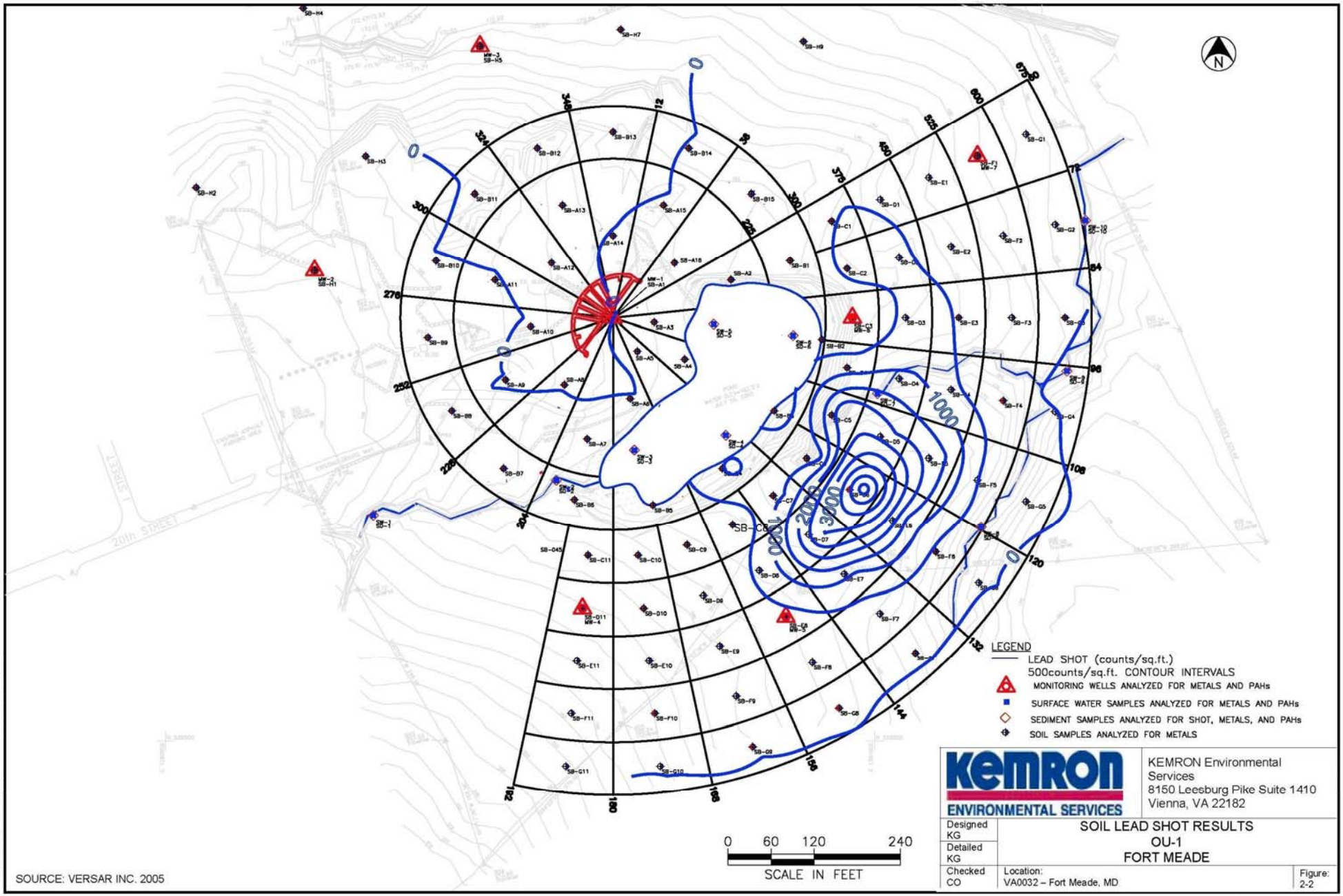
PROJECT NO.	ACAD FILE:	DRAWING DATE:
VA0032-001-001	Site Map	3/9/06

DESIGNED KG	OU-1 SAMPLE LOCATION MAP	
DETAILED KG		
CHECKED CO	CLIENT/LOCATION: FGGM83 / FORT MEADE, MD	FIGURE: 2-1


0
1000
2000
3000
0
0 60 120 240
SCALE IN FEET
LEGEND
LEAD SHOT (counts/sq.ft.)
500counts/sq.ft. CONTOUR INTERVALS
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
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Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SOIL LEAD SHOT RESULTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-2
SOURCE: VERSAR INC. 2005
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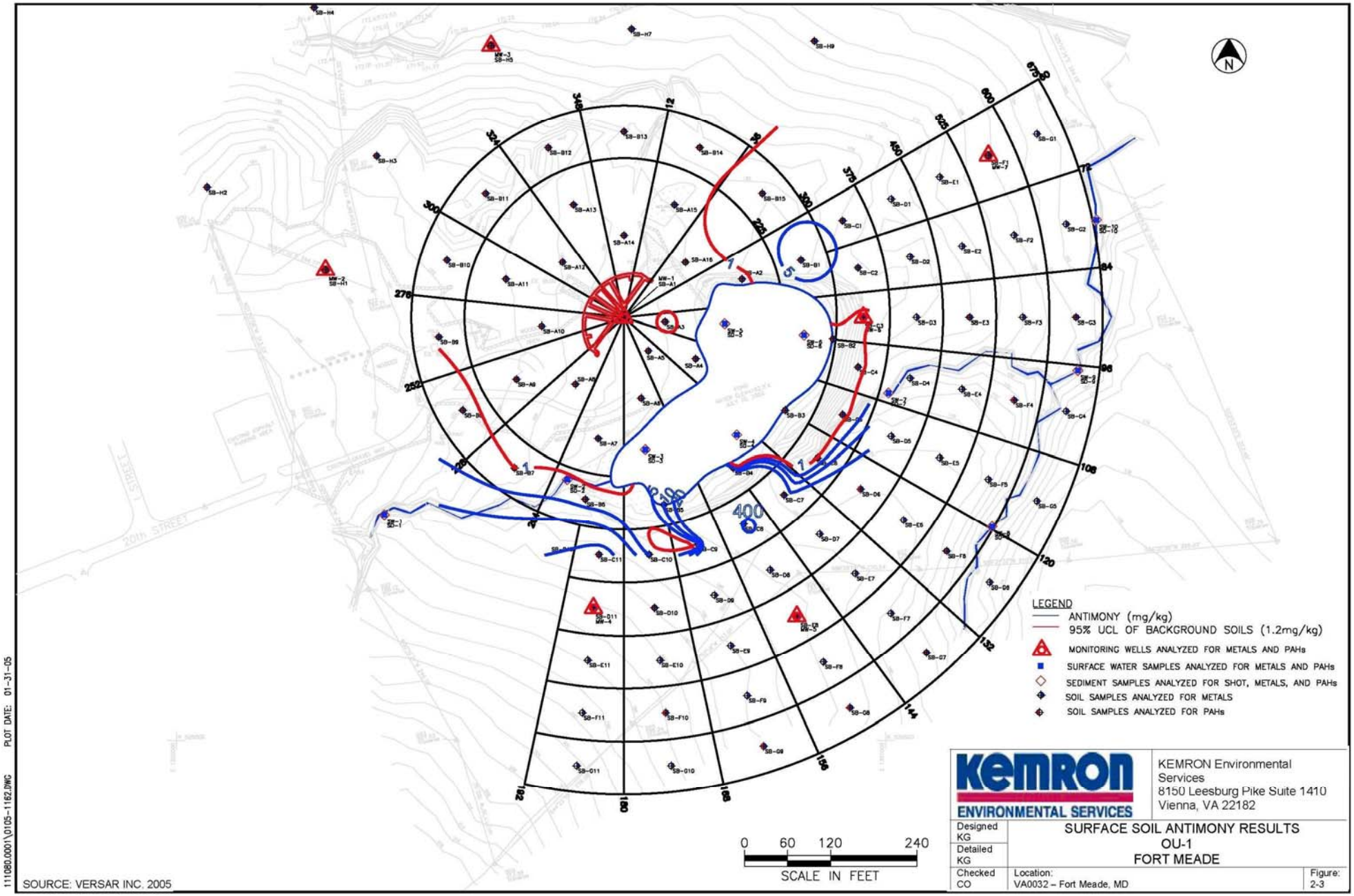

SOURCE: VERSAR INC. 2005

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Designed KG	SURFACE SOIL ANTIMONY RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-3

PLOT DATE: 01-31-05

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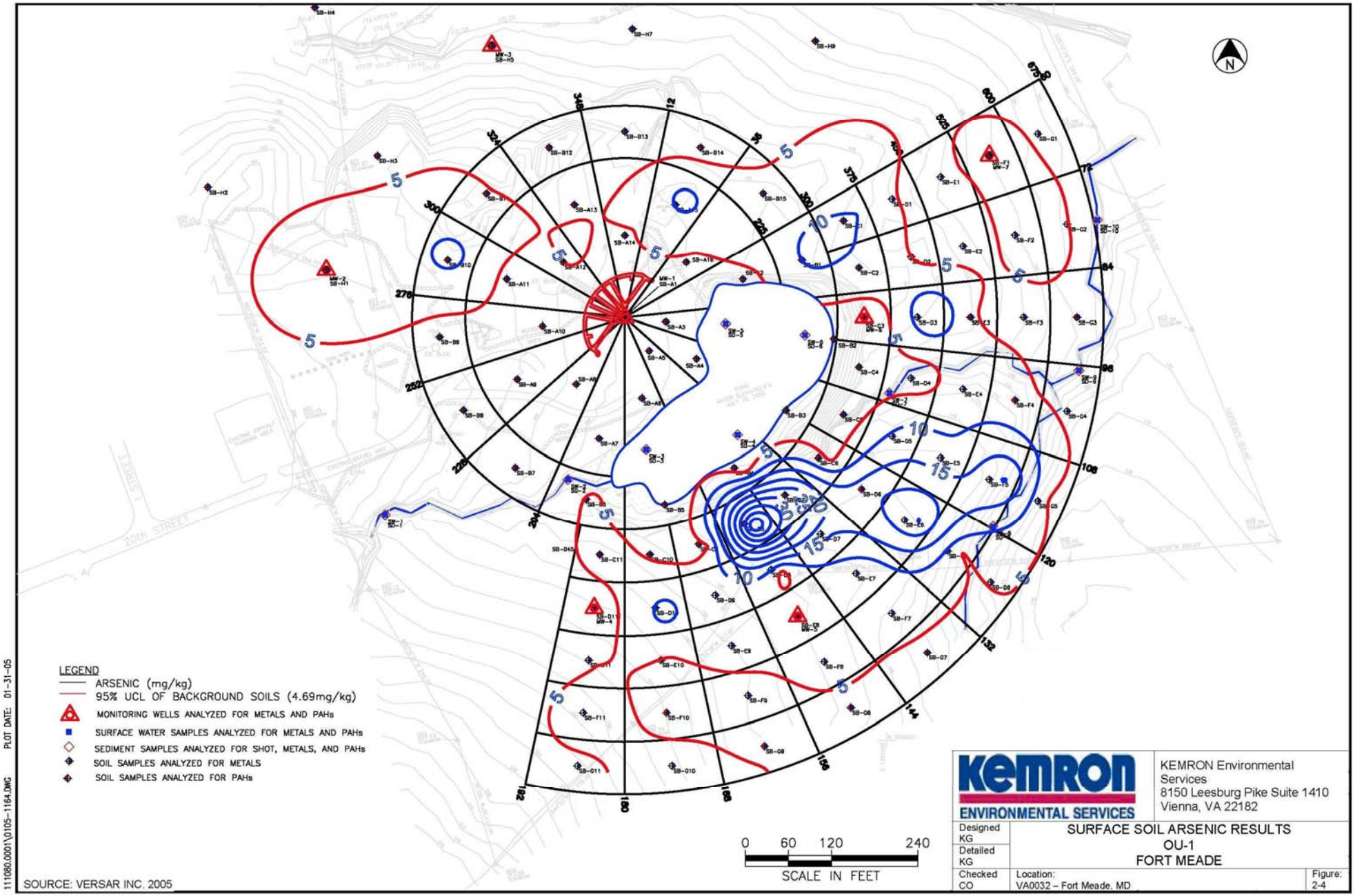

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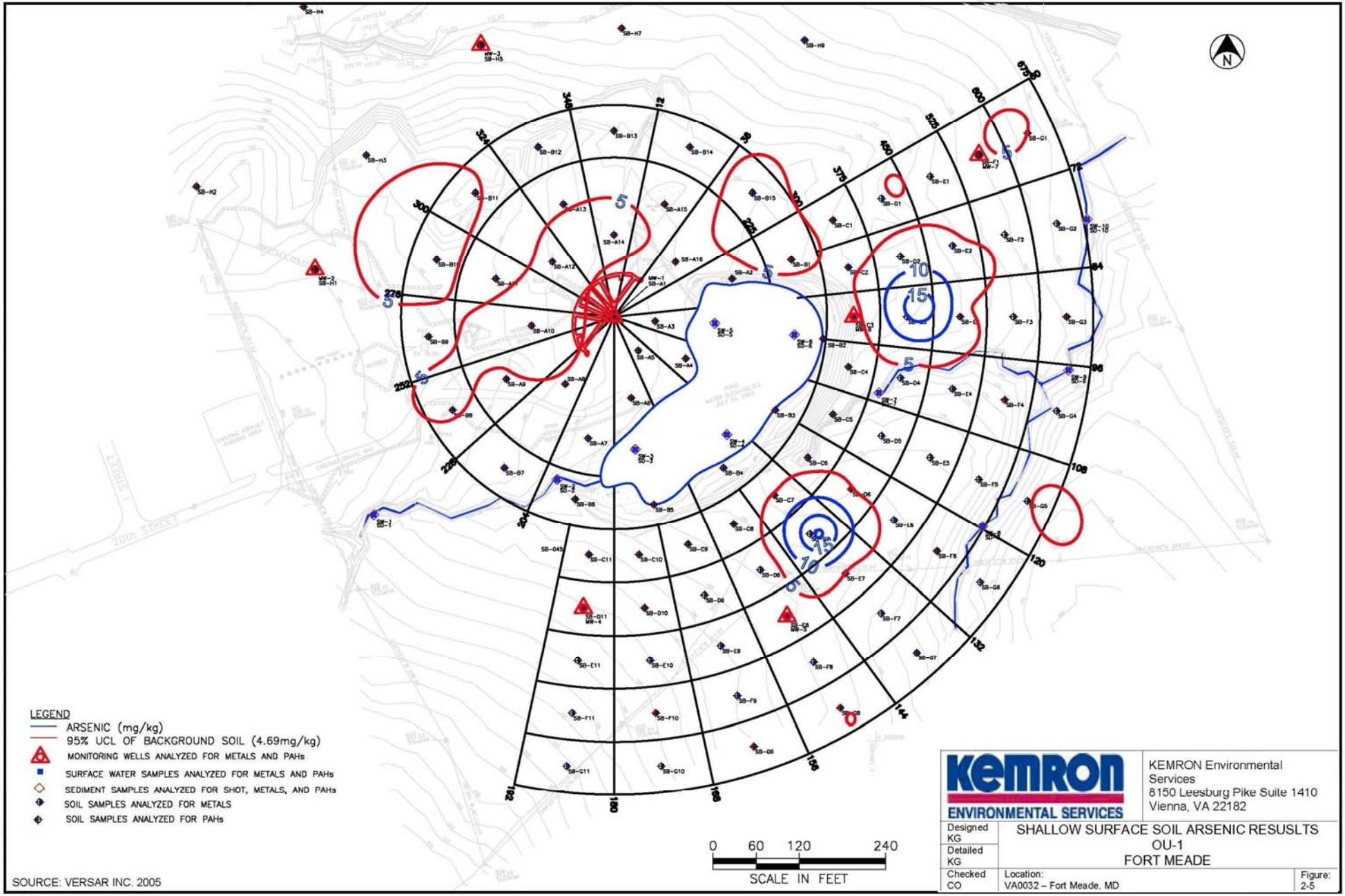
Designed KG	SURFACE SOIL ARSENIC RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-4


LEGEND
ARSENIC (mg/kg)
95% UCL OF BACKGROUND SOIL (4.69mg/kg)
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
0 60 120 240
SCALE IN FEET
N
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Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SHALLOW SURFACE SOIL ARSENIC RESUSLTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-5
PLOT DATE: 01-31-05
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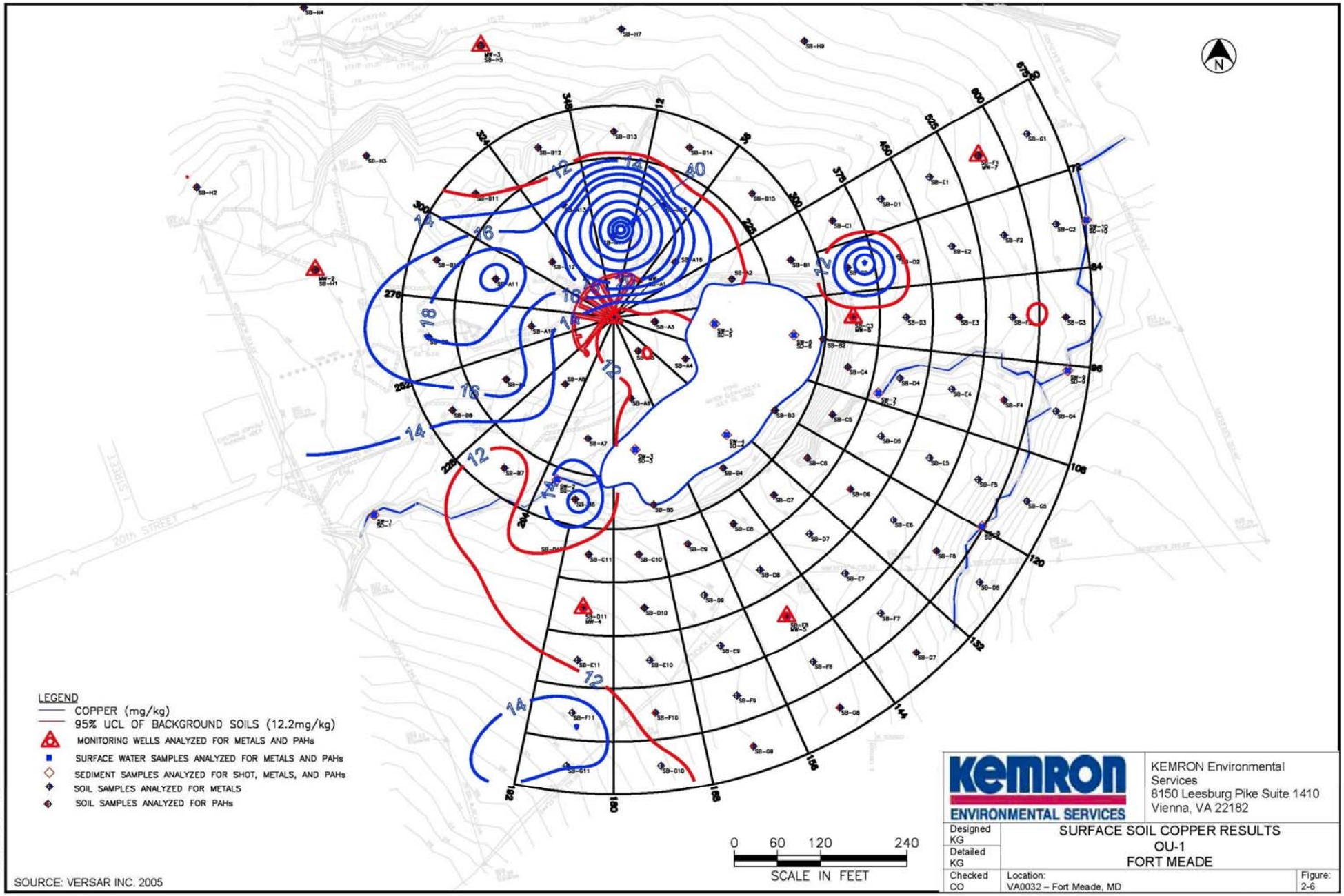
LEGEND
COPPER (mg/kg)
95% UCL OF BACKGROUND SOILS (12.2mg/kg)
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
0 60 120 240
SCALE IN FEET
N
20th STREET
KEMRON ENVIRONMENTAL SERVICES
KEMRON Environmental Services
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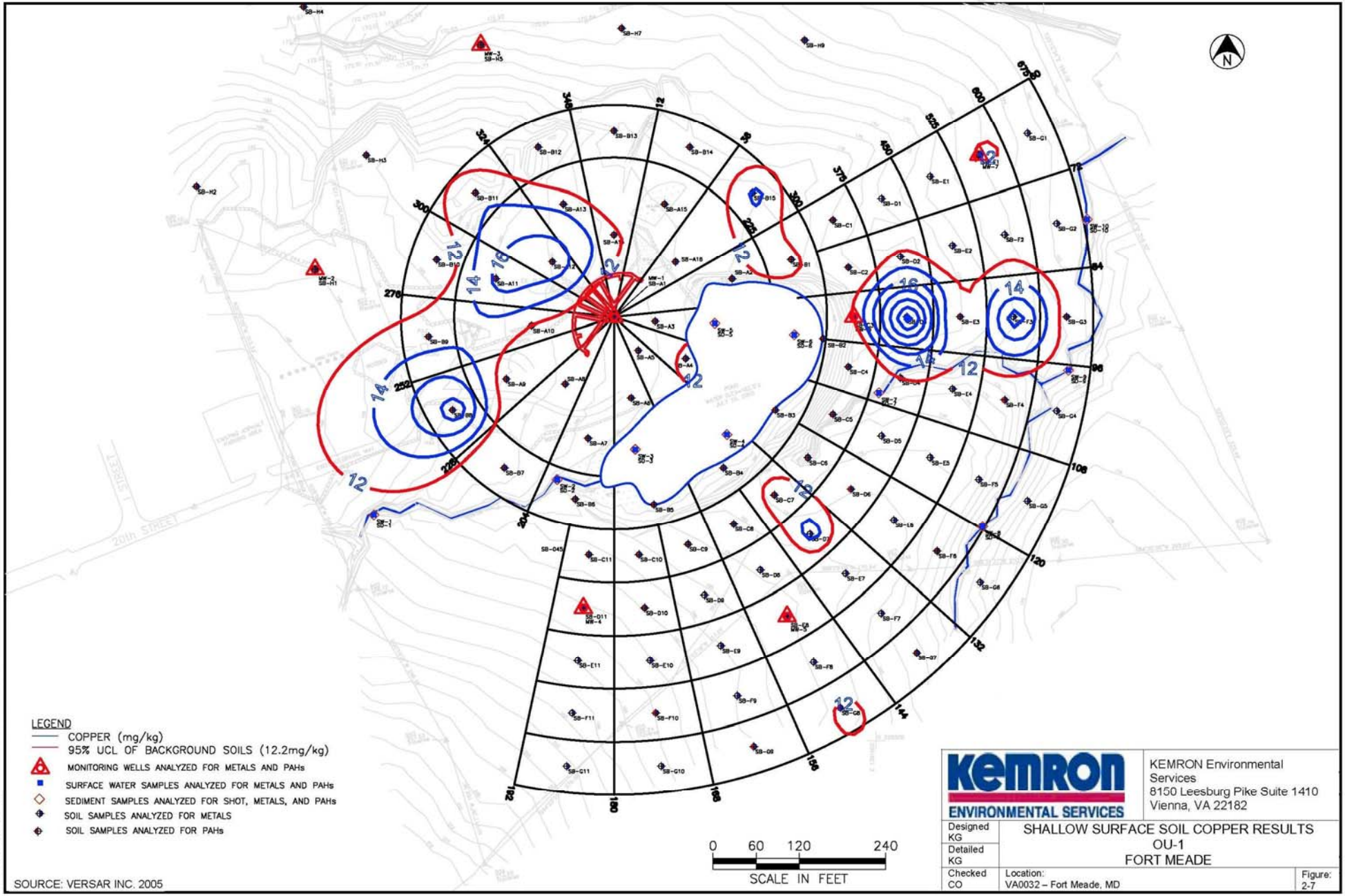
Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SURFACE SOIL COPPER RESULTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-6
111080.0001\0105-166.DWG PLOT DATE: 01-31-05


LEGEND
COPPER (mg/kg)
95% UCL OF BACKGROUND SOILS (12.2mg/kg)
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
0 60 120 240
SCALE IN FEET
N
20th STREET
KEMRON
ENVIRONMENTAL SERVICES
KEMRON Environmental Services
8150 Leesburg Pike Suite 1410
Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SHALLOW SURFACE SOIL COPPER RESULTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-7
PLOT DATE: 01-31-05
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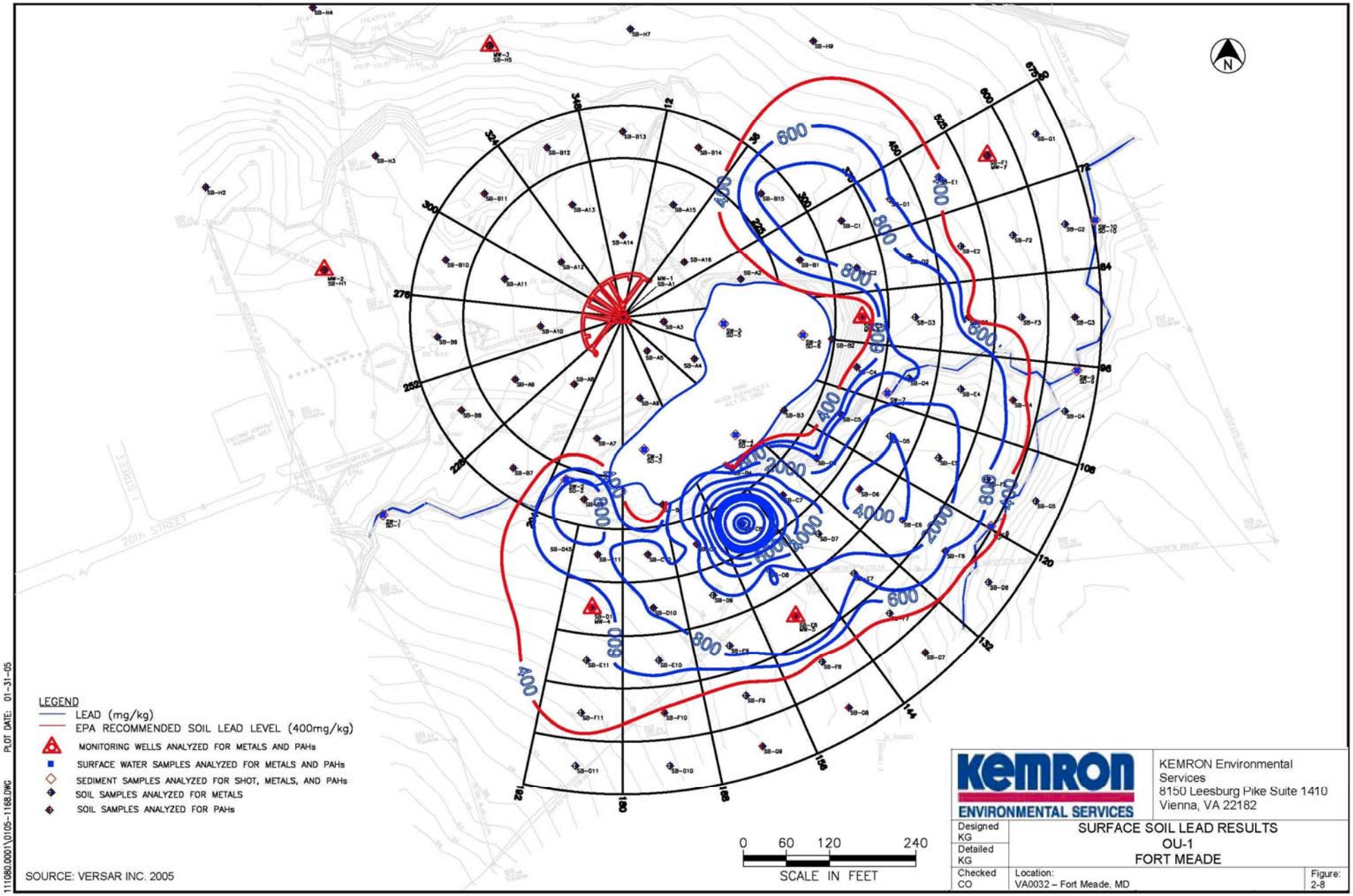

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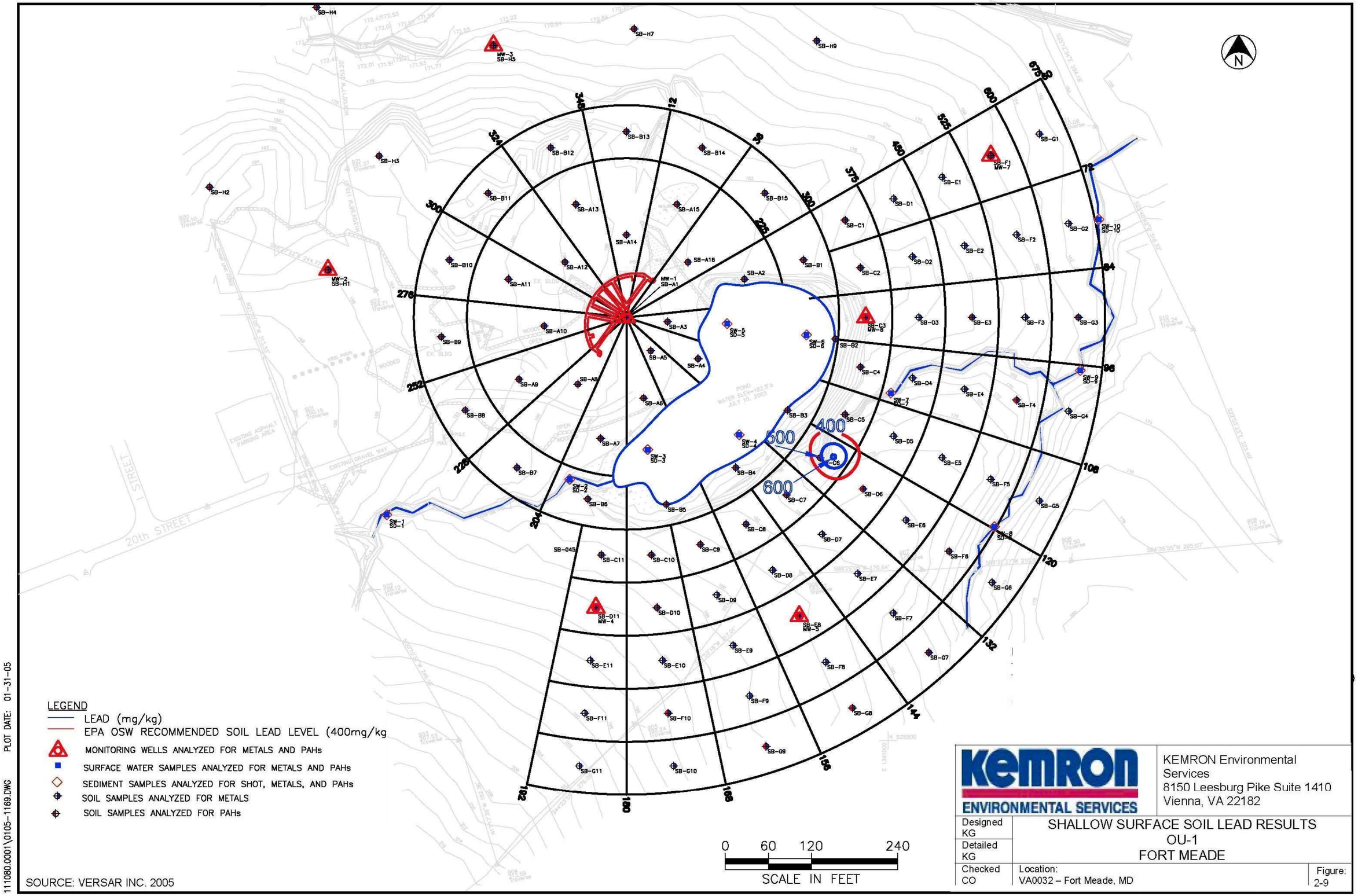
Designed KG	SURFACE SOIL LEAD RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-8

111080.0001\0105-1168.DWG PLOT DATE: 01-31-05



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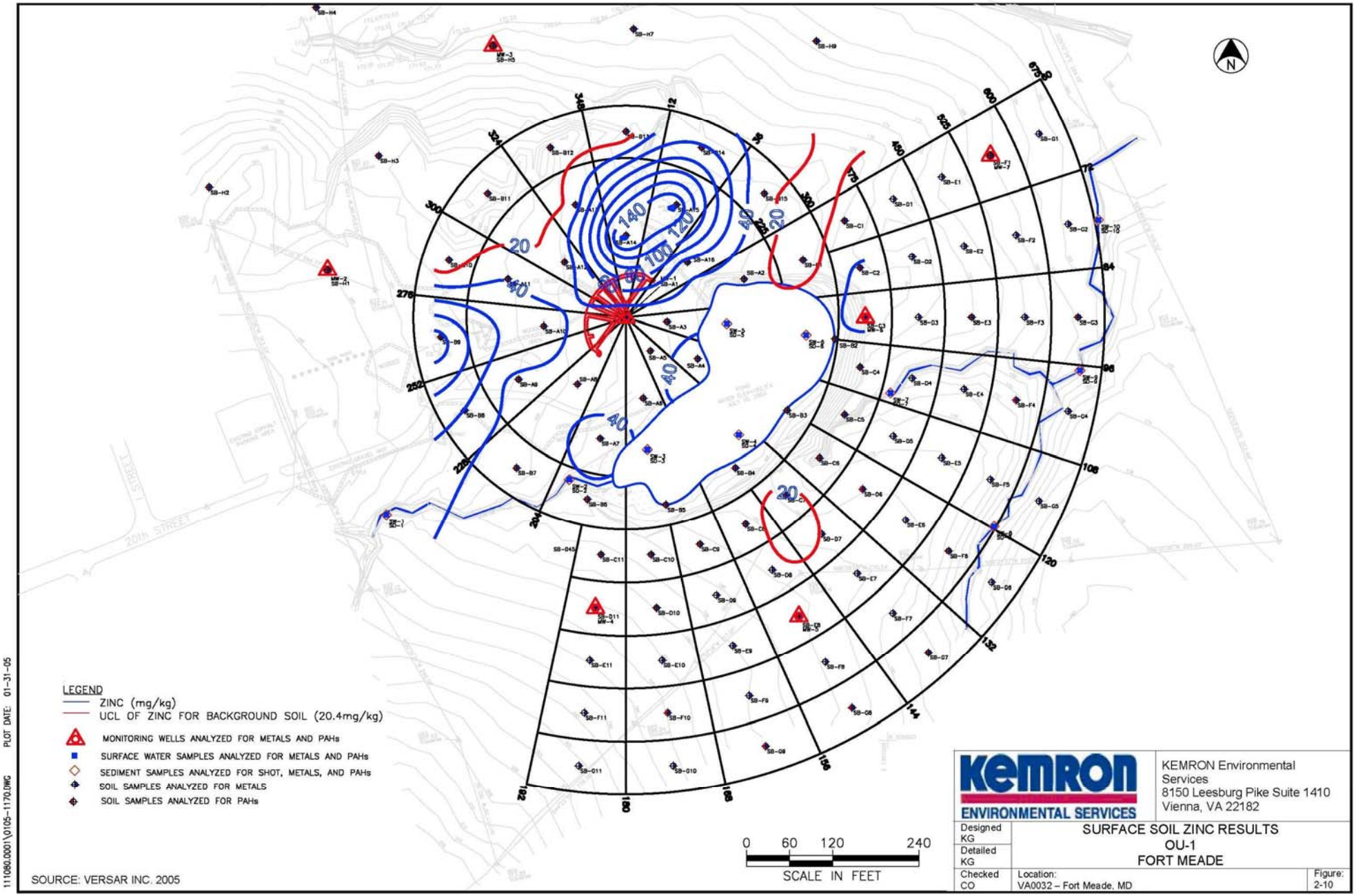
Designed KG	SHALLOW SURFACE SOIL LEAD RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-9



SOURCE: VERSAR INC. 2005

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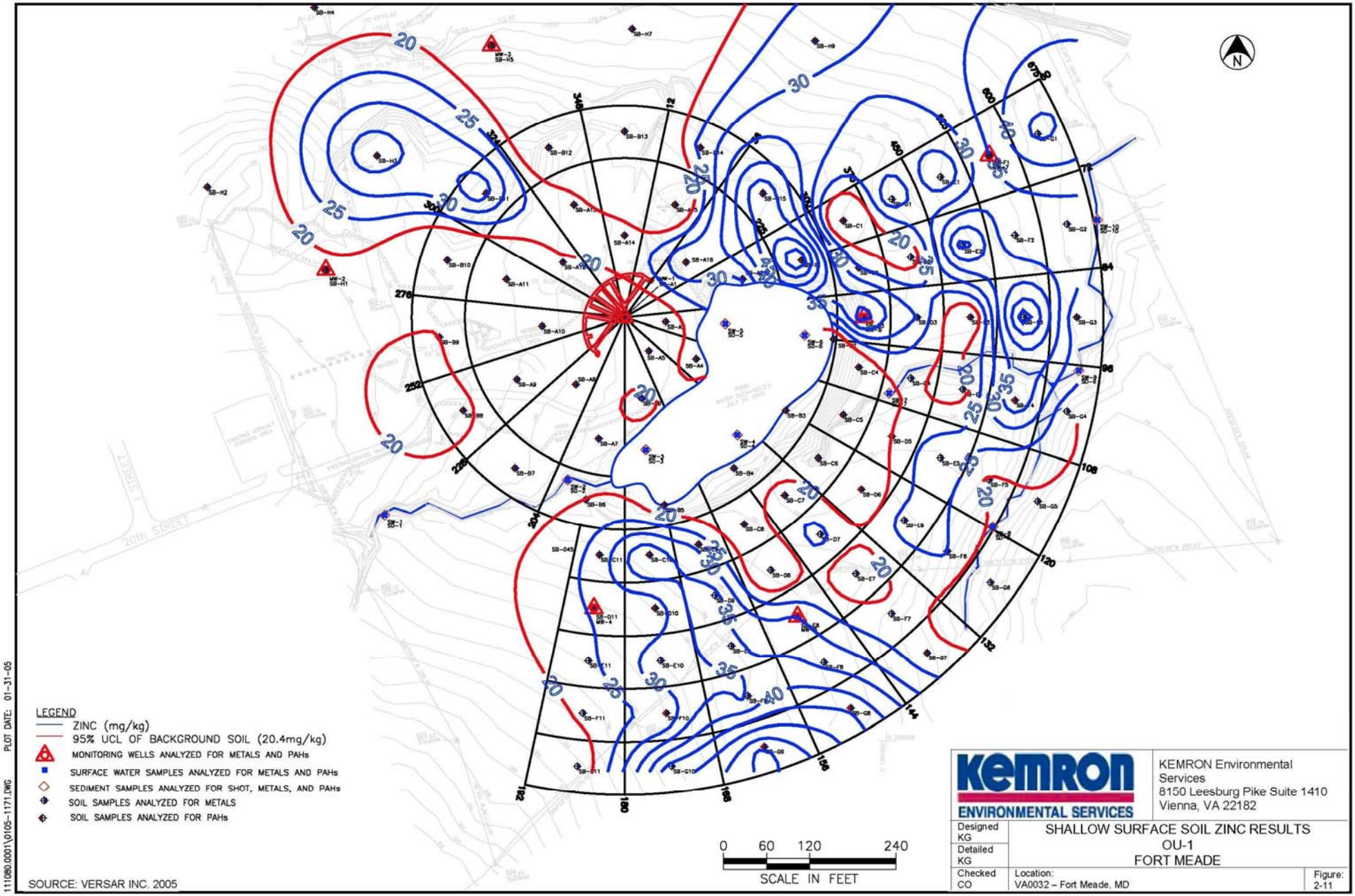
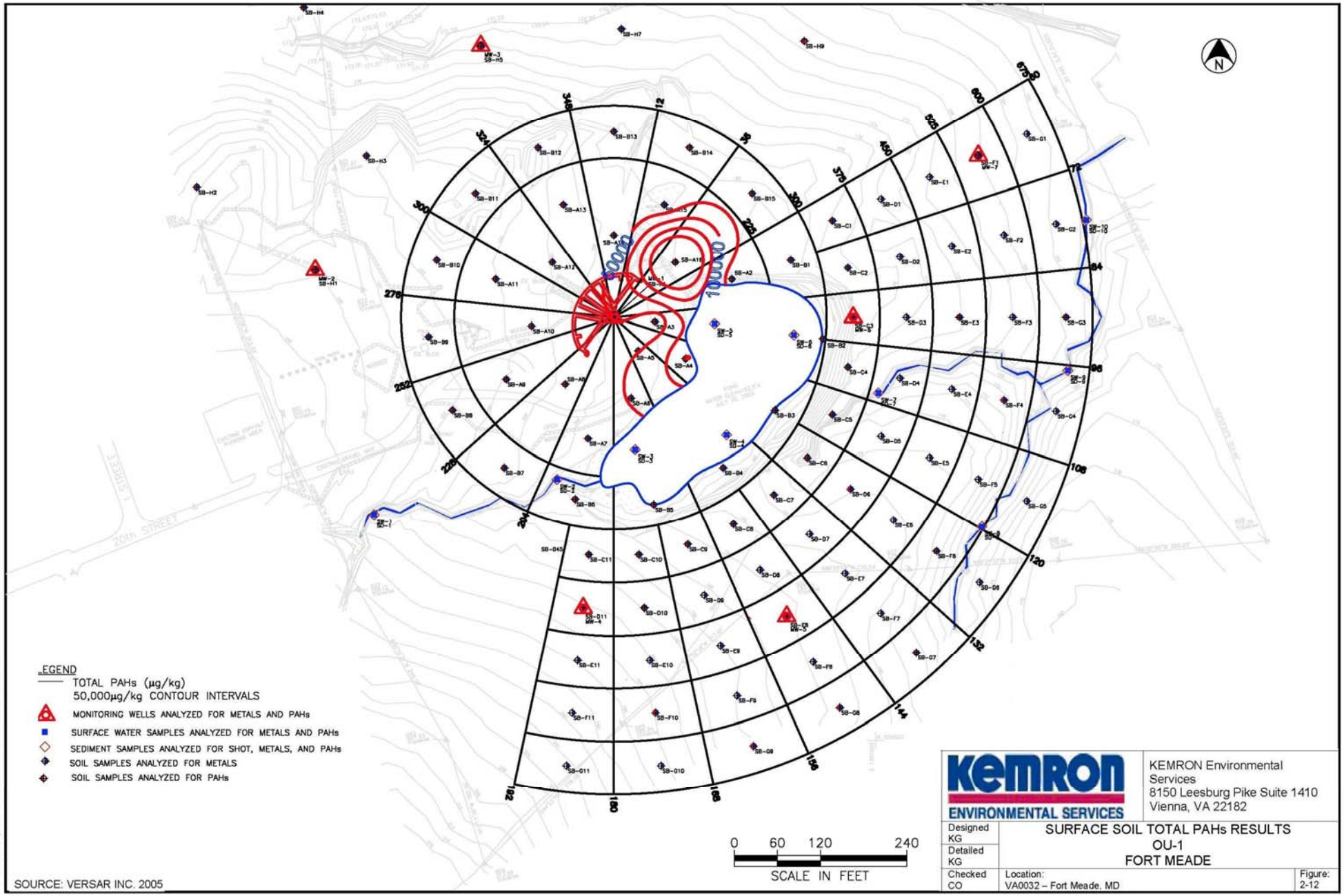
Designed KG	SURFACE SOIL ZINC RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-10

111080.0001\0105-1170.DWG PLOT DATE: 01-31-05


LEGEND
ZINC (mg/kg)
95% UCL OF BACKGROUND SOIL (20.4mg/kg)
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
0 60 120 240
SCALE IN FEET
N
KEMRON
ENVIRONMENTAL SERVICES
KEMRON Environmental Services
8150 Leesburg Pike Suite 1410
Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SHALLOW SURFACE SOIL ZINC RESULTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-11
111080.0001\0105-1171.DWG PLOT DATE: 01-31-05



SOURCE: VERSAR INC. 2005

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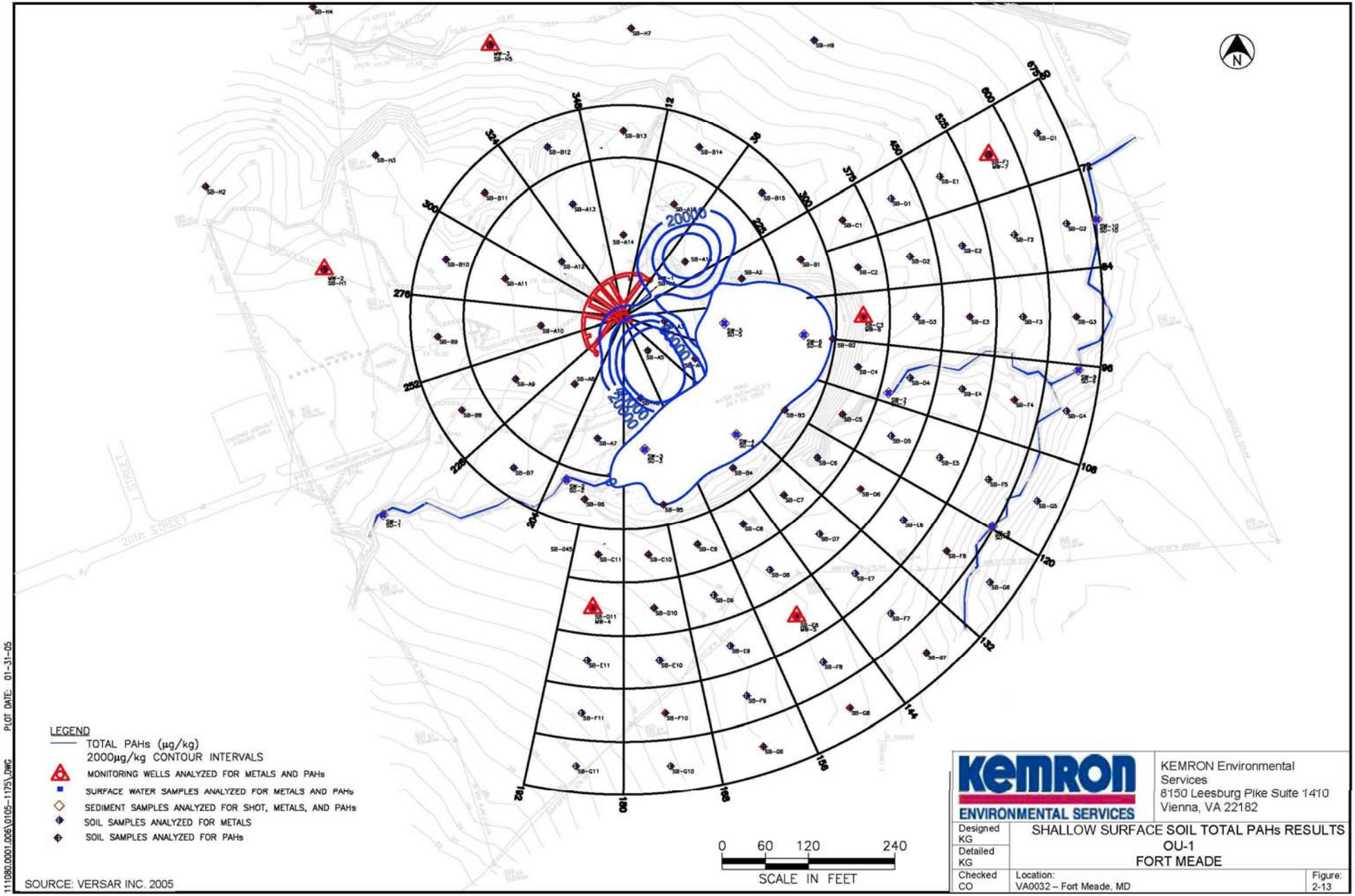
Designed KG	SURFACE SOIL TOTAL PAHs RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-12

111080.0001\0105-1174.DWG PLOT DATE: 01-31-05



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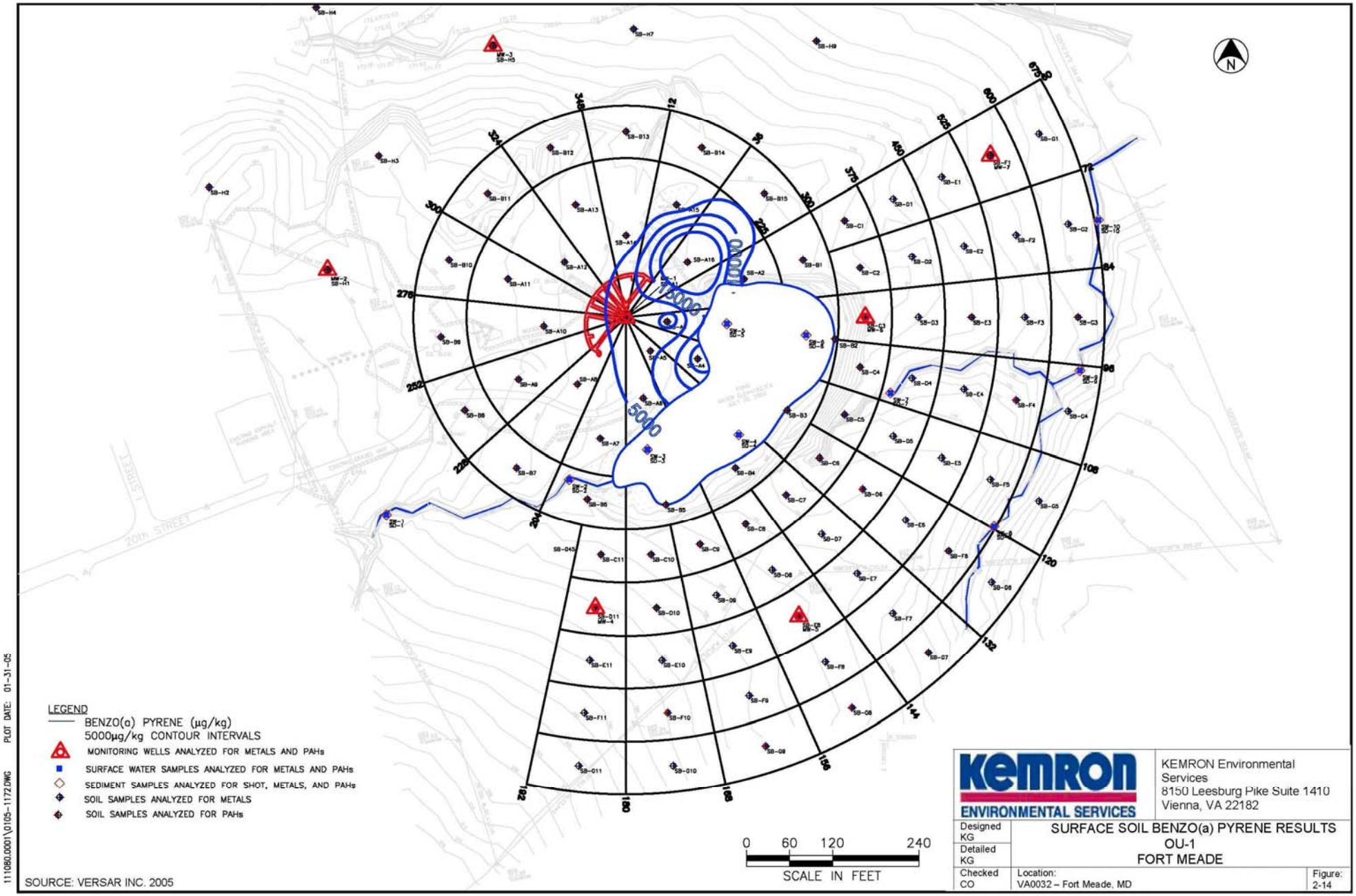
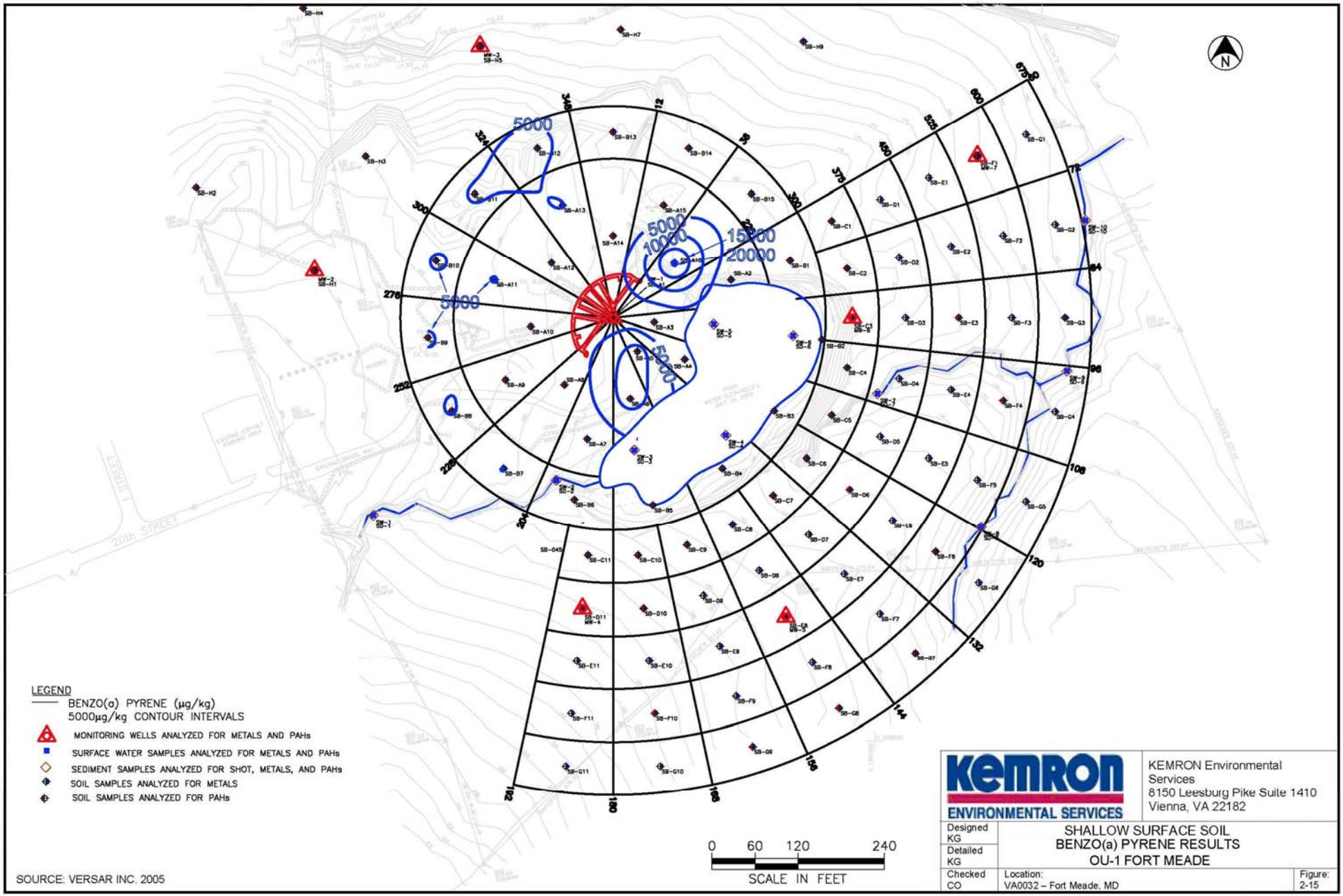
Designed KG	SHALLOW SURFACE SOIL TOTAL PAHs RESULTS OU-1 FORT MEADE	
Detailed KG		
Checked CO	Location: VA0032 – Fort Meade, MD	Figure: 2-13

111080.0001.0061\0105-1175\.DWG PLOT DATE: 01-31-05


N
15000
5000
20th STREET
0 60 120 240
SCALE IN FEET
LEGEND
BENZO(a) PYRENE (µg/kg)
5000µg/kg CONTOUR INTERVALS
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
KEMRON ENVIRONMENTAL SERVICES
KEMRON Environmental Services
8150 Leesburg Pike Suite 1410
Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SURFACE SOIL BENZO(a) PYRENE RESULTS
OU-1
FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-14
111080.0001\0105-1172.DWG PLOT DATE: 01-31-05


5000
5000
10000
15000
20000
5000
N
LEGEND
BENZO(a) PYRENE (µg/kg)
5000µg/kg CONTOUR INTERVALS
MONITORING WELLS ANALYZED FOR METALS AND PAHs
SURFACE WATER SAMPLES ANALYZED FOR METALS AND PAHs
SEDIMENT SAMPLES ANALYZED FOR SHOT, METALS, AND PAHs
SOIL SAMPLES ANALYZED FOR METALS
SOIL SAMPLES ANALYZED FOR PAHs
SOURCE: VERSAR INC. 2005
0 60 120 240
SCALE IN FEET
KEMRON
ENVIRONMENTAL SERVICES
KEMRON Environmental Services
8150 Leesburg Pike Suite 1410
Vienna, VA 22182
Designed KG
Detailed KG
Checked CO
SHALLOW SURFACE SOIL
BENZO(a) PYRENE RESULTS
OU-1 FORT MEADE
Location: VA0032 – Fort Meade, MD
Figure: 2-15
111080.0001\0105-1173.DWG PLOT DATE: 01-31-05

APPENDIX A

FGGM-87 Draft Data Report Results (Versar, 2005)

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A1			FGGM83-SB-A2			FGGM83-SB-A3			FGGM83SB-A4			FGGM83-SB-A5		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			0.12			0.012			0			0.015		
Area Count	counts/ft2	0			293			31.1			0			36		
Volume Count	counts/ft3	0			585			62.1			0			71.9		
Total Mass	g	0			3.8			0.38			0			0.54		
Solids	%	98			96			93.4			97.3			96.3		
Metals																
Antimony	mg/kg	0.97	U	UL	1	U	UL	1.1	B	L	0.99	U	UL	0.78	B	L
Arsenic	mg/kg	3			4.5			3.2			2.6			3.7		
Copper	mg/kg	10.6		J	12.1		J	11		J	12.3		J	12.1		J
Lead	mg/kg	20.5			242			94.4			135			84.2		
Zinc	mg/kg	22.3			26.1			24.3			60.1			24		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.1	U	R	1.1	U	UL	1.1	U	R	1.2	U	R	1	U	R
Arsenic	mg/kg	2.8			4.8			2.9			4.8			2.9		
Copper	mg/kg	7.9			11.4		J	8.5			13.9			7		
Lead	mg/kg	50.3			46			14.8			8.1			36.6		
Zinc	mg/kg	12.3			29			14.1			23.4			9.8		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A6			FGGM83-SB-A7			FGGM83-SB-A8			FGGM83-SB-A9			FGGM83-SB-A9 DUP		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			0.009			0			0			NA		
Area Count	counts/ft2	0			31.6			0			0			NA		
Volume Count	counts/ft3	0			63			0			0			NA		
Total Mass	g	0			0.27			0			0			NA		
Solids	%	93.6			91.5			92.4			97.2			NA		
Metals																
Antimony	mg/kg	1	U	UL	1	U	UL	1.2	U	UL	0.97	U	UL	1.1	U	
Arsenic	mg/kg	3.3			3.6			4			4.4			4.9		
Copper	mg/kg	11.9		J	12.9		J	13.1		J	17.4		J	12.2		
Lead	mg/kg	24.5			150			26.3			21.7			20.1		
Zinc	mg/kg	35.9			49.7			33.8			33.1			31.8		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.1	U	R	1.1	U	R	1.1	U	R	1.1	U	R	NA		
Arsenic	mg/kg	2.5			3.6			4.8			4.7			NA		
Copper	mg/kg	10			10			8.6			9.9			NA		
Lead	mg/kg	14.1			21.3			7.8			13.6			NA		
Zinc	mg/kg	22.8			17.2			14.4			14.9			NA		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A10			FGGM83-SB-A11			FGGM83-SB-A12			FGGM83-SB-A13			FGGM83-SB-A13 DUP		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			0			0			0			NA		
Area Count	counts/ft2	0			0			0			0			NA		
Volume Count	counts/ft3	0			0			0			0			NA		
Total Mass	g	0			0			0			0			NA		
Solids	%	91.9			96.2			96.6			92.2			NA		
Metals																
Antimony	mg/kg	1.1	U	UL	1.1	U	UL	1	U	UL	1.1	U	UL	NA		
Arsenic	mg/kg	3.6			3.6			5.3			4.8			NA		
Copper	mg/kg	14.5		J	21.3		J	16.3		J	15		J	NA		
Lead	mg/kg	45.2			14.4			18.6			23.1			NA		
Zinc	mg/kg	53.7			42.2			19.3			23.7			NA		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.2	U	R	1.1	U	R	1.1	U	R	1.2	U	UL	1.2	U	UL
Arsenic	mg/kg	9.7			1.3			5.7			4.3			7.9		
Copper	mg/kg	11.5			17			17.3			13.4		J	13.3		J
Lead	mg/kg	9.7			3.5			10.1			16.9			27.4		
Zinc	mg/kg	2.7			7.8			18.9			22.8		J	23		J
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A14			FGGM83-SB-A14 DUP			FGGM83-SB-A15			FGGM83-SB-A16			FGGM83-SB-B1		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			NA			0			0.036			0.013		
Area Count	counts/ft2	0			NA			0			89.4			78.2		
Volume Count	counts/ft3	0			NA			0			178			156		
Total Mass	g	0			NA			0			1			0.5		
Solids	%	95.3			NA			95.2			97.1			97.2		
Metals																
Antimony	mg/kg	0.97	U	UL	NA			2	U	UL	0.97	U	UL	8.8		L
Arsenic	mg/kg	4.9			NA			11.7			4.4			11.7		
Copper	mg/kg	42.2		J	NA			14.3		J	16.7		J	9.5		J
Lead	mg/kg	56.3			NA			118			111			776		
Zinc	mg/kg	164			NA			51.9			47.4			10.2		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.1	U	R	1.1	U	R	1.1	U	R	1.1	U	R	1.1	U	R
Arsenic	mg/kg	6.3			6.9			3.5			4.8			6.7		
Copper	mg/kg	12.4			8.9			7.1			8.9			13.1		
Lead	mg/kg	10			7.8			5.7			10.9			26.3		
Zinc	mg/kg	24			13.9			5.1			35.3			61.7		

NA - Denotes that sample was not analyzed for that constituent

Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)

LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)

B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)

J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision

L - Review of lab QA/QC analysis indicates a potential for low bias in the results

R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data

U - Denotes that constituent was not detected and the value is the RL

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-B2			FGGM83-SB-B3			FGGM83-SB-B4			FGGM83-SB-B4 DUP			FGGM83-SB-B5		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.089			0.075			0.41			0.27			0.054		
Area Count	counts/ft2	205			289			1140			801			250		
Volume Count	counts/ft3	408			578			2280			1600			490		J
Total Mass	g	3.6			3.6			15.4			10.2			2.7		
Solids	%	94.6			97.2			98.8			99.4			94.4		
Metals																
Antimony	mg/kg	1.2	U	UL	0.92	B	L	0.96	U	UL	0.74	B		1	U	UJ
Arsenic	mg/kg	1.5			1.1			2.3			2.2			1.1		J
Copper	mg/kg	8.8		J	7.5		J	6			5.8			6.2		
Lead	mg/kg	154			134			249			242			118		
Zinc	mg/kg	35.4			10.5			11.5		J	5.7			16.4		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.1	U	UL	1.1	U	UL	1.1	U	UL	NA			1.1	U	UL
Arsenic	mg/kg	0.7	B		0.96	B		3.1			NA			0.78	B	
Copper	mg/kg	5.1		BJ	6.1		J	9.9		J	NA			7.1		J
Lead	mg/kg	52			276			37.4			NA			21.9		
Zinc	mg/kg	12			9.6			4.6			NA			16.2		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-B6			FGGM83-SB-B7			FGGM83-SB-B8			FGGM83-SB-B9			FGGM83-SB-B10		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.097			0.011			0			0.0003			0		
Area Count	counts/ft2	176			37.1			0			33			0		
Volume Count	counts/ft3	351			74			0			65.8			0		UJ
Total Mass	g	1.9			0.41			0			0.09			0		
Solids	%	81.8			94.5			92			96			98.6		
Metals																
Antimony	mg/kg	2.6		L	1.2	U	UL	1	U	UL	1.1	U	UL	0.99	U	UL
Arsenic	mg/kg	5.4			1.3			3.1			3.2			11.6		
Copper	mg/kg	17.3		J	10.2			14.5			18.1			16.3		
Lead	mg/kg	1220			45.3			22.6			42			54		J
Zinc	mg/kg	34.7			24		J	227		J	115		J	7.6		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.3	U	UL	1.1	U	UL	1	U	UL	1.1	U	R	1.1	U	R
Arsenic	mg/kg	2.4			0.92	B		6			4			8.8		
Copper	mg/kg	9.3		J	5.9		J	19.4			13.2			10.2		
Lead	mg/kg	96.4			5.4			17.9		L	9.5			8		
Zinc	mg/kg	20		J	15.9		UJ	22.1			21.5			5.2		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-B11			FGGM83-SB-B11 DUP			FGGM83-SB-B12			FGGM83-SB-B12 DUP			FGGM83-SB-B13		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			NA			0			NA			0		
Area Count	counts/ft2	0			NA			0			NA			0		
Volume Count	counts/ft3	0		UJ	NA			0		UJ	NA			0		UJ
Total Mass	g	0			NA			0			NA			0		
Solids	%	99			NA			99.1			NA			99.3		
Metals																
Antimony	mg/kg	0.99	U	UL	NA			1	U	UL	NA			0.98	U	UL
Arsenic	mg/kg	4.9			NA			2.2			NA			1		
Copper	mg/kg	10.9			NA			8.6			NA			5.1		
Lead	mg/kg	16.5		J	NA			14.2		J	NA			8.3		J
Zinc	mg/kg	15.7			NA			11.5			NA			6.3		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.2	U	UL	1.3	U	UL	1.1	U	UL	0.77	U		1.2	U	UL
Arsenic	mg/kg	5.3			4.7			1.9			1.7			1.6		
Copper	mg/kg	13.7		J	10.8		J	8.4			8.6			5.9		J
Lead	mg/kg	12.9			15.6			10.3			8.6			6.4		
Zinc	mg/kg	39.2		J	28		J	9.7			9.4			4.4		J
								NA - Denotes that sample was not analyzed for that constituent								
								Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)								
								LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)								
								B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrume								
								J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a								
								L - Review of lab QA/QC analysis indicates a potential for low bias in the results								
								R - Denotes data do not meet validation criteria and are unusable for risk assessment o								
								U - Denotes that constituent was not detected and the value is the RL								

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-B14			FGGM83-SB-B15			FGGM83-SB-B15 DUP			FGGM83-SB-C1			FGGM83-SB-C2		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			0.033			0.02			0.25			0.24		
Area Count	counts/ft2	0			160			120			510			960		
Volume Count	counts/ft3	0		UJ	320		J	240			1000		J	1900		J
Total Mass	g	0			1.3			0.79			5.1			9.7		
Solids	%	99.1			98.5			98.8			96.9			98.2		
Metals																
Antimony	mg/kg	0.99	U	UL	1.9		UL	3.1			2.3		UL	2.7		UL
Arsenic	mg/kg	1.9			5.8			6.7			10.1			8.8		
Copper	mg/kg	6.7			9.4			9.6			7.6			20.4		
Lead	mg/kg	12.9		J	881		J	559			1060		J	948		J
Zinc	mg/kg	10.9			23.3			23			14			44.6		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1	U	UL	1.1	U	UL	NA			1	U	UL	1.1	U	R
Arsenic	mg/kg	3.6			5.8			NA			2			4.1		
Copper	mg/kg	8.1		J	14.7		J	NA			4			8.5		
Lead	mg/kg	9			128			NA			2.7		L	10.4		
Zinc	mg/kg	25.4		J	49.1		J	NA			6.5			25		

NA - Denotes that sample was not analyzed for that constituent

Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)

LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)

nt detection limit (IDL)

B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)

lack of precision

J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision

L - Review of lab QA/QC analysis indicates a potential for low bias in the results

r compliance data

R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data

U - Denotes that constituent was not detected and the value is the RL

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-C3			FGGM83-SB-C4			FGGM83-SB-C4 DUP			FGGM83-SB-C5			FGGM83-SB-C6		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.025			0.19			NA			0.99			0.34		
Area Count	counts/ft2	41			630			NA			2400			840		
Volume Count	counts/ft3	83		J	1300		J	NA			4800		J	1700		J
Total Mass	g	1			6.9			NA			32			8.9		
Solids	%	98.7			99.4			NA			99.4			99.4		
Metals																
Antimony	mg/kg	0.99	U	UL	1	U	UL	1.2	U	R	0.98	U	UL	3.2		UL
Arsenic	mg/kg	2.8			3			4.9			3.8			4		
Copper	mg/kg	10.9			7.1			11.9			7.8			6.1		
Lead	mg/kg	142		J	487		J	145			717		J	688		J
Zinc	mg/kg	46			9.7			24.5			18.9			9.4		
Shallow Subsurface Soils (0.5-1.5')																
Metals																
Antimony	mg/kg	1.2	U	R	1	U	R	1.1	U	R	1.2	U	UL	1.5	U	UL
Arsenic	mg/kg	5.6			2.9			4.1			3.7			2.8		
Copper	mg/kg	12.7			6.6			9.9			10.3			8.5		
Lead	mg/kg	33.2			112			264			172			625		
Zinc	mg/kg	44			13.4			19.9			17.9			14.3		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1A Soil Sampling Results, Metals and Shot Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-C7			FGGM83-SB-C8			FGGM83-SB-C9			FGGM83-SB-C10			FGGM83-SB-C10 DUP			FGGM83-SB-C11		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																			
Lead Shot																			
Percent Lead Shot	%	0.23			0.057			0.08			0.05			0.12			0.1		
Area Count	counts/ft2	1000			160			180			190			410			380		
Volume Count	counts/ft3	2000		J	310		J	360		J	380		J	830			760		J
Total Mass	g	8.7			1.8			1.6			1.6			3.6			3.5		
Solids	%	98.8			97.9			92.3			95.4			94.4			93.4		
Metals																			
Antimony	mg/kg	20.9		UL	457	UL		1.6		UL	4		J	NA			7.2		J
Arsenic	mg/kg	28.8			50.5			4.9			4.4		J	NA			6.5		J
Copper	mg/kg	11.8			9.9			11.4			9.2			NA			9.4		
Lead	mg/kg	4800		J	22800	J		1140		J	1170			NA			763		
Zinc	mg/kg	25.9			16.8			22			20.4			NA			22.4		
Shallow Subsurface Soils (0.5-1.5')																			
Metals																			
Antimony	mg/kg	1.3	U	UL	1.1	U	UL	1.1	U	R	1.2	U	R	NA			1.2	U	UL
Arsenic	mg/kg	5.6			1.9			2.8			4.3			NA			3.4		
Copper	mg/kg	14.3		J	6.2		J	9.9			12.5			NA			8.5		
Lead	mg/kg	56.8			7.8			24.3			12.4			NA			135		
Zinc	mg/kg	25.9			16.1			30.3			41.2			NA			26.5		
		NA - Denotes that sample was not analyzed for that constituent																	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results																	
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-D1			FGGM83-SB-D2			FGGM83-SB-D3			FGGM83-SB-D4			FGGM83-SB-D4 DUP		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.066			0.15			0.23			0.32			0.27		
Area Count	counts/ft2	220			450			740			1000			860		
Volume Count	counts/ft3	440		J	890		J	1500		J	2100		J	1700		
Total Mass	g	2.4			4.5			6.6			12			10		
Solids	%	99.2			99.1			98.2			98.2			99.6		
Metals																
Antimony	mg/kg	2.2		B	1	U	UJ	14.9		J	0.73	B	B	1.2	U	
Arsenic	mg/kg	4.2		J	3		J	15.1		J	2.9		J	3.1		
Copper	mg/kg	5.9			9.2			10.4			6.3			6.2		
Lead	mg/kg	562			703			1970			594			631		
Zinc	mg/kg	13.8			22.7			33.6			10.7			11.1		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.2	U	UL	1.1	U	R	1.1	U	R	0.84	U	UL	NA		
Arsenic	mg/kg	5.5			5.7			19.4			3.7			NA		
Copper	mg/kg	11.7			12.9			25.3			11.9		J	NA		
Lead	mg/kg	9.9		L	9.2			75			276			NA		
Zinc	mg/kg	35			14.8			30.3			21.4			NA		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-D5			FGGM83-SB-D5 DUP			FGGM83-SB-D6			FGGM83-SB-D6 DUP			FGGM83-SB-D7		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	1			NA			2.5			NA			1.3		
Area Count	counts/ft2	2000			NA			4800			NA			3000		
Volume Count	counts/ft3	4000		J	NA			9700		J	NA			6000		J
Total Mass	g	26			NA			59			NA			38		
Solids	%	95.2			NA			87.5			NA			95.1		
Metals																
Antimony	mg/kg	10		J	NA			19		J	NA			15		J
Arsenic	mg/kg	11.9		J	NA			19		J	NA			14.6		J
Copper	mg/kg	8.7			NA			10.3			NA			9.2		
Lead	mg/kg	4020			NA			4880			NA			3550		
Zinc	mg/kg	21.5			NA			26.5			NA			21.5		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.2	U	UL	1.2	U	UL	1.1	U	UL	1.2	U	UL	1.2	U	UL
Arsenic	mg/kg	4.6			3.9			3.6			5.1			21.6		
Copper	mg/kg	9.9		J	8.6		J	8		J	8.7		J	15.2		J
Lead	mg/kg	324			140			147			126			271		
Zinc	mg/kg	19.8			12.4			12.4			17.9			27.4		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-D8			FGGM83-SB-D9			FGGM83-SB-D10			FGGM83-SB-D11			FGGM83-SB-E1		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.28			0.052			0.067			0.052			0.11		
Area Count	counts/ft2	790			160			270			130			300		
Volume Count	counts/ft3	1600		J	320		J	530		J	250		J	610		J
Total Mass	g	9.4			1.7			2.5			1.6			3		
Solids	%	93.3			91.8			96.2			98.3			98.1		
Metals																
Antimony	mg/kg	2		B	8.7		J	11.2		J	1	U	UJ	1.9		B
Arsenic	mg/kg	4.2		J	6.9		J	11.8		J	2.8		J	4.9		J
Copper	mg/kg	9.4			9.1			9.3			9.1			10.4		
Lead	mg/kg	716			1570			833			447			397		
Zinc	mg/kg	20.6			21.1			23			20.4			36.9		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.1	U	UL	1.2	U	R	1.1	U	UL	NA			1.1	U	UL
Arsenic	mg/kg	1.9			3.3			2			NA			2.6		
Copper	mg/kg	5.6		BJ	10.1			7.3		J	NA			7		
Lead	mg/kg	33.4			13.6			21.8			NA			17.6		L
Zinc	mg/kg	11.6			38.8			24.2		J	NA			19.2		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-E2			FGGM83-SB-E3			FGGM83-SB-E4			FGGM83-SB-E5			FGGM83-SB-E6		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.019			0.1			0.11			0.63			0.79		
Area Count	counts/ft2	79			300			330			1500			1300		
Volume Count	counts/ft3	160		J	600		J	650		J	3100		J	2600		J
Total Mass	g	0.74			3.3			3.1			18			16		
Solids	%	99.3			99.8			96.2			98.3			95.5		
Metals																
Antimony	mg/kg	2.5		B	2.6		B	8.9		J	7.8		L	32.1		L
Arsenic	mg/kg	3.6		J	3.8		J	7.9		J	10.7			25.4		
Copper	mg/kg	7.4			7.8			8.9			8.2			10.4		
Lead	mg/kg	272			280			1870			2590			3980		
Zinc	mg/kg	26.2			27.1			21.4			18.9			27		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.1	U	UL	1.1	U	UL	1.1	U	UL	1.1	U	R	1.2	U	R
Arsenic	mg/kg	4.6			4.4			2.7			3.5			2.4		
Copper	mg/kg	8.5			9.6			10.1		J	7.5			5.9		
Lead	mg/kg	8.6		L	5.3		L	19.8			17.5			29.6		
Zinc	mg/kg	48.1			12			16.9			29.8			27.3		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-E7			FGGM83-SB-E7 DUP			FGGM83-SB-E8			FGGM83-SB-E9			FGGM83-SB-E10		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.27			0.64			0.12			0.029			0.074		
Area Count	counts/ft2	810			1900			310			77			220		
Volume Count	counts/ft3	1600		J	3700			620		J	150		J	430		
Total Mass	g	9.7			23			2.9			0.74			2		
Solids	%	99			98.9			99.6			97.4			98.9		
Metals																
Antimony	mg/kg	3.5		L	2.3			8.4		L	4.2		L	0.72	B	BL
Arsenic	mg/kg	5.8			5.7			9			6.3			4.1		
Copper	mg/kg	6.7			7.2			8.3			11.8			9.1		
Lead	mg/kg	815			776			1940			921			681		J
Zinc	mg/kg	14.5			15.5			20.6			29.6			22.9		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.1	U	UL	NA			1.1	U	UL	1.1	U	R	1.1	U	R
Arsenic	mg/kg	2.4			NA			3.5			3.5			3.3		
Copper	mg/kg	7.2		J	NA			9.3		J	9			10		
Lead	mg/kg	7.5			NA			8.8			56.9			18		
Zinc	mg/kg	15.3			NA			31.4			36.3			33.9		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-E11			FGGM83-SB-F1			FGGM83-SB-F2			FGGM83-SB-F2 DUP			FGGM83-SB-F3		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.1			0.028			0.017			NA			0.05		
Area Count	counts/ft2	140			110			59			NA			89		
Volume Count	counts/ft3	270			210		J	120		J	NA			180		J
Total Mass	g	1.9			0.98			0.51			NA			1.1		
Solids	%	90.2			95.9			91.4			NA			92.4		
Metals																
Antimony	mg/kg	1.5		BL	1	U	R	1.6		BL	NA			1.1	U	R
Arsenic	mg/kg	5			5.9			7.6			NA			4.6	U	
Copper	mg/kg	11.9			10.7			9.7			NA			12.8		
Lead	mg/kg	582		J	189			324			NA			314		
Zinc	mg/kg	24.7			26			34.3			NA			38.2		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.1	U	UL	1.1	U	UL	1.1	U	UL	1.1	U	UL	1.1	U	UL
Arsenic	mg/kg	2			5.5			4.8			4.8			4.8		
Copper	mg/kg	6.7		J	12.7			11.1			10.3			19.6		
Lead	mg/kg	14.5			10.7		L	35.5		L	68.1		L	24.8		L
Zinc	mg/kg	23.8		J	35.2			29.6			28.3			54		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-F4			FGGM83-SB-F5			FGGM83-SB-F6			FGGM83-SB-F7			FGGM83-SB-F7 DUP		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.013			0.06			0.087			0.11			0.2		
Area Count	counts/ft2	20			110			150			240			340		
Volume Count	counts/ft3	39		J	220		J	300		J	470		J	730		
Total Mass	g	0.25			1.3			1.8			2.7			5.1		
Solids	%	97.6			92.3			89			91.4			94.5		
Metals																
Antimony	mg/kg	1	U	R	21.7		L	1.1	U	R	1.1	U	R	4.9		
Arsenic	mg/kg	5.5			20.5			4.9			6.3			9.3		
Copper	mg/kg	10.5			10.2			10.2			10.6			10.1		
Lead	mg/kg	483			615			682			449			438		
Zinc	mg/kg	28.8			22			28.4			23			21.1		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.2	U	R	1.1	U	R	1.2	U	R	1.1	U	UL	NA		
Arsenic	mg/kg	4.5			2.5			2.5			2.1			NA		
Copper	mg/kg	10.4			9.3			7.1			9.5		J	NA		
Lead	mg/kg	9.4			23			10.6			11.1			NA		
Zinc	mg/kg	39.7			18.7			25.4			21.4			NA		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-F8			FGGM83-SB-F9			FGGM83-SB-F10			FGGM83-SB-F11			FGGM83-SB-G1		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.017			0.096			0.013			0.034			0.045		
Area Count	counts/ft2	53			220			25			120			140		
Volume Count	counts/ft3	110			440			49			240			290		J
Total Mass	g	0.43			2.6			0.31			0.98			1.6		
Solids	%	98.7			98.7			95.3			86.2			96.3		
Metals																
Antimony	mg/kg	3.1		L	0.99	U	UL	0.81	B	BL	3.6		L	1	U	R
Arsenic	mg/kg	5.5			3.5			4			6.2			3.8		
Copper	mg/kg	10.3			9.1			10.9			16.1			8.8		
Lead	mg/kg	186		J	197		J	359		J	572		J	79.4		
Zinc	mg/kg	42			27.8			29.2			26.8			21.3		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.2	U	UL	1.1	U	R	1	U	UL	0.79	U	UL	1.1	U	UL
Arsenic	mg/kg	2.9			3			2.8			2.1			4.8		
Copper	mg/kg	8.1		J	6.6			6.7		J	6.1		J	10.9		
Lead	mg/kg	63.2			16.6			23.7			7.9			7.3		L
Zinc	mg/kg	34.6			34.7			24.1		J	20.4		J	46.8		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-G2			FGGM83-SB-G3			FGGM83-SB-G4			FGGM83-SB-G4 DUP			FGGM83-SB-G5		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0.005			0			0			0			0.058		
Area Count	counts/ft2	30			0			0			0			71		
Volume Count	counts/ft3	59		J	0		UJ	0		UJ	0			140		J
Total Mass	g	0.16			0			0			0			1.4		
Solids	%	92.9			93			86.2			90.6			87.5		
Metals																
Antimony	mg/kg	1	U	R	1.1	U	R	1.1	U	R	1.6		B	1.1	U	UL
Arsenic	mg/kg	3.9			4			2.8			3.7			3.4		
Copper	mg/kg	11.1			8.5			6.9			7.5			7.9		
Lead	mg/kg	178			77.3			71.8			110			84.7		
Zinc	mg/kg	33.1			14.7			12.9			16.4			14.1		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1.1	U	UL	1.1	U	UL	1.1	U	UL	NA			1.1	U	UL
Arsenic	mg/kg	2.6			2.9			1.9			NA			5.7		
Copper	mg/kg	7.7			10.7			8.2			NA			9.5		
Lead	mg/kg	8		L	8.6		L	4.2			NA			15.8		
Zinc	mg/kg	31.8			25.1			20.6			NA			19.4		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-1B Soil Sampling Results, Metals and Shot Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-G6			FGGM83-SB-G7			FGGM83-SB-G8			FGGM83-SB-G9			FGGM83-SB-G10			FGGM83-SB-G11		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																			
Lead Shot																			
Percent Lead Shot	%	0			0			0.01			0			0			0		
Area Count	counts/ft2	0			0			27			0			0			0		
Volume Count	counts/ft3	0		UJ	0		UJ	54		J	0		UJ	0			0		
Total Mass	g	0			0			0.27			0			0			0		
Solids	%	81.4			92.4			91.1			90.9			79.4			84.3		
Metals																			
Antimony	mg/kg	1.2	U	UL	1.1	U	UL	1.1	U	R	1.1	U	R	3.5	U	UL	1.2	U	UL
Arsenic	mg/kg	5.5			3.7			4.6			4.9			6.6			4.4	B	
Copper	mg/kg	11.2			8.6		J	10.6			9			13.2		J	13.3		
Lead	mg/kg	208			60.1			83.7			67.6			1.7			71.2		
Zinc	mg/kg	23.1			23.2			48.7			32.8			35.2		J	25.6		
Shallow Subsurface Soils (0.5-1.0')																			
Metals																			
Antimony	mg/kg	1.1	U	UL	1.2	U	UL	1.5	U	R	1.2	U	R	1.1	U	UL	1.1	U	UL
Arsenic	mg/kg	4.1			2.3			5.1			3.9			3.6			1	B	
Copper	mg/kg	7.1			8.9		J	12.6			9.4			8.2		J	4.8		
Lead	mg/kg	8.1			9.6			15.5			12			17.8			5.8		
Zinc	mg/kg	13.3			21.9			45.6			61.8			48.1		J	13.1		
		NA - Denotes that sample was not analyzed for that constituent																	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results																	
		R - Denotes data do not meet validation criteria and are unusable for risk assessment or compliance data																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-1C Soil Sampling Results, Metals and Shot Data, Background Samples (Group H)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-H1			FGGM83-SB-H2			FGGM83-SB-H3			FGGM83-SB-H4			FGGM83-SB-H4 DUP			FGGM83-SB-H5		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Surface Soils (0-0.5')																			
Lead Shot																			
Percent Lead Shot	%	0.058			0.044			0			0			NA			0		
Area Count	counts/ft2	150			74			0			0			NA			0		
Volume Count	counts/ft3	310			150			0			0			NA			0		
Total Mass	g	1.8			1.1			0			0			NA			0		
Solids	%	92.5			91.7			95.1			88.4			NA			92.8		
Metals																			
Antimony	mg/kg	1.5		BL	0.83	B	BL	1.1	U	UJ	1.1	U	UL	NA			1.1	U	UL
Arsenic	mg/kg	6.4			4			2.9			3.9			NA			3		
Copper	mg/kg	14.1		J	12		J	11.1		J	12		J	NA			8.8		J
Lead	mg/kg	179			138			19.7			22.3			NA			32.6		
Zinc	mg/kg	43.3			20.5			17.5			16.1			NA			17.2		
Shallow Subsurface Soils (0.5-1.0')																			
Metals																			
Antimony	mg/kg	1.1	U	UL	1	U	UL	1.1	U	UL	1.2	U	UL	1.1	U	UL	1.1	U	UL
Arsenic	mg/kg	3.1			2.3			2.9			2.9			3.2			2.5		
Copper	mg/kg	8.7			8.3			10.7			7.7			6.9			7.1		
Lead	mg/kg	19.7		L	9.1		L	14.9		L	8.4			8.4			6.5		L
Zinc	mg/kg	18.4			8.4			38.7			14			11.3			12.1		
		NA - Denotes that sample was not analyzed for that constituent																	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-1C Soil Sampling Results, Metals and Shot Data, Background Samples (Group H)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-H6			FGGM83-SB-H6 DUP			FGGM83-SB-H7			FGGM83-SB-H8			FGGM83-SB-H9		
		Result	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**	**Result**	**Qual**	**LDC**
Surface Soils (0-0.5')																
Lead Shot																
Percent Lead Shot	%	0			0			0			0			0		
Area Count	counts/ft2	0			0			0			0			0		
Volume Count	counts/ft3	0			0			0			0			0		
Total Mass	g	0			0			0			0			0		
Solids	%	96.6			94.5			90.7			92.1			90.5		
Metals																
Antimony	mg/kg	1	U	UL	1.1	U		1.1	U	UL	1.1	U	UL	1.1	U	UL
Arsenic	mg/kg	4.8			3			3.3			3.6			4.3		
Copper	mg/kg	12.2		J	10.2			9.5		J	9.1		J	11.5		J
Lead	mg/kg	18.5			19.5			14.7			20.1			38.8		
Zinc	mg/kg	14.6			15.5			10.2			19.4			31.8		
Shallow Subsurface Soils (0.5-1.0')																
Metals																
Antimony	mg/kg	1	U	UL	1.1	U	UL	1.1	U	UL	1.1	U	UL	1.1	U	UL
Arsenic	mg/kg	2.3			2.5			2.3			1.9			2.9		
Copper	mg/kg	5.8			6.3			6			5.3			7.8		
Lead	mg/kg	6			4.5			7.2		L	8.2			11.8		L
Zinc	mg/kg	15.3			17.1			6.8			11.6			28.8		
		NA - Denotes that sample was not analyzed for that constituent														
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A1			FGGM83-SB-A2			FGGM83-SB-A3			FGGM83-SB-A4			FGGM83-SB-A5			FGGM83-SB-A6		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																			
Surface Soils (0-0.5')																			
Acenaphthene	ug/kg	542			76	U		162			710	U		110			522		
Acenaphthylene	ug/kg	70	U		76	U		72	U		710	U		73	U		73	U	
Anthracene	ug/kg	778			76	U		234			820			293			1040		
Benzo(a)anthracene	ug/kg	5470			76	U		1450			30000			10500			6590		
Benzo(b)fluoranthene	ug/kg	5940			76	U		1480			8860			2480			6260		
Benzo(k)fluoranthene	ug/kg	4460			76	U		1210			3140			665			2740		
Benzo(g,h,i)perylene	ug/kg	2210			76	U		1670			5040			1240			1730		
Benzo(a)pyrene	ug/kg	7950			76	U		2110			25000			8930			8310		
Chrysene	ug/kg	6660			76	U		1880			48800			13100			7860		
Dibenzo(a,h)anthracene	ug/kg	1250			76	U		493			3620			730			1110		
Fluoranthene	ug/kg	6890			76	U		1890			2490			1590			7130		
Fluorene	ug/kg	271			76	U		87.4			181	J		84.1			363		
Indeno(1,2,3-cd)pyrene	ug/kg	2310			76	U		1350			181	J		598			1640		
Isophorone	ug/kg	70	U		22	U		72	U		710	U		73	U		73	U	
2-Methylnaphthalene	ug/kg	71.6			619	J		21.2	J		619	J		156			115		
Naphthalene	ug/kg	179			76	U		49	J		710	U		52.5	J		226		
Phenanthrene	ug/kg	3320			76	U		1110			3910			1440			4590		
Pyrene	ug/kg	7210			76	U		2040			19200			6470			8260		
Shallow Subsurface Soils (0.5-1.5')																			
Acenaphthene	ug/kg	171			77	U		27.3	J		80	U		958			3390		
Acenaphthylene	ug/kg	72	U		77	U		72	U		80	U		72	U		74	U	
Anthracene	ug/kg	206			77	U		31.1	J		80	U		1300			13300		
Benzo(a)anthracene	ug/kg	1290			77	U		229			30.9	J		11900			15200		
Benzo(b)fluoranthene	ug/kg	1690			77	U		236			80	U		8660			11900		
Benzo(k)fluoranthene	ug/kg	653			77	U		226			80	U		4900			9650		
Benzo(g,h,i)perylene	ug/kg	1030			77	U		282			80	U		2080			2750		
Benzo(a)pyrene	ug/kg	1990			77	U		341			31.2	J		12800			12200		
Chrysene	ug/kg	1700			77	U		298			80	U		13700			16800		
Dibenzo(a,h)anthracene	ug/kg	378			77	U		85.7			80	U		1360			1980		
Fluoranthene	ug/kg	1600			77	U		286			80	U		10600			34300		
Fluorene	ug/kg	77.9			77	U		72	U		80	U		519			3320		
Indeno(1,2,3-cd)pyrene	ug/kg	818			77	U		215			80	U		1990			3460		
Isophorone	ug/kg	72	U		77	U		72	U		80	U		72	U		74	U	
2-Methylnaphthalene	ug/kg	27.3	J		21.2	J		72	U		80	U		195			488		
Naphthalene	ug/kg	63.3	J		77	U		72	U		80	U		336			1610		
Phenanthrene	ug/kg	901			77	U		156			80	U		6900			25800		
Pyrene	ug/kg	1710			77	U		313			80	U		13100			28400		
		NA - Denotes that sample was not analyzed for that constituent																	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A7			FGGM83-SB-A8			FGGM83-SB-A9			FGGM83-SB-A9 DUP			FGGM83-SB-A10			FGGM83-SB-A11		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																			
Surface Soils (0-0.5')																			
Acenaphthene	ug/kg	56.5	J		112			74	U		NA			74	U		32.1	J	
Acenaphthylene	ug/kg	79	U		74	U		74	U		NA			74	U		77	U	
Anthracene	ug/kg	62.7	J		136			74	U		NA			74	U		33	J	
Benzo(a)anthracene	ug/kg	324			916			64.3	J		NA			23.2	J		114		
Benzo(b)fluoranthene	ug/kg	348			1460			89			NA			74	U		100		
Benzo(k)fluoranthene	ug/kg	262			899			58.5	J		NA			74	U		89.7		
Benzo(g,h,i)perylene	ug/kg	330			1100			58.1	J		NA			74	U		76.7	J	
Benzo(a)pyrene	ug/kg	413			1450			80.2			NA			24.7	J		100		
Chrysene	ug/kg	423			1170			92.3			NA			30.3	J		145		
Dibenzo(a,h)anthracene	ug/kg	118			343			74	U		NA			74	U		30.6	J	
Fluoranthene	ug/kg	513			1260			86.4			NA			74	U		276		
Fluorene	ug/kg	30.3	J		47.7	J		74	U		NA			74	U		21.7	J	
Indeno(1,2,3-cd)pyrene	ug/kg	280			934			49.1	J		NA			74	U		69.5	J	
Isophorone	ug/kg	79	U		74	U		74	U		NA			74	U		77	U	
2-Methylnaphthalene	ug/kg	79	U		74	U		74	U		NA			74	U		77	U	
Naphthalene	ug/kg	23.7	J		34.3	J		74	U		NA			74	U		77	U	
Phenanthrene	ug/kg	286			563			42.4	J		NA			74	U		230		
Pyrene	ug/kg	511			1270			91.9			NA			74	U		230		
Shallow Subsurface Soils (0.5-1.5')																			
Acenaphthene	ug/kg	73	U		28.2	J		72	U		NA			78	U		73	U	
Acenaphthylene	ug/kg	73	U		72	U		72	U		NA			78	U		73	U	
Anthracene	ug/kg	73	U		35	J		72	U		NA			78	U		73	U	
Benzo(a)anthracene	ug/kg	34.6	J		231			79.6			NA			78	U		73	U	
Benzo(b)fluoranthene	ug/kg	73	U		254			203			NA			78	U		73	U	
Benzo(k)fluoranthene	ug/kg	73	U		197			189			NA			78	U		73	U	
Benzo(g,h,i)perylene	ug/kg	73	U		190			65.7	J		NA			78	U		73	U	
Benzo(a)pyrene	ug/kg	34.2	J		267			110			NA			78	U		73	U	
Chrysene	ug/kg	36.9	J		273			159			NA			78	U		73	U	
Dibenzo(a,h)anthracene	ug/kg	73	U		68.4	J		31.8	J		NA			78	U		73	U	
Fluoranthene	ug/kg	73	U		368			47.2	J		NA			78	U		73	U	
Fluorene	ug/kg	73	U		72	U		72	U		NA			78	U		73	U	
Indeno(1,2,3-cd)pyrene	ug/kg	73	U		165			68.6	J		NA			78	U		73	U	
Isophorone	ug/kg	73	U		72	U		72	U		NA			78	U		73	U	
2-Methylnaphthalene	ug/kg	73	U		72	U		72	U		NA			78	U		73	U	
Naphthalene	ug/kg	73	U		72	U		72	U		NA			78	U		73	U	
Phenanthrene	ug/kg	33.6	J		155			72	U		NA			78	U		73	U	
Pyrene	ug/kg	50.6	J		343			89.6			NA			78	U		73	U	
		NA - Denotes that sample was not analyzed for that constituent																	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-A12			FGGM83-SB-A13			FGGM83-SB-A13 DUP			FGGM83-SB-A14			FGGM83-SB-A14 DUP			FGGM83-SB	
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual
PAHs																		
Surface Soils (0-0.5')																		
Acenaphthene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Acenaphthylene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Anthracene	ug/kg	72	U		33.1	J		75	U		72	U		71	U		71	U
Benzo(a)anthracene	ug/kg	72	U		53.5	J		40.1	J		41.3	J		62.2	J		71	U
Benzo(b)fluoranthene	ug/kg	72	U		38.8	J		53.4	J		51	J		49.9	J		71	U
Benzo(k)fluoranthene	ug/kg	72	U		43.1	J		40.1	J		29.8	J		54.3	J		71	U
Benzo(g,h,i)perylene	ug/kg	72	U		76	U		75	U		34	J		37.4	J		71	U
Benzo(a)pyrene	ug/kg	72	U		48.4	J		49.5	J		44.5	J		53.4	J		71	U
Chrysene	ug/kg	72	U		57.7	J		43.3	J		54.8	J		73.5	J		71	U
Dibenzo(a,h)anthracene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Fluoranthene	ug/kg	72	U		137			85.1			84.9			134	J		31.5	J
Fluorene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Indeno(1,2,3-cd)pyrene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Isophorone	ug/kg	72	U		76	U		76	U		72	U		71	U		71	U
2-Methylnaphthalene	ug/kg	72	U		76	U		76	U		72	U		71	U		71	U
Naphthalene	ug/kg	72	U		76	U		75	U		72	U		71	U		71	U
Phenanthrene	ug/kg	72	U		127			27	J		45.8	J		78.1			71	U
Pyrene	ug/kg	72	U		106			70.2	J		78			122			71	U
Shallow Subsurface Soils (0.5-1.5')																		
Acenaphthene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Acenaphthylene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Anthracene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Benzo(a)anthracene	ug/kg	72	U		28.3	J		46.4	J		77	U		76	U		72	U
Benzo(b)fluoranthene	ug/kg	72	U		30.6	J		48.5	J		77	U		76	U		72	U
Benzo(k)fluoranthene	ug/kg	72	U		75	U		49.7	J		77	U		76	U		72	U
Benzo(g,h,i)perylene	ug/kg	72	U		75	U		33.5	J		77	U		76	U		72	U
Benzo(a)pyrene	ug/kg	72	U		31.4	J		46.2	J		77	U		76	U		72	U
Chrysene	ug/kg	72	U		32.3	J		56	J		77	U		76	U		72	U
Dibenzo(a,h)anthracene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Fluoranthene	ug/kg	72	U		37.8	J		81.3			77	U		76	U		72	U
Fluorene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Indeno(1,2,3-cd)pyrene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Isophorone	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
2-Methylnaphthalene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Naphthalene	ug/kg	72	U		75	U		76	U		77	U		76	U		72	U
Phenanthrene	ug/kg	72	U		20.2	J		40.3	J		77	U		76	U		72	U
Pyrene	ug/kg	72	U		75	J		64.7	J		77	U		76	U		72	U
		NA - Denotes that sample was not analyzed for that constituent																
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																
		U - Denotes that constituent was not detected and the value is the RL																

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	-A15	FGGM83-SB-A16			FGGM83-SB-B1			FGGM83-SB-B2			FGGM83-SB-B3			FGGM83-SB-B4			FGGM83-SB-B4	
		LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual
PAHs																			
Surface Soils (0-0.5')																			
Acenaphthene	ug/kg		7610			81	U		74	U		72	U		72	U		NA	
Acenaphthylene	ug/kg		350	U		81	U		74	U		72	U		72	U		NA	
Anthracene	ug/kg		7830			81	U		74	U		72	U		72	U		NA	
Benzo(a)anthracene	ug/kg		30900			81	U		92.1			72	U		72	U		NA	
Benzo(b)fluoranthene	ug/kg		35200			81	U		38.4	J		72	U		72	U		NA	
Benzo(k)fluoranthene	ug/kg		20400			81	U		74	U		72	U		72	U		NA	
Benzo(g,h,i)perylene	ug/kg		28300			81	U		63.2	J		72	U		72	U		NA	
Benzo(a)pyrene	ug/kg		42600			81	U		106			72	U		72	U		NA	
Chrysene	ug/kg		38200			81	U		154			72	U		72	U		NA	
Dibenzo(a,h)anthracene	ug/kg		9480			81	U		23.1	J		72	U		72	U		NA	
Fluoranthene	ug/kg		46500			35.5	J		74	U		72	U		72	U		NA	
Fluorene	ug/kg		3720			81	U		74	U		72	U		72	U		NA	
Indeno(1,2,3-cd)pyrene	ug/kg		25700			81	U		74	U		72	U		72	U		NA	
Isophorone	ug/kg		350	U		81	U		74	U		72	U		72	U		NA	
2-Methylnaphthalene	ug/kg		1160			81	U		74	U		72	U		72	U		NA	
Naphthalene	ug/kg		4700			81	U		74	U		72	U		72	U		NA	
Phenanthrene	ug/kg		27700			81	U		74	U		72	U		72	U		NA	
Pyrene	ug/kg		44700			45.7	J		93.2			72	U		72	U		NA	
Shallow Subsurface Soils (0.5-1.5')																			
Acenaphthene	ug/kg		3510			75	U		73	U		73	U		71	U		NA	
Acenaphthylene	ug/kg		74	U		75	U		73	U		73	U		71	U		NA	
Anthracene	ug/kg		3310			75	U		73	U		73	U		71	U		NA	
Benzo(a)anthracene	ug/kg		15700			75	U		73	U		73	U		71	U		NA	
Benzo(b)fluoranthene	ug/kg		16600			75	U		73	U		73	U		71	U		NA	
Benzo(k)fluoranthene	ug/kg		11600			75	U		73	U		73	U		71	U		NA	
Benzo(g,h,i)perylene	ug/kg		NA			75	U		73	U		73	U		71	U		NA	
Benzo(a)pyrene	ug/kg		21100			75	U		73	U		73	U		71	U		NA	
Chrysene	ug/kg		19200			75	U		73	U		73	U		71	U		NA	
Dibenzo(a,h)anthracene	ug/kg		2580			75	U		73	U		73	U		71	U		NA	
Fluoranthene	ug/kg		NA			75	U		73	U		73	U		71	U		NA	
Fluorene	ug/kg		1690			75	U		73	U		73	U		71	U		NA	
Indeno(1,2,3-cd)pyrene	ug/kg		12000			75	U		73	U		73	U		71	U		NA	
Isophorone	ug/kg		74	U		75	U		73	U		73	U		71	U		NA	
2-Methylnaphthalene	ug/kg		508			75	U		73	U		73	U		71	U		NA	
Naphthalene	ug/kg		2050			75	U		73	U		73	U		71	U		NA	
Phenanthrene	ug/kg		15000			75	U		73	U		73	U		71	U		NA	
Pyrene	ug/kg		NA			75	U		73	U		73	U		71	U		NA	
			NA - Denotes that sample was not analyzed for that co						NA - Denotes that sample was not analyzed for that constituent										
			Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
			LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
			J - Value is estimated between MDL and RL or laborat						J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision										
			U - Denotes that constituent was not detected and the v						U - Denotes that constituent was not detected and the value is the RL										

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	DUP	FGGM83-SB-B5			FGGM83-SB-B6			FGGM83-SB-B7			FGGM83-SB-B8			FGGM83-SB-B9			FGGM83-SB-B10		
		LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																				
Surface Soils (0-0.5')																				
Acenaphthene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Acenaphthylene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Anthracene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Benzo(a)anthracene	ug/kg		30.6	J		79	U		78	U		73	U		71	U		25.1	J	
Benzo(b)fluoranthene	ug/kg		22.5	J		79	U		78	U		73	U		71	U		131		J
Benzo(k)fluoranthene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	UJ
Benzo(g,h,i)perylene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	UJ
Benzo(a)pyrene	ug/kg		25.8	J		79	U		78	U		73	U		71	U		29.1	J	J
Chrysene	ug/kg		30.5	J		79	U		78	U		73	U		71	U		39.2	J	
Dibenzo(a,h)anthracene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	UJ
Fluoranthene	ug/kg		57.4	J		79	U		21.1	J		24.2	J		71	U		43	J	
Fluorene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Indeno(1,2,3-cd)pyrene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	UJ
Isophorone	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
2-Methylnaphthalene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Naphthalene	ug/kg		77	U		79	U		78	U		73	U		71	U		70	U	
Phenanthrene	ug/kg		26.5	J		79	U		78	U		73	U		71	U		24.1	J	
Pyrene	ug/kg		48.2	J		79	U		78	U		73	U		71	U		63.3	J	
Shallow Subsurface Soils (0.5-1.5')																				
Acenaphthene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Acenaphthylene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Anthracene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Benzo(a)anthracene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Benzo(b)fluoranthene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Benzo(k)fluoranthene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Benzo(g,h,i)perylene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Benzo(a)pyrene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Chrysene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Dibenzo(a,h)anthracene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Fluoranthene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Fluorene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Indeno(1,2,3-cd)pyrene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Isophorone	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
2-Methylnaphthalene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Naphthalene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Phenanthrene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
Pyrene	ug/kg		78	U		79	U		72	U		70	U		75	U		69	U	
			NA - Denotes that sample was not analyzed for that constituent																	
			Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
			LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
			J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
			U - Denotes that constituent was not detected and the value is the RL																	

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-B11			FGGM83-B-B11 DUP			FGGM83-SB-B12			FGGM83-SB-B12 DUP			FGGM83-SB-B13			FGGM83-SB	
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual
PAHs																		
Surface Soils (0-0.5')																		
Acenaphthene	ug/kg	24.1	J		80	U		83	U		79	U		73	U		76	U
Acenaphthylene	ug/kg	83	U		80	U		83	U		79	U		73	U		76	U
Anthracene	ug/kg	69.5	J		80	U		83	U		79	U		73	U		76	U
Benzo(a)anthracene	ug/kg	154			36.7	J		28.5	J		35.7	J		73	U		76	U
Benzo(b)fluoranthene	ug/kg	113			38	J		21.6	J		31.8	J		73	U		76	U
Benzo(k)fluoranthene	ug/kg	91.9			80	U		83	U		32.8	J		73	U		76	U
Benzo(g,h,i)perylene	ug/kg	81.9	J		40.1	J		83	U		79	U		73	U		76	U
Benzo(a)pyrene	ug/kg	131			38.2	J		83	U		38.3	J		73	U		76	U
Chrysene	ug/kg	174			43.2	J		29.5	J		36.8	J		73	U		76	U
Dibenzo(a,h)anthracene	ug/kg	31	J		80	U		83	U		79	U		73	U		76	U
Fluoranthene	ug/kg	297			59.4	J		57.6	J		60.3	J		73	U		76	U
Fluorene	ug/kg	25.2	J		80	U		83	U		79	U		73	U		76	U
Indeno(1,2,3-cd)pyrene	ug/kg	74	J		80	U		83	U		79	U		73	U		76	U
Isophorone	ug/kg	83	U		80	U		83	U		NA			73	U		76	U
2-Methylnaphthalene	ug/kg	83	U		80	U		83	U		NA			73	U		76	U
Naphthalene	ug/kg	83	U		80	U		83	U		79	U		73	U		76	U
Phenanthrene	ug/kg	289			32.6	J		29.2	J		29.5	J		73	U		76	U
Pyrene	ug/kg	287			57.6	J		83	U		54	J		73	U		76	U
Shallow Subsurface Soils (0.5-1.5')																		
Acenaphthene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Acenaphthylene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Anthracene	ug/kg	79	U		79	U		30	J		75	U		74	U		72	U
Benzo(a)anthracene	ug/kg	79	U		79	U		77.3			75	U		74	U		72	U
Benzo(b)fluoranthene	ug/kg	79	U		79	U		57.4	J		75	U		74	U		72	U
Benzo(k)fluoranthene	ug/kg	79	U		79	U		73.5	J		75	U		74	U		72	U
Benzo(g,h,i)perylene	ug/kg	79	U		79	U		46	J		75	U		74	U		72	U
Benzo(a)pyrene	ug/kg	79	U		23.3	J		73.2	J		75	U		74	U		72	U
Chrysene	ug/kg	79	U		79	U		77			75	U		74	U		72	U
Dibenzo(a,h)anthracene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Fluoranthene	ug/kg	79	U		79	U		202			75	U		74	U		72	U
Fluorene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Indeno(1,2,3-cd)pyrene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Isophorone	ug/kg	79	U		79	U		77	U		NA			74	U		72	U
2-Methylnaphthalene	ug/kg	79	U		79	U		77	U		NA			74	U		72	U
Naphthalene	ug/kg	79	U		79	U		77	U		75	U		74	U		72	U
Phenanthrene	ug/kg	79	U		79	U		140			75	U		74	U		72	U
Pyrene	ug/kg	79	U		79	U		153			75	U		74	U		72	U
		NA - Denotes that sample was not analyzed for that constituent																
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																
		U - Denotes that constituent was not detected and the value is the RL																

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	-B14	FGGM83-SB-B15			FGGM83-SB-B15 DUP			FGGM83-SB-C1			FGGM83-SB-C2			FGGM83-SB-C3			FGGM83-SE	
		LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual
PAHs																			
Surface Soils (0-0.5')																			
Acenaphthene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Acenaphthylene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Anthracene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Benzo(a)anthracene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Benzo(b)fluoranthene	ug/kg		70	U		NA			71	U	UJ	84	U		69	U		78	U
Benzo(k)fluoranthene	ug/kg		70	U		NA			71	U	UJ	84	U		69	U		78	U
Benzo(g,h,i)perylene	ug/kg		70	U		NA			71	U	UJ	84	U		69	U		78	U
Benzo(a)pyrene	ug/kg		70	U		NA			71	U	UJ	22	J		69	U		78	U
Chrysene	ug/kg		34.6	J		NA			71	U		23.9	J		69	U		78	U
Dibenzo(a,h)anthracene	ug/kg		70	U		NA			71	U	UJ	84	U		69	U		78	U
Fluoranthene	ug/kg		62.5	J		NA			71	U		31.1	J		69	U		78	U
Fluorene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Indeno(1,2,3-cd)pyrene	ug/kg		70	U		NA			71	U	UJ	84	U		69	U		78	U
Isophorone	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
2-Methylnaphthalene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Naphthalene	ug/kg		70	U		NA			71	U		84	U		69	U		78	U
Phenanthrene	ug/kg		25.3	J		NA			71	U		23.4	J		69	U		78	U
Pyrene	ug/kg		52.3	J		NA			71	U		84	U		69	U		78	U
Shallow Subsurface Soils (0.5-1.5')																			
Acenaphthene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Acenaphthylene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Anthracene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Benzo(a)anthracene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Benzo(b)fluoranthene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Benzo(k)fluoranthene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Benzo(g,h,i)perylene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Benzo(a)pyrene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Chrysene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Dibenzo(a,h)anthracene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Fluoranthene	ug/kg		72	U		NA			67	U		75	U		77	U		19.2	J
Fluorene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Indeno(1,2,3-cd)pyrene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Isophorone	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
2-Methylnaphthalene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Naphthalene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Phenanthrene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
Pyrene	ug/kg		72	U		NA			67	U		75	U		77	U		69	U
			NA - Denotes that sample was not analyzed for that constituent																
			Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
			LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
			J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																
			U - Denotes that constituent was not detected and the value is the RL																

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	-C4	FGGM83-SB-C4 DUP			FGGM83-SB-C5			FGGM83-SB-C6			FGGM83-SB-C7			FGGM83-SB-C8		
		LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																	
Surface Soils (0-0.5')																	
Acenaphthene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Acenaphthylene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Anthracene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Benzo(a)anthracene	ug/kg		75	U		56.9	J		78	U		77	U		79	U	
Benzo(b)fluoranthene	ug/kg		75	U		153			78	U		77	U		79	U	
Benzo(k)fluoranthene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Benzo(g,h,i)perylene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Benzo(a)pyrene	ug/kg		75	U		51.3	J		78	U		77	U		79	U	
Chrysene	ug/kg		75	U		54.3	J		78	U		77	U		79	U	
Dibenzo(a,h)anthracene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Fluoranthene	ug/kg		75	U		101			78	U		24.5	J		79	U	
Fluorene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Indeno(1,2,3-cd)pyrene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Isophorone	ug/kg		75	U		NA			NA			77	U		79	U	
2-Methylnaphthalene	ug/kg		75	U		NA			NA			77	U		79	U	
Naphthalene	ug/kg		75	U		73	U		78	U		77	U		79	U	
Phenanthrene	ug/kg		75	U		58.4	J		78	U		23	J		79	U	
Pyrene	ug/kg		75	U		99.1			78	U		77	J		79	U	
Shallow Subsurface Soils (0.5-1.5')																	
Acenaphthene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Acenaphthylene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Anthracene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Benzo(a)anthracene	ug/kg		71	U		24.7	J		77	U		85	U		73	U	
Benzo(b)fluoranthene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Benzo(k)fluoranthene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Benzo(g,h,i)perylene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Benzo(a)pyrene	ug/kg		71	U		19.9	J		77	U		85	U		73	U	
Chrysene	ug/kg		71	U		24.1	J		77	U		85	U		73	U	
Dibenzo(a,h)anthracene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Fluoranthene	ug/kg		71	U		40.7	J		77	U		85	U		73	U	
Fluorene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Indeno(1,2,3-cd)pyrene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Isophorone	ug/kg		71	U		NA			NA			85	U		73	U	
2-Methylnaphthalene	ug/kg		71	U		NA			NA			85	U		73	U	
Naphthalene	ug/kg		71	U		75	U		77	U		85	U		73	U	
Phenanthrene	ug/kg		71	U		23	J		77	U		85	U		73	U	
Pyrene	ug/kg		71	U		41.9	J		77	U		85	U		73	U	
			NA - Denotes that sample was not analyzed for that constituent														
			Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
			LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
			J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
			U - Denotes that constituent was not detected and the value is the RL														

Table 3-2A Soil Sampling Results, PAH Data, Samples within 375 feet (i.e., A,B, and C Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-C9			FGGM83-SB-C10			FGGM83-SB-C10 DUP			FGGM83-SB-C11		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs													
Surface Soils (0-0.5')													
Acenaphthene	ug/kg	81	U		78	U		NA			79	U	
Acenaphthylene	ug/kg	81	U		78	U		NA			79	U	
Anthracene	ug/kg	81	U		78	U		NA			79	U	
Benzo(a)anthracene	ug/kg	81	U		78	U		NA			79	U	
Benzo(b)fluoranthene	ug/kg	81	U		78	U		NA			79	U	
Benzo(k)fluoranthene	ug/kg	81	U		78	U		NA			79	U	
Benzo(g,h,i)perylene	ug/kg	81	U		78	U		NA			79	U	
Benzo(a)pyrene	ug/kg	81	U		78	U		NA			79	U	
Chrysene	ug/kg	81	U		78	U		NA			79	U	
Dibenzo(a,h)anthracene	ug/kg	81	U		78	U		NA			79	U	
Fluoranthene	ug/kg	25.6	J		78	U		NA			21.2	J	
Fluorene	ug/kg	81	U		78	U		NA			79	U	
Indeno(1,2,3-cd)pyrene	ug/kg	81	U		78	U		NA			79	U	
Isophorone	ug/kg	81	U		78	U		NA			NA		
2-Methylnaphthalene	ug/kg	81	U		78	U		NA			NA		
Naphthalene	ug/kg	81	U		78	U		NA			79	U	
Phenanthrene	ug/kg	26.5	J		78	U		NA			79	U	
Pyrene	ug/kg	81	U		78	U		NA			79	U	
Shallow Subsurface Soils (0.5-1.5')													
Acenaphthene	ug/kg	76	U		77	U		NA			74	U	
Acenaphthylene	ug/kg	76	U		77	U		NA			74	U	
Anthracene	ug/kg	76	U		77	U		NA			74	U	
Benzo(a)anthracene	ug/kg	76	U		77	U		NA			74	U	
Benzo(b)fluoranthene	ug/kg	76	U		77	U		NA			74	U	
Benzo(k)fluoranthene	ug/kg	76	U		77	U		NA			74	U	
Benzo(g,h,i)perylene	ug/kg	76	U		77	U		NA			74	U	
Benzo(a)pyrene	ug/kg	76	U		77	U		NA			74	U	
Chrysene	ug/kg	76	U		77	U		NA			74	U	
Dibenzo(a,h)anthracene	ug/kg	76	U		77	U		NA			74	U	
Fluoranthene	ug/kg	76	U		77	U		NA			74	U	
Fluorene	ug/kg	76	U		77	U		NA			74	U	
Indeno(1,2,3-cd)pyrene	ug/kg	76	U		77	U		NA			74	U	
Isophorone	ug/kg	76	U		77	U		NA			NA		
2-Methylnaphthalene	ug/kg	76	U		77	U		NA			NA		
Naphthalene	ug/kg	76	U		77	U		NA			74	U	
Phenanthrene	ug/kg	76	U		77	U		NA			74	U	
Pyrene	ug/kg	76	U		77	U		NA			74	U	
		NA - Denotes that sample was not analyzed for that constituent											
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)											
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)											
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision											
		U - Denotes that constituent was not detected and the value is the RL											

Table 3-2B Soil Sampling Results, PAH Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-D6			FGGM83-SB-D6 DUP			FGGM83-SB-D10			FGGM83-SB-D11			FGGM83-SB-E3		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																
Surface Soils (0-0.5')																
Acenaphthene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Acenaphthylene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Anthracene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Benzo(a)anthracene	ug/kg	370	U		89	U		91	U		72	U		25.2	J	
Benzo(b)fluoranthene	ug/kg	370	U		89	U		91	U		72	U		75	U	UJ
Benzo(k)fluoranthene	ug/kg	370	U		89	U		91	U		72	U		75	U	UJ
Benzo(g,h,i)perylene	ug/kg	370	U		89	U		91	U		72	U		75	U	UJ
Benzo(a)pyrene	ug/kg	370	U		89	U		91	U		72	U		26	J	J
Chrysene	ug/kg	370	U		89	U		91	U		72	U		28	J	
Dibenzo(a,h)anthracene	ug/kg	370	U		89	U		91	U		72	U		75	U	UJ
Fluoranthene	ug/kg	370	U		89	U		91	U		72	U		48	J	
Fluorene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Indeno(1,2,3-cd)pyrene	ug/kg	370	U		89	U		91	U		72	U		75	U	UJ
Isophorone	ug/kg	370	U		89	U		91	U		72	U		75	U	
2-Methylnaphthalene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Naphthalene	ug/kg	370	U		89	U		91	U		72	U		75	U	
Phenanthrene	ug/kg	370	U		89	U		91	U		72	U		44.7	J	
Pyrene	ug/kg	370	U		89	U		91	U		72	U		75	U	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-2B Soil Sampling Results, PAH Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-E8			FGGM83-SB-F1			FGGM83-SB-F4			FGGM83-SB-F5			FGGM83-SB-F6		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																
Surface Soils (0-0.5')																
Acenaphthene	ug/kg	79	U		76	U		79	U		NA			73	U	
Acenaphthylene	ug/kg	79	U		76	U		79	U		NA			73	U	
Anthracene	ug/kg	79	U		76	U		79	U		NA			73	U	
Benzo(a)anthracene	ug/kg	79	U		76	U		79	U		NA			73	U	
Benzo(b)fluoranthene	ug/kg	79	U		76	U		79	U		NA			73	U	
Benzo(k)fluoranthene	ug/kg	79	U		76	U		79	U		NA			73	U	
Benzo(g,h,i)perylene	ug/kg	79	U		76	U		79	U		NA			73	U	
Benzo(a)pyrene	ug/kg	79	U		76	U		79	U		NA			73	U	
Chrysene	ug/kg	79	U		76	U		79	U		NA			73	U	
Dibenzo(a,h)anthracene	ug/kg	79	U		76	U		79	U		NA			73	U	
Fluoranthene	ug/kg	79	U		76	U		79	U		NA			73	U	
Fluorene	ug/kg	79	U		76	U		79	U		NA			73	U	
Indeno(1,2,3-cd)pyrene	ug/kg	79	U		76	U		79	U		NA			73	U	
Isophorone	ug/kg	79	U		76	U		79	U		NA			73	U	
2-Methylnaphthalene	ug/kg	79	U		76	U		79	U		NA			73	U	
Naphthalene	ug/kg	79	U		76	U		79	U		NA			73	U	
Phenanthrene	ug/kg	79	U		76	U		79	U		NA			73	U	
Pyrene	ug/kg	79	U		76	U		79	U		NA			73	U	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-2B Soil Sampling Results, PAH Data, Samples beyond 375 feet (i.e., D,E,F, and G Rings)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-F10			FGGM83-SB-G3			FGGM83-SB-G7			FGGM83-SB-G8			FGGM83-B-G9		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																
Surface Soils (0-0.5')																
Acenaphthene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Acenaphthylene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Anthracene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Benzo(a)anthracene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Benzo(b)fluoranthene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Benzo(k)fluoranthene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Benzo(g,h,i)perylene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Benzo(a)pyrene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Chrysene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Dibenzo(a,h)anthracene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Fluoranthene	ug/kg	27.9	J		76	U		28.4	J		23.8	J		82	U	
Fluorene	ug/kg	21.9	J		76	U		78	U		85	U		82	U	
Indeno(1,2,3-cd)pyrene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Isophorone	ug/kg	74	U		76	U		78	U		85	U		82	U	
2-Methylnaphthalene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Naphthalene	ug/kg	74	U		76	U		78	U		85	U		82	U	
Phenanthrene	ug/kg	22.8	J		76	U		78	U		85	U		82	U	
Pyrene	ug/kg	74	U		76	U		78	U		85	U		82	U	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-2C Soil Sampling Results, PAH Data, Background Samples (Group H)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-H1			FGGM83-SB-H2			FGGM83-SB-H3			FGGM83-ESB-H4			FGGM83-SB-H4 DUP			FGGM83-SB-H5		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																			
Surface Soils (0-0.5')																			
Acenaphthene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Acenaphthylene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Anthracene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Benzo(a)anthracene	ug/kg	76	U		79.7			23.6	J		36.8	J		76	U		22.4	J	
Benzo(b)fluoranthene	ug/kg	76	U	UJ	167			76	U		34.8	J		19.7	J		73	U	UJ
Benzo(k)fluoranthene	ug/kg	76	U	UJ	45.6	J		76	U		44.3	J		76	U		73	U	UJ
Benzo(g,h,i)perylene	ug/kg	76	U	UJ	72	U		76	U		78	U		76	U		73	U	UJ
Benzo(a)pyrene	ug/kg	76	U	UJ	60.3	J		19.6	J		42.9	J		22.6	J		20.6	J	J
Chrysene	ug/kg	76	U		76.5			26.1	J		43.5	J		24.7	J		20.5	J	
Dibenzo(a,h)anthracene	ug/kg	76	U	UJ	72	U		76	U		78	U		76	U		73	U	UJ
Fluoranthene	ug/kg	23.1	J		147			41.7	J		62.8	J		26.2	J		36.9	J	
Fluorene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Indeno(1,2,3-cd)pyrene	ug/kg	76	U	UJ	72	U		76	U		78	U		76	U		73	U	UJ
Isophorone	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
2-Methylnaphthalene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Naphthalene	ug/kg	76	U		72	U		76	U		78	U		76	U		73	U	
Phenanthrene	ug/kg	76	U		81.9			23.3	J		26.3	J		76	U		31.5	J	
Pyrene	ug/kg	76	U		137			46	J		56.3	J		76	U		60.6	J	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																	
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																	
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																	
		U - Denotes that constituent was not detected and the value is the RL																	

Table 3-2C Soil Sampling Results, PAH Data, Background Samples (Group H)
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SB-H6			FGGM83-SB-H6 DUP			FGGM83-SB-H7			FGGM83-SB-H8			FGGM83-SB-H9		
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																
Surface Soils (0-0.5')																
Acenaphthene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Acenaphthylene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Anthracene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Benzo(a)anthracene	ug/kg	72	U		22	J		42	J		73	U		77	U	
Benzo(b)fluoranthene	ug/kg	18.3	J		23.3	J		121			73	U		77	U	
Benzo(k)fluoranthene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Benzo(g,h,i)perylene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Benzo(a)pyrene	ug/kg	72	U		74	U		25	J		73	U		77	U	
Chrysene	ug/kg	20.4	J		23.9	J		29	J		73	U		77	U	
Dibenzo(a,h)anthracene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Fluoranthene	ug/kg	31	J		40.7	J		82			73	U		77	U	
Fluorene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Indeno(1,2,3-cd)pyrene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Isophorone	ug/kg	72	U		74	U		75	U		73	U		77	U	
2-Methylnaphthalene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Naphthalene	ug/kg	72	U		74	U		75	U		73	U		77	U	
Phenanthrene	ug/kg	72	U		74	U		68.2	J		73	U		77	U	
Pyrene	ug/kg	72	U		74	U		69.3	J		73	U		77	U	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
		U - Denotes that constituent was not detected and the value is the RL														

Table 3-3 Sediment Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83SD-1			FGGM83-SD-2			FGGM83-SD-3			FGGM83-SD-3 DUP			FGGM83-SD-4			FGGM83-S	
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual
Lead Shot																		
Percent Lead Shot	%	0			0			0			0			0.055			0	
Area Count	counts/ft2	0			0			0			0			340			0	
Volume Count	counts/ft3	0			0			0			0			680			0	
Total Mass	g	0			0			0			0			3.7			0	
Solids	%	99.4			99.3			99.4			99.5			80.7			97.1	
Metals																		
Antimony	mg/kg	1	U		1	U	UL	0.98	U	UL	5	U		1.1	B	L	5	U
Arsenic	mg/kg	3.1			1.6			1.3			1.2			4.3			2.4	
Copper	mg/kg	15.3			10.4			11.1			10.8			7.7		J	10.7	
Lead	mg/kg	37.6		J	45.6		J	38.5		J	45.1			159		L	37	
Zinc	mg/kg	73.5			55.2			35.7			35.5			11.2			38.9	
PAHs																		
Acenaphthene	ug/kg	80	U		94	U		100	U		120	U		82	U		83	U
Acenaphthylene	ug/kg	80	U		94	U		100	U		120	U		82	U		83	U
Anthracene	ug/kg	26	J		94	U		100	U		120	U		82	U		83	U
Benzo(a)anthracene	ug/kg	62.9	J		34.7	J		120			181			82	U		37.8	J
Benzo(b)fluoranthene	ug/kg	109			37.3	J		227			262			82	U		27.1	J
Benzo(k)fluoranthene	ug/kg	94.8			94	U		90.6	J		214			82	U		41.5	J
Benzo(g,h,i)perylene	ug/kg	80	U		94	U		140			105	J		82	U		83	U
Benzo(a)pyrene	ug/kg	56	J		34	J		180			233			82	U		34.6	J
Chrysene	ug/kg	94.2			35.8	J		162			238			82	U		43.7	J
Dibenzo(a,h)anthracene	ug/kg	80	U		94	U		100	U		120	U		82	U		83	U
Fluoranthene	ug/kg	50.2	J		75.7	J		168			281			82	U		63.9	J
Fluorene	ug/kg	80	U		94	U		100	U		120	U		82	U		83	U
Indeno(1,2,3-cd)pyrene	ug/kg	80	U		94	U		115			94.9	J		82	U		83	U
Naphthalene	ug/kg	80	U		94	U		100	U		120	U		82	U		83	U
Phenanthrene	ug/kg	80	U		46.8	J		67.2	J		127			82	U		27.5	J
Pyrene	ug/kg	63.5	J		60.6	J		201			297			82	U		63.7	J
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)																
		J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision																
		L - Review of lab QA/QC analysis indicates a potential for low bias in the results																
		U - Denotes that constituent was not detected and the value is the RL																

Table 3-3 Sediment Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	D-5	FGGM83-SD-6			FGGM83-SD-7			FGGM83-SD-8			FGGM83-SD-9			FGGM83-SD-10		
		LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
Lead Shot																	
Percent Lead Shot	%		0			0.72			0.096			0			0		
Area Count	counts/ft2		0			1600			430			0			0		
Volume Count	counts/ft3		0			3100			850			0			0		
Total Mass	g		0			18			5.8			0			0		
Solids	%		99.6			98.8			97.3			97.4			99.3		
Metals																	
Antimony	mg/kg	UL	0.98	U		11.7		UL	1	U	UL	1	U	UL	1	U	UL
Arsenic	mg/kg		1.4			15			3			2.2			1.9		
Copper	mg/kg		7.1			8.6			20.1			16.3			13		
Lead	mg/kg	J	91.4		J	2550		J	62.9		J	27.6		J	23.5		J
Zinc	mg/kg		22.1			13.6			116			129			75.4		
PAHs																	
Acenaphthene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Acenaphthylene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Anthracene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Benzo(a)anthracene	ug/kg		79	U		86	U		91	U		35.2	J		74	U	
Benzo(b)fluoranthene	ug/kg		79	U		86	U		34.9	J		58.2	J		74	U	
Benzo(k)fluoranthene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Benzo(g,h,i)perylene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Benzo(a)pyrene	ug/kg		79	U		86	U		26.9	J		39	J		74	U	
Chrysene	ug/kg		79	U		86	U		91	U		40.2	J		74	U	
Dibenzo(a,h)anthracene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Fluoranthene	ug/kg		79	U		86	U		38.4	J		73.6	J		74	U	
Fluorene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Indeno(1,2,3-cd)pyrene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Naphthalene	ug/kg		79	U		86	U		91	U		92	U		74	U	
Phenanthrene	ug/kg		79	U		86	U		91	U		31.9	J		74	U	
Pyrene	ug/kg		79	U		86	U		91	U		66.9	J		74	U	
			Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)														
			LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)														
			B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)														
			J - Value is estimated between MDL and RL or laboratory QA/QC analysis indicates a lack of precision														
			L - Review of lab QA/QC analysis indicates a potential for low bias in the results														
			U - Denotes that constituent was not detected and the value is the RL														

Table 3-4 Surface Water Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-SW-1			FGGM83-SW-2			FGGM83-SW-3			FGGM83-SW-3 DUP			FGGM83-SW-4			FG
		Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result
PAHs																	
Acenaphthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Acenaphthylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Benzo(a)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Benzo(b)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Benzo(k)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Benzo(g,h,i)perylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Benzo(a)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Chrysene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Dibenzo(a,h)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Fluorene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Indeno(1,2,3-cd)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Naphthalene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Phenanthrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U		0.2	U		0.2
Metals - Total																	
Antimony (total)	ug/L	5	U		5	U		5	U		5	U		5	U		5
Arsenic (total)	ug/L	5	U		5	U		5	U		5	U		5	U		5
Copper (total)	ug/L	6.5	B		6.2	B		5.2	B	B	4.8	B	B	6.8	B		4.1
Lead (total)	ug/L	12.4			5.2			6.4			3.6			5			6.7
Zinc (total)	ug/L	31.3		B	14.7	B	B	14.1	B	B	11.1	B	B	7.7	B	B	12.6
Metals - Dissolved																	
Antimony (dissolved)	ug/L	5	U		5	U		5	U		5	U		5	U		5
Arsenic (dissolved)	ug/L	5	U		5	U		5	U		5	U		5	U		5
Copper (dissolved)	ug/L	6.9	B		6.9	B		5.8	B	B	4	B	B	4.3	B	B	5.2
Lead (dissolved)	ug/L	4.5			2.9	B		4.1			3			3.3			4.3
Zinc (dissolved)	ug/L	89			16.3	B	B	17.1	B	B	6	B	B	4.3	B	B	6.5
		NA - Denotes that sample was not analyzed for that constituent															
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)															
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)															
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)															
		U - Denotes that constituent was not detected and the value is the RL															

Table 3-4 Surface Water Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	GM83-SW-5		FGGM83-SW-6			FGGM83-SW-7			FGGM83-SW-8			FGGM83-SW-9			FGGM83-SW-10		
		Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC	Result	Qual	LDC
PAHs																		
Acenaphthene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Acenaphthylene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Anthracene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Benzo(a)anthracene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Benzo(b)fluoranthene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Benzo(k)fluoranthene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Benzo(g,h,i)perylene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Benzo(a)pyrene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Chrysene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Dibenzo(a,h)anthracene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Fluoranthene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Fluorene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Indeno(1,2,3-cd)pyrene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Naphthalene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Phenanthrene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Pyrene	ug/L	U		0.22	U		NA			0.2	U		NA			NA		
Metals - Total																		
Antimony (total)	ug/L	U		5	U		NA			5	U		NA			NA		
Arsenic (total)	ug/L	U		5	U		NA			5	U		NA			NA		
Copper (total)	ug/L	B	B	6.1	B		NA			5	B	B	NA			NA		
Lead (total)	ug/L			5			NA			3.2			NA			NA		
Zinc (total)	ug/L	B	B	10.3	B	B	NA			21.6		B	NA			NA		
Metals - Dissolved																		
Antimony (dissolved)	ug/L	U		5	U		NA			5	U		NA			NA		
Arsenic (dissolved)	ug/L	U		5	U		NA			5	U		NA			NA		
Copper (dissolved)	ug/L	B	B	4.3	B	B	NA			3.2	B	B	NA			NA		
Lead (dissolved)	ug/L			3.8			NA			3	U		NA			NA		
Zinc (dissolved)	ug/L	B	B	6.7	B	B	NA			9.4	B	B	NA			NA		
		NA - Denotes that sample was not analyzed for that constituent																
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)																
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)																
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)																
		U - Denotes that constituent was not detected and the value is the RL																

Table 3-5 Groundwater Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-MW-1			FGGM83-MW-2			FGGM83-MW-3			FGGM83-MW-3 DUP		
		Result	Lab	LDC	Result	Lab	LDC	Result	Lab	LDC	Result	Lab	LDC
PAHs													
Acenaphthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Acenaphthylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(a)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(b)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(k)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(g,h,i)perylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(a)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Chrysene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Dibenzo(a,h)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Fluorene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Indeno(1,2,3-cd)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Naphthalene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Phenanthrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Metals - Total													
Antimony (total)	ug/L	10	U		10	U		5	U		5	U	
Arsenic (total)	ug/L	8.9	B	B	11.1		B	5	U		5	U	
Copper (total)	ug/L	73.4			69.8			2.8	B	B	3	B	B
Lead (total)	ug/L	13.6		B	8.8		B	3	U		3	U	
Zinc (total)	ug/L	52			42.1			17.6	B		17	B	
Metals - Dissolved													
Antimony (dissolved)	ug/L	5	U		5	U		5	U		5	U	
Arsenic (dissolved)	ug/L	5	U		5	U		5	U		5	U	
Copper (dissolved)	ug/L	25	U		25	U		25	U	B	3	B	B
Lead (dissolved)	ug/L	3	U		3	U		3	U		3	U	
Zinc (dissolved)	ug/L	9.1	B		19.6	B		14.8	B		19.7	B	
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)											
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)											
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)											
		U - Denotes that constituent was not detected and the value is the RL											

Table 3-5 Groundwater Sampling Results
FGGM 83 Former Trap and Skeet, Fort Meade, Maryland

Parameters	Units	FGGM83-MW-4			FGGM83-MW-5			FGGM83-MW-6			FGGM83-MW-7		
		Result	Lab	LDC	Result	Lab	LDC	Result	Lab	LDC	Result	Lab	LDC
PAHs													
Acenaphthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Acenaphthylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(a)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(b)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(k)fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(g,h,i)perylene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Benzo(a)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Chrysene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Dibenzo(a,h)anthracene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Fluoranthene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Fluorene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Indeno(1,2,3-cd)pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Naphthalene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Phenanthrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Pyrene	ug/L	0.2	U		0.2	U		0.2	U		0.2	U	
Metals - Total													
Antimony (total)	ug/L	10	U		10	U		5	U		5	U	
Arsenic (total)	ug/L	24.2		B	34.7	B		5	U		5	U	
Copper (total)	ug/L	113			169			25	U		12.8	B	
Lead (total)	ug/L	24		B	52.2			3	U		3.2		
Zinc (total)	ug/L	66.4			194			6.8	U		92.4		
Metals - Dissolved													
Antimony (dissolved)	ug/L	5	U		5	U		5	U		5	U	
Arsenic (dissolved)	ug/L	5	U		5	U		5	U		5	U	
Copper (dissolved)	ug/L	3.7	B		25	U		2.8	B	B	4.6	B	B
Lead (dissolved)	ug/L	3	U		3	U		3	U		3	U	
Zinc (dissolved)	ug/L	34.9			7.8	B		8.5	B		84.4		
		Qual - Indicates qualifier assigned by laboratory (Accutest Laboratories)											
		LDC - Qualifiers assigned by third party data validator (Laboratory Data Consultants)											
		B (Inorganic) - Value is less than the reporting limit (RL) but greater than the instrument detection limit (IDL)											
		U - Denotes that constituent was not detected and the value is the RL											

APPENDIX B

Exposure Point 95% UCL Calculations

APPENDIX B

Exposure Point 95% UCL Calculations <375 feet

General UCL Statistics for Full Data Sets	
User Selected Options	**PAH**
From File	
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

acenaphthene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	39

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	7610	Maximum of Log Data	8.937
Mean	196.4	Mean of log Data	3.021
Median	12.66	SD of log Data	1.331
SD	925.9		
Coefficient of Variation	4.714		
Skewness	6.593		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.443	Lilliefors Test Statistic	0.439
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	355.1	95% H-UCL	70.69
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	87.47
95% Adjusted-CLT UCL	422.9	97.5% Chebyshev (MVUE) UCL	104.2
95% Modified-t UCL	365.9	99% Chebyshev (MVUE) UCL	137
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.302	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	650.8		
nu star	56.74		
Approximate Chi Square Value (.05)	40.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	353.5
Adjusted Chi Square Value	40.22	95% Jackknife UCL	355.1
		95% Standard Bootstrap UCL	355.6
Anderson-Darling Test Statistic	27.69	95% Bootstrap-t UCL	563.9
Anderson-Darling 5% Critical Value	0.867	95% Hall's Bootstrap UCL	394.6
Kolmogorov-Smirnov Test Statistic	0.483	95% Percentile Bootstrap UCL	370.6
Kolmogorov-Smirnov 5% Critical Value	0.1	95% BCA Bootstrap UCL	470.1
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	612.7
		97.5% Chebyshev(Mean, Sd) UCL	792.9
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1147
95% Approximate Gamma UCL	275.7		
95% Adjusted Gamma UCL	277.2		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	792.9

anthracene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	40

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	13300	Maximum of Log Data	9.496
Mean	325	Mean of log Data	3.134
Median	12.66	SD of log Data	1.494
SD	1618		
Coefficient of Variation	4.979		
Skewness	6.827		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.445	Lilliefors Test Statistic	0.428
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	602.3	95% H-UCL	106.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	131.8
95% Adjusted-CLT UCL	725.1	97.5% Chebyshev (MVUE) UCL	159.3
95% Modified-t UCL	621.9	99% Chebyshev (MVUE) UCL	213.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.264	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	1231		
nu star	49.65		
Approximate Chi Square Value (.05)	34.47	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	599.5
Adjusted Chi Square Value	34.28	95% Jackknife UCL	602.3
		95% Standard Bootstrap UCL	593
Anderson-Darling Test Statistic	26.43	95% Bootstrap-t UCL	1473
Anderson-Darling 5% Critical Value	0.883	95% Hall's Bootstrap UCL	1707
Kolmogorov-Smirnov Test Statistic	0.461	95% Percentile Bootstrap UCL	622.5
Kolmogorov-Smirnov 5% Critical Value	0.101	95% BCA Bootstrap UCL	783.9
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1052
		97.5% Chebyshev(Mean, Sd) UCL	1367
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1986
95% Approximate Gamma UCL	468.1		
95% Adjusted Gamma UCL	470.8		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	1367

benzo(a)anthracene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	56

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	30900	Maximum of Log Data	10.34
Mean	1411	Mean of log Data	3.665
Median	13	SD of log Data	2.083
SD	5159		
Coefficient of Variation	3.657		
Skewness	4.516		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.466	Lilliefors Test Statistic	0.304
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2295	95% H-UCL	716
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	796.6
95% Adjusted-CLT UCL	2551	97.5% Chebyshev (MVUE) UCL	1003
95% Modified-t UCL	2336	99% Chebyshev (MVUE) UCL	1409
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.205	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	6881		
nu star	38.54		
Approximate Chi Square Value (.05)	25.32	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	2286
Adjusted Chi Square Value	25.16	95% Jackknife UCL	2295
		95% Standard Bootstrap UCL	2259
Anderson-Darling Test Statistic	22.1	95% Bootstrap-t UCL	2919
Anderson-Darling 5% Critical Value	0.91	95% Hall's Bootstrap UCL	2662
Kolmogorov-Smirnov Test Statistic	0.382	95% Percentile Bootstrap UCL	2345
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	2571
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3730
		97.5% Chebyshev(Mean, Sd) UCL	4734
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6705
95% Approximate Gamma UCL	2147		
95% Adjusted Gamma UCL	2161		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	6705

benzo(b)fluoranthene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	54

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	35200	Maximum of Log Data	10.47
Mean	1100	Mean of log Data	3.635
Median	13	SD of log Data	2.033
SD	4380		
Coefficient of Variation	3.981		
Skewness	5.974		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.451	Lilliefors Test Statistic	0.335
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1851	95% H-UCL	607.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	686.5
95% Adjusted-CLT UCL	2141	97.5% Chebyshev (MVUE) UCL	861.9
95% Modified-t UCL	1897	99% Chebyshev (MVUE) UCL	1207
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.216	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5092		
nu star	40.62		
Approximate Chi Square Value (.05)	27.02	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	1843
Adjusted Chi Square Value	26.84	95% Jackknife UCL	1851
		95% Standard Bootstrap UCL	1858
Anderson-Darling Test Statistic	21.33	95% Bootstrap-t UCL	2629
Anderson-Darling 5% Critical Value	0.905	95% Hall's Bootstrap UCL	4303
Kolmogorov-Smirnov Test Statistic	0.373	95% Percentile Bootstrap UCL	1941
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	2222
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3069
		97.5% Chebyshev(Mean, Sd) UCL	3921
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5595
95% Approximate Gamma UCL	1654		
95% Adjusted Gamma UCL	1665		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	5595

benzo(k)fluoranthene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	48

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	20400	Maximum of Log Data	9.923
Mean	666.4	Mean of log Data	3.455
Median	12.82	SD of log Data	1.857
SD	2678		
Coefficient of Variation	4.018		
Skewness	5.637		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.443	Lilliefors Test Statistic	0.38
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1125	95% H-UCL	325.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	383.7
95% Adjusted-CLT UCL	1292	97.5% Chebyshev (MVUE) UCL	476.5
95% Modified-t UCL	1152	99% Chebyshev (MVUE) UCL	658.8
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.235	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2836		
nu star	44.18		
Approximate Chi Square Value (.05)	29.93	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	1121
Adjusted Chi Square Value	29.75	95% Jackknife UCL	1125
		95% Standard Bootstrap UCL	1127
Anderson-Darling Test Statistic	22.55	95% Bootstrap-t UCL	1549
Anderson-Darling 5% Critical Value	0.896	95% Hall's Bootstrap UCL	1414
Kolmogorov-Smirnov Test Statistic	0.397	95% Percentile Bootstrap UCL	1167
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	1333
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1870
		97.5% Chebyshev(Mean, Sd) UCL	2391
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3414
95% Approximate Gamma UCL	983.5		
95% Adjusted Gamma UCL	989.5		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	2391

benzo(g,h,i)perylene

General Statistics

Number of Valid Samples	93	Number of Unique Samples	46

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	28300	Maximum of Log Data	10.25
Mean	531.1	Mean of log Data	3.354
Median	12.67	SD of log Data	1.721
SD	2998		
Coefficient of Variation	5.645		
Skewness	8.874		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.431	Lilliefors Test Statistic	0.39
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1048	95% H-UCL	215.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	259.5
95% Adjusted-CLT UCL	1348	97.5% Chebyshev (MVUE) UCL	319.4
95% Modified-t UCL	1095	99% Chebyshev (MVUE) UCL	436.9
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.243	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2181		
nu star	45.28		
Approximate Chi Square Value (.05)	30.84	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	1042
Adjusted Chi Square Value	30.66	95% Jackknife UCL	1048
		95% Standard Bootstrap UCL	1042
Anderson-Darling Test Statistic	22.89	95% Bootstrap-t UCL	2974
Anderson-Darling 5% Critical Value	0.892	95% Hall's Bootstrap UCL	2751
Kolmogorov-Smirnov Test Statistic	0.409	95% Percentile Bootstrap UCL	1111
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	1520
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1886
		97.5% Chebyshev(Mean, Sd) UCL	2472
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3624
95% Approximate Gamma UCL	779.6		
95% Adjusted Gamma UCL	784.4		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	2472

benzo(a)pyrene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	57

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	42600	Maximum of Log Data	10.66
Mean	1568	Mean of log Data	3.71
Median	13	SD of log Data	2.131
SD	5856		
Coefficient of Variation	3.735		
Skewness	5.07		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.461	Lilliefors Test Statistic	0.286
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2572	95% H-UCL	854.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	935.5
95% Adjusted-CLT UCL	2899	97.5% Chebyshev (MVUE) UCL	1181
95% Modified-t UCL	2624	99% Chebyshev (MVUE) UCL	1664
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.202	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	7756		
nu star	38.01		
Approximate Chi Square Value (.05)	24.89	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	2562
Adjusted Chi Square Value	24.73	95% Jackknife UCL	2572
		95% Standard Bootstrap UCL	2539
Anderson-Darling Test Statistic	21.75	95% Bootstrap-t UCL	3395
Anderson-Darling 5% Critical Value	0.911	95% Hall's Bootstrap UCL	3143
Kolmogorov-Smirnov Test Statistic	0.388	95% Percentile Bootstrap UCL	2632
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	2892
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4201
		97.5% Chebyshev(Mean, Sd) UCL	5340
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7578
95% Approximate Gamma UCL	2394		
95% Adjusted Gamma UCL	2410		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	7578

chrysene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	57

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	48800	Maximum of Log Data	10.8
Mean	1833	Mean of log Data	3.748
Median	13	SD of log Data	2.163
SD	7071		
Coefficient of Variation	3.858		
Skewness	5.074		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.462	Lilliefors Test Statistic	0.3
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3044	95% H-UCL	970.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1051
95% Adjusted-CLT UCL	3440	97.5% Chebyshev (MVUE) UCL	1329
95% Modified-t UCL	3108	99% Chebyshev (MVUE) UCL	1876
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.197	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	9309		
nu star	37.01		
Approximate Chi Square Value (.05)	24.09	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	3032
Adjusted Chi Square Value	23.92	95% Jackknife UCL	3044
		95% Standard Bootstrap UCL	3022
Anderson-Darling Test Statistic	21.52	95% Bootstrap-t UCL	4075
Anderson-Darling 5% Critical Value	0.916	95% Hall's Bootstrap UCL	4042
Kolmogorov-Smirnov Test Statistic	0.376	95% Percentile Bootstrap UCL	3136
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	3608
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5012
		97.5% Chebyshev(Mean, Sd) UCL	6387
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9089
95% Approximate Gamma UCL	2816		
95% Adjusted Gamma UCL	2836		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	9089

dibenzo(a,h)anthracene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	42

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	9480	Maximum of Log Data	9.157
Mean	262.8	Mean of log Data	3.186
Median	12.67	SD of log Data	1.543
SD	1101		
Coefficient of Variation	4.191		
Skewness	6.912		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.436	Lilliefors Test Statistic	0.412
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	451.5	95% H-UCL	124
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	152.6
95% Adjusted-CLT UCL	536.1	97.5% Chebyshev (MVUE) UCL	185.1
95% Modified-t UCL	465	99% Chebyshev (MVUE) UCL	249
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.288	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	911.1		
nu star	54.22		
Approximate Chi Square Value (.05)	38.3	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	449.6
Adjusted Chi Square Value	38.09	95% Jackknife UCL	451.5
		95% Standard Bootstrap UCL	453.4
Anderson-Darling Test Statistic	24.95	95% Bootstrap-t UCL	695.9
Anderson-Darling 5% Critical Value	0.872	95% Hall's Bootstrap UCL	1092
Kolmogorov-Smirnov Test Statistic	0.445	95% Percentile Bootstrap UCL	467.1
Kolmogorov-Smirnov 5% Critical Value	0.1	95% BCA Bootstrap UCL	548.3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	757.9
		97.5% Chebyshev(Mean, Sd) UCL	972.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1393
95% Approximate Gamma UCL	372		
95% Adjusted Gamma UCL	374		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	972.1

fluoranthene

General Statistics

Number of Valid Samples	93	Number of Unique Samples	58

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	46500	Maximum of Log Data	10.75
Mean	1271	Mean of log Data	3.736
Median	13	SD of log Data	1.97
SD	6094		
Coefficient of Variation	4.793		
Skewness	6.362		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.442	Lilliefors Test Statistic	0.268
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2321	95% H-UCL	572.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	656.7
95% Adjusted-CLT UCL	2756	97.5% Chebyshev (MVUE) UCL	821.7
95% Modified-t UCL	2391	99% Chebyshev (MVUE) UCL	1146
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.214	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5948		
nu star	39.76		
Approximate Chi Square Value (.05)	26.31	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	2311
Adjusted Chi Square Value	26.14	95% Jackknife UCL	2321
		95% Standard Bootstrap UCL	2278
Anderson-Darling Test Statistic	19.86	95% Bootstrap-t UCL	5388
Anderson-Darling 5% Critical Value	0.906	95% Hall's Bootstrap UCL	6290
Kolmogorov-Smirnov Test Statistic	0.354	95% Percentile Bootstrap UCL	2480
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	2985
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4026
		97.5% Chebyshev(Mean, Sd) UCL	5218
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7559
95% Approximate Gamma UCL	1921		
95% Adjusted Gamma UCL	1934		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	5218

fluorene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	38

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	3720	Maximum of Log Data	8.221
Mean	122.1	Mean of log Data	2.951
Median	12.5	SD of log Data	1.175
SD	537.4		
Coefficient of Variation	4.403		
Skewness	5.882		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.451	Lilliefors Test Statistic	0.42
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	214.2	95% H-UCL	50.99
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	62.75
95% Adjusted-CLT UCL	249.2	97.5% Chebyshev (MVUE) UCL	73.61
95% Modified-t UCL	219.8	99% Chebyshev (MVUE) UCL	94.92
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.356	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	342.4		
nu star	67.02		
Approximate Chi Square Value (.05)	49.18	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	213.2
Adjusted Chi Square Value	48.94	95% Jackknife UCL	214.2
		95% Standard Bootstrap UCL	211.7
Anderson-Darling Test Statistic	27.73	95% Bootstrap-t UCL	536.4
Anderson-Darling 5% Critical Value	0.853	95% Hall's Bootstrap UCL	603.3
Kolmogorov-Smirnov Test Statistic	0.466	95% Percentile Bootstrap UCL	222.4
Kolmogorov-Smirnov 5% Critical Value	0.0994	95% BCA Bootstrap UCL	269.8
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	363.7
		97.5% Chebyshev(Mean, Sd) UCL	468.2
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	673.6
95% Approximate Gamma UCL	166.3		
95% Adjusted Gamma UCL	167.2		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	468.2

indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	41

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	25700	Maximum of Log Data	10.15
Mean	562.5	Mean of log Data	3.284
Median	12.66	SD of log Data	1.724
SD	2938		
Coefficient of Variation	5.222		
Skewness	7.54		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.432	Lilliefors Test Statistic	0.431
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1066	95% H-UCL	201
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	242.6
95% Adjusted-CLT UCL	1313	97.5% Chebyshev (MVUE) UCL	298.5
95% Modified-t UCL	1105	99% Chebyshev (MVUE) UCL	408.2
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.235	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2395		
nu star	44.16		
Approximate Chi Square Value (.05)	29.92	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	1061
Adjusted Chi Square Value	29.74	95% Jackknife UCL	1066
		95% Standard Bootstrap UCL	1065
Anderson-Darling Test Statistic	24.83	95% Bootstrap-t UCL	3256
Anderson-Darling 5% Critical Value	0.896	95% Hall's Bootstrap UCL	2961
Kolmogorov-Smirnov Test Statistic	0.459	95% Percentile Bootstrap UCL	1139
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	1489
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1883
		97.5% Chebyshev(Mean, Sd) UCL	2455
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3577
95% Approximate Gamma UCL	830.3		
95% Adjusted Gamma UCL	835.4		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	2455

2-methylnaphthalene

General Statistics

Number of Valid Samples	87	Number of Unique Samples	27

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	1160	Maximum of Log Data	7.056
Mean	56.66	Mean of log Data	2.872
Median	12.67	SD of log Data	1.027
SD	167.8		
Coefficient of Variation	2.962		
Skewness	4.703		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.474	Lilliefors Test Statistic	0.459
Lilliefors Critical Value	0.095	Lilliefors Critical Value	0.095
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	86.58	95% H-UCL	38.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	46.82
95% Adjusted-CLT UCL	95.95	97.5% Chebyshev (MVUE) UCL	54.24
95% Modified-t UCL	88.09	99% Chebyshev (MVUE) UCL	68.82
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.528	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	107.3		
nu star	91.86		
Approximate Chi Square Value (.05)	70.76	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0472	95% CLT UCL	86.26
Adjusted Chi Square Value	70.45	95% Jackknife UCL	86.58
		95% Standard Bootstrap UCL	86.83
Anderson-Darling Test Statistic	25.96	95% Bootstrap-t UCL	111.4
Anderson-Darling 5% Critical Value	0.815	95% Hall's Bootstrap UCL	94.97
Kolmogorov-Smirnov Test Statistic	0.509	95% Percentile Bootstrap UCL	88.82
Kolmogorov-Smirnov 5% Critical Value	0.101	95% BCA Bootstrap UCL	99.47
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	135.1
		97.5% Chebyshev(Mean, Sd) UCL	169
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	235.7
95% Approximate Gamma UCL	73.56		
95% Adjusted Gamma UCL	73.88		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	169

naphthalene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	38

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	4700	Maximum of Log Data	8.455
Mean	113.1	Mean of log Data	2.912
Median	12.5	SD of log Data	1.116
SD	548.3		
Coefficient of Variation	4.846		
Skewness	7.135		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.462	Lilliefors Test Statistic	0.422
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	207.1	95% H-UCL	44.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	55.05
95% Adjusted-CLT UCL	250.6	97.5% Chebyshev (MVUE) UCL	64.19
95% Modified-t UCL	214	99% Chebyshev (MVUE) UCL	82.13
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.363	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	312		
nu star	68.18		
Approximate Chi Square Value (.05)	50.18	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	206.2
Adjusted Chi Square Value	49.94	95% Jackknife UCL	207.1
		95% Standard Bootstrap UCL	203.8
Anderson-Darling Test Statistic	28.44	95% Bootstrap-t UCL	359.1
Anderson-Darling 5% Critical Value	0.851	95% Hall's Bootstrap UCL	304.8
Kolmogorov-Smirnov Test Statistic	0.471	95% Percentile Bootstrap UCL	217.3
Kolmogorov-Smirnov 5% Critical Value	0.0993	95% BCA Bootstrap UCL	283.1
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	359.6
		97.5% Chebyshev(Mean, Sd) UCL	466.3
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	675.8
95% Approximate Gamma UCL	153.7		
95% Adjusted Gamma UCL	154.5		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	466.3

phenanthrene

General Statistics

Number of Valid Samples	94	Number of Unique Samples	53

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	27700	Maximum of Log Data	10.23
Mean	999.4	Mean of log Data	3.574
Median	13	SD of log Data	1.937
SD	4230		
Coefficient of Variation	4.232		
Skewness	5.408		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.45	Lilliefors Test Statistic	0.3
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	1724	95% H-UCL	445.8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	516.6
95% Adjusted-CLT UCL	1977	97.5% Chebyshev (MVUE) UCL	644.9
95% Modified-t UCL	1765	99% Chebyshev (MVUE) UCL	896.8
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.218	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	4585		
nu star	40.98		
Approximate Chi Square Value (.05)	27.31	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	1717
Adjusted Chi Square Value	27.13	95% Jackknife UCL	1724
		95% Standard Bootstrap UCL	1725
Anderson-Darling Test Statistic	21.94	95% Bootstrap-t UCL	2723
Anderson-Darling 5% Critical Value	0.904	95% Hall's Bootstrap UCL	4377
Kolmogorov-Smirnov Test Statistic	0.387	95% Percentile Bootstrap UCL	1803
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	2049
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2901
		97.5% Chebyshev(Mean, Sd) UCL	3724
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5340
95% Approximate Gamma UCL	1500		
95% Adjusted Gamma UCL	1509		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	3724

pyrene

General Statistics

Number of Valid Samples	93	Number of Unique Samples	55

Raw Statistics		**Log-transformed Statistics**	
Minimum	11.17	Minimum of Log Data	2.413
Maximum	44700	Maximum of Log Data	10.71
Mean	1464	Mean of log Data	3.733
Median	13	SD of log Data	2.08
SD	6005		
Coefficient of Variation	4.1		
Skewness	5.537		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.456	Lilliefors Test Statistic	0.333
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	2499	95% H-UCL	763.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	847.5
95% Adjusted-CLT UCL	2871	97.5% Chebyshev (MVUE) UCL	1067
95% Modified-t UCL	2559	99% Chebyshev (MVUE) UCL	1499
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.206	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	7092		
nu star	38.41		
Approximate Chi Square Value (.05)	25.21	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	2489
Adjusted Chi Square Value	25.05	95% Jackknife UCL	2499
		95% Standard Bootstrap UCL	2490
Anderson-Darling Test Statistic	20.56	95% Bootstrap-t UCL	3620
Anderson-Darling 5% Critical Value	0.909	95% Hall's Bootstrap UCL	3425
Kolmogorov-Smirnov Test Statistic	0.36	95% Percentile Bootstrap UCL	2569
Kolmogorov-Smirnov 5% Critical Value	0.103	95% BCA Bootstrap UCL	2910
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4178
		97.5% Chebyshev(Mean, Sd) UCL	5353
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7660
95% Approximate Gamma UCL	2231		
95% Adjusted Gamma UCL	2246		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	7660

	General UCL Statistics for Full Data Sets
User Selected Options	**Complete Metals ABC**
From File	
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Number of Valid Samples	93	Number of Unique Samples	24

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.162	Minimum of Log Data	-1.822
Maximum	457	Maximum of Log Data	6.125
Mean	5.746	Mean of log Data	-1.214
Median	0.165	SD of log Data	1.343
SD	47.37		
Coefficient of Variation	8.243		
Skewness	9.604		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.472	Lilliefors Test Statistic	0.422
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	13.91	95% H-UCL	1.048
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.296
95% Adjusted-CLT UCL	19.05	97.5% Chebyshev (MVUE) UCL	1.546
95% Modified-t UCL	14.72	99% Chebyshev (MVUE) UCL	2.037
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.241	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	23.89		
nu star	44.75		
Approximate Chi Square Value (.05)	30.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	13.83
Adjusted Chi Square Value	30.22	95% Jackknife UCL	13.91
		95% Standard Bootstrap UCL	13.94
Anderson-Darling Test Statistic	27.17	95% Bootstrap-t UCL	213.6
Anderson-Darling 5% Critical Value	0.894	95% Hall's Bootstrap UCL	115.6
Kolmogorov-Smirnov Test Statistic	0.459	95% Percentile Bootstrap UCL	15.6
Kolmogorov-Smirnov 5% Critical Value	0.102	95% BCA Bootstrap UCL	20.64
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	27.16
		97.5% Chebyshev(Mean, Sd) UCL	36.42
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	54.62
95% Approximate Gamma UCL	8.457		
95% Adjusted Gamma UCL	8.509		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	36.42

Accutest LabLink@464066 10:52 18-Sep-2008

Report of Analysis

Client Sample ID:	FGGM83-EE/CA-SB-C8		
Lab Sample ID:	N76417-14A	**Date Sampled:**	08/26/04
Matrix:	SO - Soil	**Date Received:**	08/27/04
		Percent Solids:	97.9
Project:	EE/CA of the former Trap & Skeet Range, Fort Meade, MD		

Metals Analysis

Analyte	Result	RL	MDL	Units	DF	Prep	Analyzed	By	Method	Prep Method
Antimony	457	1.0	0.74	mg/kg	1	09/13/04	09/15/04	ND	SW846 6010B [1]	SW846 3050B [3]
Arsenic	50.5	1.0	0.61	mg/kg	1	09/13/04	09/15/04	ND	SW846 6010B [1]	SW846 3050B [3]
Copper	9.9	2.5	0.18	mg/kg	1	09/13/04	09/15/04	ND	SW846 6010B [1]	SW846 3050B [3]
Lead	22800	100	33	mg/kg	100	09/13/04	09/17/04	LH	SW846 6010B [2]	SW846 3050B [3]
Zinc	16.8	2.0	0.52	mg/kg	1	09/13/04	09/15/04	ND	SW846 6010B [1]	SW846 3050B [3]

(1) Instrument QC Batch: MA14432
(2) Instrument QC Batch: MA14454
(3) Prep QC Batch: MP27093

RL = Reporting Limit
MDL = Method Detection Limit

U = Indicates a result < MDL
B = Indicates a result > = MDL but < RL

Arsenic

General Statistics

Number of Valid Samples	93	Number of Unique Samples	54

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.7	Minimum of Log Data	-0.357
Maximum	50.5	Maximum of Log Data	3.922
Mean	4.961	Mean of log Data	1.319
Median	4	SD of log Data	0.699
SD	5.91		
Coefficient of Variation	1.191		
Skewness	5.826		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.272	Lilliefors Test Statistic	0.103
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	5.979	95% H-UCL	5.506
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6.414
95% Adjusted-CLT UCL	6.365	97.5% Chebyshev (MVUE) UCL	7.131
95% Modified-t UCL	6.041	99% Chebyshev (MVUE) UCL	8.539
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.863	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2.663		
nu star	346.5		
Approximate Chi Square Value (.05)	304.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	5.969
Adjusted Chi Square Value	303.8	95% Jackknife UCL	5.979
		95% Standard Bootstrap UCL	5.952
Anderson-Darling Test Statistic	2.59	95% Bootstrap-t UCL	7.105
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL	10.93
Kolmogorov-Smirnov Test Statistic	0.152	95% Percentile Bootstrap UCL	6.097
Kolmogorov-Smirnov 5% Critical Value	0.0941	95% BCA Bootstrap UCL	6.627
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	7.632
		97.5% Chebyshev(Mean, Sd) UCL	8.788
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	11.06
95% Approximate Gamma UCL	5.648		
95% Adjusted Gamma UCL	5.659		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	7.632

Copper

General Statistics

Number of Valid Samples	93	Number of Unique Samples	65

Raw Statistics		Log-transformed Statistics	
Minimum	4	Minimum of Log Data	1.386
Maximum	42.2	Maximum of Log Data	3.742
Mean	11.16	Mean of log Data	2.339
Median	10.2	SD of log Data	0.375
SD	4.916		
Coefficient of Variation	0.44		
Skewness	2.946		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.11	Lilliefors Test Statistic	0.0506
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	12.01	95% H-UCL	11.93
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.06
95% Adjusted-CLT UCL	12.17	97.5% Chebyshev (MVUE) UCL	13.91
95% Modified-t UCL	12.04	99% Chebyshev (MVUE) UCL	15.56
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.735	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	1.658		
nu star	1253		
Approximate Chi Square Value (.05)	1171	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	12
Adjusted Chi Square Value	1170	95% Jackknife UCL	12.01
		95% Standard Bootstrap UCL	12
Anderson-Darling Test Statistic	0.479	95% Bootstrap-t UCL	12.2
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL	12.49
Kolmogorov-Smirnov Test Statistic	0.0596	95% Percentile Bootstrap UCL	12.02
Kolmogorov-Smirnov 5% Critical Value	0.0929	95% BCA Bootstrap UCL	12.21
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	13.39
		97.5% Chebyshev(Mean, Sd) UCL	14.35
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16.24
95% Approximate Gamma UCL	11.94		
95% Adjusted Gamma UCL	11.95		
Potential UCL to Use		Use 95% Approximate Gamma UCL	11.94

Lead

General Statistics

Number of Valid Samples	93	Number of Unique Samples	86

Raw Statistics		Log-transformed Statistics	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	22800	Maximum of Log Data	10.03
Mean	463.7	Mean of log Data	3.976
Median	36.6	SD of log Data	1.77
SD	2408		
Coefficient of Variation	5.193		
Skewness	8.924		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.424	Lilliefors Test Statistic	0.13
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	878.7	95% H-UCL	447.3
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	535.4
95% Adjusted-CLT UCL	1121	97.5% Chebyshev (MVUE) UCL	661.1
95% Modified-t UCL	917.2	99% Chebyshev (MVUE) UCL	908
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.313	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	1481		
nu star	58.23		
Approximate Chi Square Value (.05)	41.68	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	874.5
Adjusted Chi Square Value	41.46	95% Jackknife UCL	878.7
		95% Standard Bootstrap UCL	882.3
Anderson-Darling Test Statistic	9.178	95% Bootstrap-t UCL	2965
Anderson-Darling 5% Critical Value	0.864	95% Hall's Bootstrap UCL	2448
Kolmogorov-Smirnov Test Statistic	0.24	95% Percentile Bootstrap UCL	962.2
Kolmogorov-Smirnov 5% Critical Value	0.101	95% BCA Bootstrap UCL	1352
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1552
		97.5% Chebyshev(Mean, Sd) UCL	2023
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2948
95% Approximate Gamma UCL	647.8		
95% Adjusted Gamma UCL	651.2		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	2023

Zinc

General Statistics

Number of Valid Samples	93	Number of Unique Samples	84

Raw Statistics		**Log-transformed Statistics**	
Minimum	2.7	Minimum of Log Data	0.993
Maximum	227	Maximum of Log Data	5.425
Mean	27.56	Mean of log Data	3.01
Median	22.3	SD of log Data	0.75
SD	30.25		
Coefficient of Variation	1.098		
Skewness	4.453		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.225	Lilliefors Test Statistic	0.0707
Lilliefors Critical Value	0.0919	Lilliefors Critical Value	0.0919
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	32.77	95% H-UCL	31.45
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	36.94
95% Adjusted-CLT UCL	34.27	97.5% Chebyshev (MVUE) UCL	41.34
95% Modified-t UCL	33.01	99% Chebyshev (MVUE) UCL	49.97
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.732	**Data appear Lognormal at 5% Significance Level**	
Theta Star	15.92		
nu star	322.1		
Approximate Chi Square Value (.05)	281.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	32.72
Adjusted Chi Square Value	280.9	95% Jackknife UCL	32.77
		95% Standard Bootstrap UCL	32.49
Anderson-Darling Test Statistic	1.752	95% Bootstrap-t UCL	36.17
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL	54.38
Kolmogorov-Smirnov Test Statistic	0.13	95% Percentile Bootstrap UCL	33.22
Kolmogorov-Smirnov 5% Critical Value	0.0942	95% BCA Bootstrap UCL	34.85
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	41.23
		97.5% Chebyshev(Mean, Sd) UCL	47.15
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	58.77
95% Approximate Gamma UCL	31.53		
95% Adjusted Gamma UCL	31.6		
Potential UCL to Use		Use 95% H-UCL	31.45

APPENDIX B

Exposure Point 95% UCL Calculations > 375 feet

General UCL Statistics for Full Data Sets	
User Selected Options	
From File	
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		Log-transformed Statistics	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.27
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.25
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.89
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.56
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.14
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Acenaphthylene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.09
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	78.4
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.91
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.42
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.08
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Anthracene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.19
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.75
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	49.11
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.51
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.11
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Benzo(a)anthracene

General Statistics			
Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		Log-transformed Statistics	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	17.56	Mean of log Data	2.737
Median	13.17	SD of log Data	0.44
SD	13.12		
Coefficient of Variation	0.747		
Skewness	3.382		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.45	Shapiro Wilk Test Statistic	0.571
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.77	95% H-UCL	21.78
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	25.73
95% Adjusted-CLT UCL	26.72	97.5% Chebyshev (MVUE) UCL	29.55
95% Modified-t UCL	24.3	99% Chebyshev (MVUE) UCL	37.07
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.236	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.428		
nu star	90.6		
Approximate Chi Square Value (.05)	69.65	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	23.33
Adjusted Chi Square Value	67.22	95% Jackknife UCL	23.77
		95% Standard Bootstrap UCL	23.05
Anderson-Darling Test Statistic	2.839	95% Bootstrap-t UCL	74.84
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	50.33
Kolmogorov-Smirnov Test Statistic	0.405	95% Percentile Bootstrap UCL	24.3
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.55
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.85
		97.5% Chebyshev(Mean, Sd) UCL	39.46
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	52.45
95% Approximate Gamma UCL	22.84		
95% Adjusted Gamma UCL	23.67		
Potential UCL to Use		Use 95% Student's-t UCL	23.77
		or 95% Modified-t UCL	24.3

Benzo(b)fluoranthene

General Statistics			
Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		Log-transformed Statistics	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.19
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.04
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.91
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.5
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.04
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Benzo(k)fluoranthene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.17
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	78.46
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.55
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.49
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.12
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Benzo(g,h,i)perylene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	77.9
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.93
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.4
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.02
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Benzo(a)pyrene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	17.62	Mean of log Data	2.74
Median	13.17	SD of log Data	0.442
SD	13.16		
Coefficient of Variation	0.747		
Skewness	3.344		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.455	Shapiro Wilk Test Statistic	0.574
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.85	95% H-UCL	21.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	25.87
95% Adjusted-CLT UCL	26.76	97.5% Chebyshev (MVUE) UCL	29.73
95% Modified-t UCL	24.37	99% Chebyshev (MVUE) UCL	37.32
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.212	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.486		
nu star	89.92		
Approximate Chi Square Value (.05)	69.06	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	23.4
Adjusted Chi Square Value	66.64	95% Jackknife UCL	23.85
		95% Standard Bootstrap UCL	23.25
Anderson-Darling Test Statistic	2.834	95% Bootstrap-t UCL	78.33
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	50.53
Kolmogorov-Smirnov Test Statistic	0.407	95% Percentile Bootstrap UCL	23.82
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	28.1
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.95
		97.5% Chebyshev(Mean, Sd) UCL	39.58
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	52.61
95% Approximate Gamma UCL	22.94		
95% Adjusted Gamma UCL	23.78		
Potential UCL to Use		Use 95% Student's-t UCL	23.85
		or 95% Modified-t UCL	24.37

Chrysene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	17.76	Mean of log Data	2.745
Median	13.17	SD of log Data	0.449
SD	13.27		
Coefficient of Variation	0.747		
Skewness	3.246		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.466	Shapiro Wilk Test Statistic	0.579
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	24.04	95% H-UCL	22.19
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	26.23
95% Adjusted-CLT UCL	26.88	97.5% Chebyshev (MVUE) UCL	30.19
95% Modified-t UCL	24.55	99% Chebyshev (MVUE) UCL	37.97
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.147	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.643		
nu star	88.13		
Approximate Chi Square Value (.05)	67.48	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	23.59
Adjusted Chi Square Value	65.09	95% Jackknife UCL	24.04
		95% Standard Bootstrap UCL	23.29
Anderson-Darling Test Statistic	2.834	95% Bootstrap-t UCL	79.47
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	52.68
Kolmogorov-Smirnov Test Statistic	0.411	95% Percentile Bootstrap UCL	24.42
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.89
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.22
		97.5% Chebyshev(Mean, Sd) UCL	39.91
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	53.04
95% Approximate Gamma UCL	23.2		
95% Adjusted Gamma UCL	24.05		
Potential UCL to Use		Use 95% Student's-t UCL	24.04
		or 95% Modified-t UCL	24.55

Dibenzo(a,h)anthracene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.23
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.7
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.99
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.55
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.05
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Fluoranthene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	22.09	Mean of log Data	2.935
Median	14.25	SD of log Data	0.543
SD	15.25		
Coefficient of Variation	0.69		
Skewness	1.858		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.702	Shapiro Wilk Test Statistic	0.791
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	29.31	95% H-UCL	30.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	35.62
95% Adjusted-CLT UCL	30.96	97.5% Chebyshev (MVUE) UCL	41.71
95% Modified-t UCL	29.65	99% Chebyshev (MVUE) UCL	53.67
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.619	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	8.433		
nu star	73.34		
Approximate Chi Square Value (.05)	54.62	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	28.79
Adjusted Chi Square Value	52.48	95% Jackknife UCL	29.31
		95% Standard Bootstrap UCL	28.48
Anderson-Darling Test Statistic	1.439	95% Bootstrap-t UCL	37.45
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	55.83
Kolmogorov-Smirnov Test Statistic	0.316	95% Percentile Bootstrap UCL	29.31
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	31.03
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	39.85
		97.5% Chebyshev(Mean, Sd) UCL	47.54
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	62.64
95% Approximate Gamma UCL	29.66		
95% Adjusted Gamma UCL	30.87		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	39.85

Fluorene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	17.34	Mean of log Data	2.728
Median	13.17	SD of log Data	0.428
SD	13		
Coefficient of Variation	0.75		
Skewness	3.525		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.426	Shapiro Wilk Test Statistic	0.552
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.49	95% H-UCL	21.32
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	25.16
95% Adjusted-CLT UCL	26.55	97.5% Chebyshev (MVUE) UCL	28.83
95% Modified-t UCL	24.04	99% Chebyshev (MVUE) UCL	36.05
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.328	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.209		
nu star	93.19		
Approximate Chi Square Value (.05)	71.93	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	23.05
Adjusted Chi Square Value	69.45	95% Jackknife UCL	23.49
		95% Standard Bootstrap UCL	22.9
Anderson-Darling Test Statistic	2.92	95% Bootstrap-t UCL	72.48
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.28
Kolmogorov-Smirnov Test Statistic	0.398	95% Percentile Bootstrap UCL	23.88
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	28.15
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	32.48
		97.5% Chebyshev(Mean, Sd) UCL	39.03
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.9
95% Approximate Gamma UCL	22.46		
95% Adjusted Gamma UCL	23.26		
Potential UCL to Use		Use 95% Student's-t UCL	23.49
		or 95% Modified-t UCL	24.04

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.33
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.05
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	49.66
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.45
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.07
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

2-Methylnaphthalene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.2
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	80.31
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	49.43
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.52
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Naphthalene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.26
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.31
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	48.9
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.58
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.14
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

Phenanthrene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	19.7	Mean of log Data	2.822
Median	13.42	SD of log Data	0.511
SD	14.81		
Coefficient of Variation	0.752		
Skewness	2.389		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.565	Shapiro Wilk Test Statistic	0.654
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	26.71	95% H-UCL	25.84
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	30.6
95% Adjusted-CLT UCL	28.91	97.5% Chebyshev (MVUE) UCL	35.64
95% Modified-t UCL	27.13	99% Chebyshev (MVUE) UCL	45.52
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.651	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	7.433		
nu star	74.22		
Approximate Chi Square Value (.05)	55.38	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	26.21
Adjusted Chi Square Value	53.23	95% Jackknife UCL	26.71
		95% Standard Bootstrap UCL	25.8
Anderson-Darling Test Statistic	2.474	95% Bootstrap-t UCL	51.33
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	56.82
Kolmogorov-Smirnov Test Statistic	0.392	95% Percentile Bootstrap UCL	26.02
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	29.08
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	36.96
		97.5% Chebyshev(Mean, Sd) UCL	44.42
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	59.09
95% Approximate Gamma UCL	26.41		
95% Adjusted Gamma UCL	27.47		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	36.96

Pyrene

General Statistics

Number of Valid Samples	14	Number of Unique Samples	12

Raw Statistics		**Log-transformed Statistics**	
Minimum	12	Minimum of Log Data	2.485
Maximum	61.67	Maximum of Log Data	4.122
Mean	16.65	Mean of log Data	2.687
Median	13.08	SD of log Data	0.419
SD	12.99		
Coefficient of Variation	0.78		
Skewness	3.706		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.361	Shapiro Wilk Test Statistic	0.45
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	22.8	95% H-UCL	20.25
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	23.87
95% Adjusted-CLT UCL	26.04	97.5% Chebyshev (MVUE) UCL	27.3
95% Modified-t UCL	23.38	99% Chebyshev (MVUE) UCL	34.04
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	3.308	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.035		
nu star	92.63		
Approximate Chi Square Value (.05)	71.43	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	22.37
Adjusted Chi Square Value	68.97	95% Jackknife UCL	22.8
		95% Standard Bootstrap UCL	22.29
Anderson-Darling Test Statistic	3.605	95% Bootstrap-t UCL	79.6
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	49.33
Kolmogorov-Smirnov Test Statistic	0.437	95% Percentile Bootstrap UCL	23.55
Kolmogorov-Smirnov 5% Critical Value	0.23	95% BCA Bootstrap UCL	27.02
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.79
		97.5% Chebyshev(Mean, Sd) UCL	38.34
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	51.2
95% Approximate Gamma UCL	21.6		
95% Adjusted Gamma UCL	22.37		
Potential UCL to Use		Use 95% Student's-t UCL	22.8
		or 95% Modified-t UCL	23.38

	General UCL Statistics for Full Data Sets
User Selected Options	**Complete Metals DEFG**
From File	
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Number of Valid Samples	94	Number of Unique Samples	40

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.165	Minimum of Log Data	-1.802
Maximum	32.1	Maximum of Log Data	3.469
Mean	2.486	Mean of log Data	-0.516
Median	0.183	SD of log Data	1.604
SD	5.157		
Coefficient of Variation	2.074		
Skewness	3.441		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.326	Lilliefors Test Statistic	0.316
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	3.369	95% H-UCL	3.467
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.244
95% Adjusted-CLT UCL	3.562	97.5% Chebyshev (MVUE) UCL	5.174
95% Modified-t UCL	3.401	99% Chebyshev (MVUE) UCL	7
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.445	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	5.587		
nu star	83.64		
Approximate Chi Square Value (.05)	63.56	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	3.361
Adjusted Chi Square Value	63.29	95% Jackknife UCL	3.369
		95% Standard Bootstrap UCL	3.352
Anderson-Darling Test Statistic	10.03	95% Bootstrap-t UCL	3.749
Anderson-Darling 5% Critical Value	0.83	95% Hall's Bootstrap UCL	3.738
Kolmogorov-Smirnov Test Statistic	0.314	95% Percentile Bootstrap UCL	3.419
Kolmogorov-Smirnov 5% Critical Value	0.0982	95% BCA Bootstrap UCL	3.567
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.804
		97.5% Chebyshev(Mean, Sd) UCL	5.807
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7.778
95% Approximate Gamma UCL	3.271		
95% Adjusted Gamma UCL	3.285		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	5.807

Arsenic

General Statistics

Number of Valid Samples	94	Number of Unique Samples	53

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.767	Minimum of Log Data	-0.266
Maximum	25.4	Maximum of Log Data	3.235
Mean	5.515	Mean of log Data	1.494
Median	4.15	SD of log Data	0.614
SD	4.537		
Coefficient of Variation	0.823		
Skewness	2.58		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.264	Lilliefors Test Statistic	0.122
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	6.292	95% H-UCL	6.077
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6.973
95% Adjusted-CLT UCL	6.417	97.5% Chebyshev (MVUE) UCL	7.667
95% Modified-t UCL	6.313	99% Chebyshev (MVUE) UCL	9.031
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.427	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	2.272		
nu star	456.3		
Approximate Chi Square Value (.05)	407.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	6.284
Adjusted Chi Square Value	407	95% Jackknife UCL	6.292
		95% Standard Bootstrap UCL	6.285
Anderson-Darling Test Statistic	3.98	95% Bootstrap-t UCL	6.471
Anderson-Darling 5% Critical Value	0.762	95% Hall's Bootstrap UCL	6.402
Kolmogorov-Smirnov Test Statistic	0.173	95% Percentile Bootstrap UCL	6.317
Kolmogorov-Smirnov 5% Critical Value	0.0932	95% BCA Bootstrap UCL	6.368
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	7.554
		97.5% Chebyshev(Mean, Sd) UCL	8.437
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	10.17
95% Approximate Gamma UCL	6.171		
95% Adjusted Gamma UCL	6.182		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	7.554

Copper

General Statistics

Number of Valid Samples	94	Number of Unique Samples	60

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.8	Minimum of Log Data	1.569
Maximum	25.3	Maximum of Log Data	3.231
Mean	9.58	Mean of log Data	2.224
Median	9.25	SD of log Data	0.26
SD	2.844		
Coefficient of Variation	0.297		
Skewness	2.379		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Lilliefors Test Statistic	0.145	Lilliefors Test Statistic	0.0848
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	10.07	95% H-UCL	10.02
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	10.69
95% Adjusted-CLT UCL	10.14	97.5% Chebyshev (MVUE) UCL	11.18
95% Modified-t UCL	10.08	99% Chebyshev (MVUE) UCL	12.15
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	13.78	**Data appear Lognormal at 5% Significance Level**	
Theta Star	0.695		
nu star	2591		
Approximate Chi Square Value (.05)	2473	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	10.06
Adjusted Chi Square Value	2472	95% Jackknife UCL	10.07
		95% Standard Bootstrap UCL	10.07
Anderson-Darling Test Statistic	1.025	95% Bootstrap-t UCL	10.18
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL	10.26
Kolmogorov-Smirnov Test Statistic	0.102	95% Percentile Bootstrap UCL	10.11
Kolmogorov-Smirnov 5% Critical Value	0.0921	95% BCA Bootstrap UCL	10.16
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	10.86
		97.5% Chebyshev(Mean, Sd) UCL	11.41
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	12.5
95% Approximate Gamma UCL	10.03		
95% Adjusted Gamma UCL	10.04		
Potential UCL to Use		Use 95% Student's-t UCL	10.07
		or 95% Modified-t UCL	10.08
		or 95% H-UCL	10.02

Lead

General Statistics

Number of Valid Samples	94	Number of Unique Samples	92

Raw Statistics		Log-transformed Statistics	
Minimum	1.7	Minimum of Log Data	0.531
Maximum	4880	Maximum of Log Data	8.493
Mean	463.3	Mean of log Data	4.547
Median	81.55	SD of log Data	1.957
SD	912.6		
Coefficient of Variation	1.97		
Skewness	3.185		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.307	Lilliefors Test Statistic	0.114
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	619.7	95% H-UCL	1243
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1434
95% Adjusted-CLT UCL	651.2	97.5% Chebyshev (MVUE) UCL	1792
95% Modified-t UCL	624.8	99% Chebyshev (MVUE) UCL	2495
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.406	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	1142		
nu star	76.26		
Approximate Chi Square Value (.05)	57.15	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	618.1
Adjusted Chi Square Value	56.89	95% Jackknife UCL	619.7
		95% Standard Bootstrap UCL	614.6
Anderson-Darling Test Statistic	2.939	95% Bootstrap-t UCL	670.2
Anderson-Darling 5% Critical Value	0.84	95% Hall's Bootstrap UCL	664
Kolmogorov-Smirnov Test Statistic	0.141	95% Percentile Bootstrap UCL	621.1
Kolmogorov-Smirnov 5% Critical Value	0.0988	95% BCA Bootstrap UCL	660.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	873.6
		97.5% Chebyshev(Mean, Sd) UCL	1051
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1400
95% Approximate Gamma UCL	618.3		
95% Adjusted Gamma UCL	621.1		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	1051

Zinc

General Statistics

Number of Valid Samples	94	Number of Unique Samples	82

Raw Statistics		Log-transformed Statistics	
Minimum	10.7	Minimum of Log Data	2.37
Maximum	61.8	Maximum of Log Data	4.124
Mean	26.11	Mean of log Data	3.189
Median	24.15	SD of log Data	0.387
SD	10.23		
Coefficient of Variation	0.392		
Skewness	0.964		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.0906	Lilliefors Test Statistic	0.0715
Lilliefors Critical Value	0.0914	Lilliefors Critical Value	0.0914
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	27.86	95% H-UCL	28.08
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	30.82
95% Adjusted-CLT UCL	27.95	97.5% Chebyshev (MVUE) UCL	32.85
95% Modified-t UCL	27.88	99% Chebyshev (MVUE) UCL	36.84
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	6.777	**Data appear Normal at 5% Significance Level**	
Theta Star	3.852		
nu star	1274		
Approximate Chi Square Value (.05)	1192	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0474	95% CLT UCL	27.84
Adjusted Chi Square Value	1191	95% Jackknife UCL	27.86
		95% Standard Bootstrap UCL	27.81
Anderson-Darling Test Statistic	0.352	95% Bootstrap-t UCL	28.07
Anderson-Darling 5% Critical Value	0.754	95% Hall's Bootstrap UCL	28.02
Kolmogorov-Smirnov Test Statistic	0.054	95% Percentile Bootstrap UCL	27.96
Kolmogorov-Smirnov 5% Critical Value	0.0924	95% BCA Bootstrap UCL	27.96
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.71
		97.5% Chebyshev(Mean, Sd) UCL	32.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	36.6
95% Approximate Gamma UCL	27.9		
95% Adjusted Gamma UCL	27.93		
Potential UCL to Use		Use 95% Student's-t UCL	27.86

APPENDIX C -1

Evaluation of Potential Exposure Pathways to COPCs in Soil

EVALUATION OF POTENTIAL EXPOSURE PATHWAYS FOR COPCs in SOIL

Pathway Evaluation			Comments	Conclusion
Release of Contaminants to Soil				
Food Chain				
Does contaminated soil support Edible Species?	Consider transfer of Contaminants to Plants or Animals Consumed by Humans	Are Persons Potentially Exposed via Ingestion of Home-grown Food?	There are no gardens or grazing areas near the site	Pathway Eliminated
Volatilization/Air transport pathway				
Are contaminants volatile?	Consider Transfer of Contaminants to Atmosphere	Are persons Potentially Exposed via Inhalation of On-site Air?	None of the contaminants are volatile.	Pathway Eliminated
Are contaminants in particulate form?			Grass and leaves at the site essentially eliminates generation; however, some particulate matter is generated from soils.	Potential exposure to Trespassers, Recreational Users, Commercial/Industrial Workers, and Construction Workers
Direct Contact pathway				
Identify Human Populations Directly Exposed to Soils	Are persons potentially exposed via dermal contact?		There are current or reasonably-anticipated land uses that result in routine contact with soils. Worker exposure is possible if construction activities are undertaken in the area.	Potential exposure to Trespassers, Recreational Users, Commercial/Industrial Workers, and Construction Workers
	Are persons potentially exposed via soil ingestion?		There are current or reasonably-anticipated land uses that result in routine contact with soils. Worker exposure is possible if construction activities are undertaken in the area.	Potential exposure to Trespassers, Recreational Users, Commercial/Industrial Workers, and Construction Workers

APPENDIX C -2

Evaluation of Potential Exposure Pathways to COPCs in Sediment

EVALUATION OF POTENTIAL EXPOSURE PATHWAYS FOR COPCs in SEDIMENT

Pathway Evaluation			Comments	Conclusion
Release of Contaminants to Sediment				
Does contaminated sediment support Edible Species?	Consider transfer of Contaminants to Plants or Animals Consumed by Humans	Are Persons Potentially Exposed via Ingestion of Food Source?	COPCs were not detected in surface water. High molecular weight of COPCs inhibit tranfer of contamination to water.	Pathway Eliminated
Volatilization/Air transport pathway				
Are contaminants volatile?	Consider Transfer of Contaminants to Atmosphere	Are persons Potentially Exposed via Inhalation of On-site Air?	Low molecular weight of contaminants inhibit volatilization.	Pathway Eliminated
Are contaminants in particulate form?			No particulate matter is generated from the sediments.	Pathway Eliminated
Direct Contact pathway				
Identify Human Populations Directly Exposed to Sediment	Are persons potentially exposed via dermal contact?		There are current or reasonably-anticipated land uses that result in routine contact with soils. Worker exposure is possible if construction activities are undertaken in the area.	Potential exposure to Trespassers, Recreational Users, Commercial/Industrial Workers, and Construction Workers
	Are persons potentially exposed via soil ingestion?		There are current or reasonably-anticipated land uses that result in routine contact with soils. Worker exposure is possible if construction activities are undertaken in the area.	Potential exposure to Trespassers, Recreational Users, Commercial/Industrial Workers, and Construction Workers

APPENDIX D

Values Used For Daily Intake / Risk Assessment Calculations

VALUES USED FOR SOIL/SEDIMENT INTAKE / RISK CALCULATIONS - CONSTRUCTION WORKER

Exposure Medium:	Soil / Sed
Receptor Population:	Construction/Utility Worker
Exposure Route:	Ingestion / Dermal / Inhalation

Parameter Code	Parameter Definition	Units	Default	Reference	Defined Value	Reference
DAD	Dermally Absorbed Dose	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
IR	Ingestion Rate	mg_{soil}/day	330	EPA, 2002		
SA	Skin Surface Area Exposed	cm^2/day	3,330 (3)	EPA, 2001		
AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	EPA, 2002		
ABS	Absorption Factor	unitless	Chemical Specific (4)	EPA, 1995 and EPA, 2001		
IhR	Inhalation Rate	m^3/day	20	EPA, 2002		
PEF	Particulate Emission Factor	m^3/kg	1.81E+09	default, EPA, 1996b		
EF	Exposure Frequency	days/years	250	EPA, 2002		
ED	Exposure Duration	years	1	EPA, 1991b		
ET	Exposure Time	hrs	8	EPA, 2002		
BW	Body Weight	kg	70 kg	EPA, 1991		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	365	EPA, 1989		

EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.

EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03

EPA, 1995= Assessing Dermal Exposure from Soil. Region III. Office of Superfund Programs. EPA/903-K-95-003.

EPA, 2001= RAGS E, Chapter 3

EPA, 2002= Supplement Guidance For Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

(1) Based on soil-to-skin adherence data presented in U. S. EPA (2001) for a "utility worker".

(2) Represents face, hands, forearms, lower legs and feet

(3) Represents the face, hands, and forearms for workers; face hands, forearms and lower legs for resident adults.

(4) Absorption Factors: PAHs = 0.13; Metals = 0.01

Note the following AFs from RAGS E for site specific scenarios:

groundskeeper	AF=0.1
construction worker	AF=0.3
utility worker	AF=0.9

VALUES USED FOR SOIL/SEDIMENT INTAKE / RISK CALCULATIONS - COMMERCIAL / INDUSTRIAL WORKER

Exposure Medium:	Soil / Sed
Receptor Population:	Commercial / Industrial Worker
Exposure Route:	Ingestion / Dermal / Inhalation

Parameter Code	Parameter Definition	Units	Default	Reference	Defined Value	Reference
DAD	Dermally Absorbed Dose	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
IR	Ingestion Rate	mg_{soil}/day	50	EPA, 2002		
SA	Skin Surface Area Exposed	cm^2/day	3,330 (3)	EPA, 2001		
AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	EPA, 2002		
ABS	Absorption Factor	unitless	Chemical Specific (4)	EPA, 1995 and EPA, 2001		
IhR	Inhalation Rate	m^3/day	20	EPA, 2002		
PEF	Particulate Emission Factor	m^3/kg	1.81E+09	default, EPA, 1996b		
EF	Exposure Frequency	days/years	250	EPA, 2002		
ED	Exposure Duration	years	25	EPA, 1991b		
ET	Exposure Time	hrs	8	EPA, 2002		
BW	Body Weight	kg	70 kg	EPA, 1991		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	9,125	EPA, 1989		

EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.

EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03

EPA, 1995= Assessing Dermal Exposure from Soil. Region III. Office of Superfund Programs. EPA/903-K-95-003.

EPA, 2001= RAGS E, Chapter 3

EPA, 2002= Supplement Guidance For Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

(1) Based on soil-to-skin adherence data presented in U. S. EPA (2001) for a "utility worker".

(2) Represents face, hands, forearms, lower legs and feet

(3) Represents the face, hands, and forearms for workers; face hands, forearms and lower legs for resident adults.

(4) Absorption Factors: PAHs = 0.13; Metals = 0.01

Note the following AFs from RAGS E for site specific scenarios:

groundskeeper	AF=0.1
construction worker	AF=0.3
utility worker	AF=0.9

VALUES USED FOR SOIL/SEDIMENT INTAKE / RISK CALCULATIONS - YOUTH TRESPASSER AND YOUTH RECREATIONAL VISITOR

Exposure Medium:	Soil / Sed
Receptor Population:	Youth Trespasser / Recreational Visitor
Exposure Route:	Ingestion / Dermal / Inhalation

Parameter Code	Parameter Definition	Units	Default	Reference	User Defined Value	Reference
DAD	Dermally Absorbed Dose	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
IR	Ingestion Rate	mg_{soil}/day	200	EPA, 2002		
SA	Skin Surface Area Exposed	cm^2 /day	2,800	EPA, 2002		
AF	Soil to Skin Adherence Factor	mg/cm^2	0.2	EPA, 2002		
ABS	Absorption Factor	unitless	Chemical Specific (4)	EPA, 1995 and EPA, 2001		
IhR	Inhalation Rate	m^3 /day	20	EPA, 2002		
PEF	Particulate Emission Factor	m^3/kg	1.81E+09	default, EPA, 1996b		
EF	Exposure Frequency	days/years			39	3mths/jun,jul,aug
ED	Exposure Duration	years	11	EPA, 1991b		
	Exposure Time	hrs			4	
BW	Body Weight	kg	42	EPA, 1991		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	4,015	EPA, 1989		

EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.

EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03

EPA, 1995= Assessing Dermal Exposure from Soil. Region III. Office of Superfund Programs. EPA/903-K-95-003.

EPA, 2001= RAGS E, Chapter 3

EPA, 2002= Supplement Guidance For Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

(1) Based on soil-to-skin adherence data presented in U. S. EPA (2001) for a "utility worker".

(2) Represents face, hands, forearms, lower legs and feet

(3) Represents the face, hands, and forearms for workers; face hands, forearms and lower legs for resident adults.

(4) Absorption Factors: PAHs = 0.13; Metals = 0.01

Note the following AFs from RAGS E for site specific scenarios:

groundskeeper	AF=0.1
construction worker	AF=0.3
utility worker	AF=0.9

VALUES USED FOR SOIL/ SEDIMENT INTAKE / RISK CALCULATIONS - ADULT TRESPASSER AND ADULT RECREATIONAL VISITOR

Exposure Medium:	Soil / Sed
Receptor Population:	Adult Trespasser / Recreational Visitor
Exposure Route:	Ingestion / Dermal / Inhalation

Parameter Code	Parameter Definition	Units	Default	Reference	User Defined Value	Reference
DAD	Dermally Absorbed Dose	mg/kg-day				
CS	Chemical Concentration in Soil	mg/kg				
CF	Conversion Factor	kg/mg	1E-06			
IR	Ingestion Rate	mg_{soil}/day	100	EPA, 2002		
SA	Skin Surface Area Exposed	cm^2 /day	5,700	EPA, 2002		
AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	EPA, 2002		
ABS	Absorption Factor	unitless	Chemical Specific (4)	EPA, 1995 and EPA, 2001		
IhR	Inhalation Rate	m^3 /day	20	EPA, 2002		
PEF	Particulate Emission Factor	m^3/kg	1.81E+09	default, EPA, 1996b		
EF	Exposure Frequency	days/years			39	3mths/jun,jul,aug
ED	Exposure Duration	years	30	EPA, 1991b		
ET	Exposure Time	hrs			4	
BW	Body Weight	kg	70 kg	EPA, 1991		
AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989		
AT-N	Averaging Time (Non-Cancer)	days	10,950	EPA, 1989		

EPA, 1989= Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (Part A). Office of Emergency and Remedial Response. EPA/540/1-89/002.

EPA, 1991= Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. OSWER Directive 9285.6-03

EPA, 1995= Assessing Dermal Exposure from Soil. Region III. Office of Superfund Programs. EPA/903-K-95-003.

EPA, 2001= RAGS E, Chapter 3

EPA, 2002= Supplement Guidance For Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24

(1) Based on soil-to-skin adherence data presented in U. S. EPA (2001) for a "utility worker".

(2) Represents face, hands, forearms, lower legs and feet

(3) Represents the face, hands, and forearms for workers; face hands, forearms and lower legs for resident adults.

(4) Absorption Factors: PAHs = 0.13; Metals = 0.01

Note the following AFs from RAGS E for site specific scenarios:

groundskeeper	AF=0.1
construction worker	AF=0.3
utility worker	AF=0.9

APPENDIX E - 1

Youth Trespasser and Recreational Visitor Intake and Risk Calculations

Youth Trespasser and Recreational Visitor
Soil < 375' Inhalation Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Assigned Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	(1/PEF)	Ia (mg/kg-day)	Rfc mg/m^3	RfDi (mg/kg-day)	HQ
Antimony	Not Classified	27.2		1.81E+09	5.53E-10	3.06E-09	na	na	
Arsenic	A	7.6		1.81E+09	5.53E-10	8.56E-10	na	na	
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	4.17E-10	na	na	
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	3.49E-10	na	na	
Benzo[k]fluoranthene	B2	1.9		1.81E+09	5.53E-10	2.14E-10	na	na	
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	4.73E-10	na	na	
Chrysene	B2	5		1.81E+09	5.53E-10	5.63E-10	na	na	
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	8.56E-11	na	na	
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	2.14E-10	na	na	

HQ associated with inhalation of soil COPCs particulates < 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
1-V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - youth (EPA, 2002)
BW (kg)	42	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Youth Trespasser and Recreational Visitor
Soil > 375' Inhalation Intake and Hazard Calcuations
OU-1 Former Trap and Skeet (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Ia (mg/kg-day)	RfDi (mg/kg-day)	HQ
Antimony	Not classified	4.8		1.81E+09	1.77E+09	na	
Arsenic	A	7.6		1.81E+09	2.80E+09	na	
Benzo[a]pyrene	B2	0.02		1.81E+09	7.36E+06	na	

HQ associated with inhalation of soil COPCs particulates > 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002) (Um/Ut)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - outdoor industrial worker (EPA, 2002)
BW (kg)	42	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Youth Trespasser and Recreational Visitor
Soil < 375' Soil Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)
PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)
Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT
HQ = Ia/RfDi

SFi (mg/kg-day) = Unit Risk (mg/m3) x 70 kg x(20 m3/day)-1 x 1000 ug/mg

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	HQ
Arsenic	A	7.6		1.81E+09	5.53E-10	1.34E-10	4.30E+00	1.50E+01	8.96E-12
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	6.55E-11	8.00E-02	2.80E+02	2.34E-13
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	5.48E-11	8.80E-02	3.08E+02	1.78E-13
Benzo[k]fluoranthene	B2	1.1		1.81E+09	5.53E-10	1.95E-11	8.80E-03	3.08E+01	6.32E-13
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	7.43E-11	8.80E-01	3.08E+03	2.41E-14
Chrysene	B2	5		1.81E+09	5.53E-10	8.85E-11	8.80E-04	3.08E+00	2.87E-11
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	1.34E-11	8.80E-01	3.08E+03	4.37E-15
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	3.36E-11	8.80E-02	3.08E+02	1.09E-13

ILCR associated with inhalation of soil COPCs particulates < 375'	**3.89E-11**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	11	Exposure duration (EPA, 2002)
InR (m^3/day)	20	Inhalation rate (EPA, 2002)
BW (kg)	42	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
Atc (days)	25,550	Averaging time - carcinogenic (70 yrs x 365 days)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area
2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Youth Trespasser and Recreational Visitor
Soil > 375' Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

SFi (mg/kg-day) = Unit Risk (mg/m^3) x 70 kg x (20 m^3/day)$^{-1}$ x 1000 ug/mg

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

ICLR = Ia x CSFi

Analyte	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	ILCR
Arsenic	7.6		1.81E+09	5.53E-10	1.34E-10	4.30E+00	1.50E+01	2.02E-09
Benzo[a]pyrene	0.024		1.81E+09	5.53E-10	4.25E-13	8.80E-01	3.08E+03	1.31E-09

ILCR associated with inhalation of soil COPCs particulates > 375'	**3.32E-09**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on (Um/Ut)^3 (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	11	Exposure duration - recreational youth
InR (m^3/day)	20	Inhalation rate
BW (kg)	42	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATc (days)	25,550	Averaging time - carcinogenic ([70 yrs x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Youth Trespasser and Recreational Visitor
Soil < 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	27.2	1.38E-05	4.00E-04	**0.0346**
Arsenic	7.6	3.87E-06	3.00E-04	**0.0129**
Benz[a]anthracene	3.7	1.88E-06	na	
Benzo[b]fluoranthene	3.1	1.58E-06	na	
Benzo[k]fluoranthene	1.9	9.67E-07	na	
Benzo[a]pyrene	4.2	2.14E-06	na	
Chrysene	5	2.54E-06	na	
Dibenz[a,h]anthracene	0.76	3.87E-07	na	
Indeno[1,2,3-cd]pyrene	1.9	9.67E-07	na	

HQ associated with ingestion of soil COPCs < 375':	**0.047**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate - indoor industrial worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Youth Trespasser and Recreational Visitor
Soil > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	4.8	2.44E-06	3.00E-04	**0.0081**
Arsenic	7.6	3.87E-06	3.00E-04	**0.0129**
Benzo[a]pyrene	0.024	1.22E-08	na	

HQ associated with ingestion of soil COPCs > 375':	**0.021**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Youth Trespasser and Recreational Visitor
Soil < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	EPA Weight of Evidence	Csoil mg/kg	Is (mg/kg-day)	chronic CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	A	7.6	6.08E-07	1.50E+00	9.11E-07
Benz[a]anthracene	B2	3.7	2.96E-07	7.30E-01	2.16E-07
Benzo[b]fluoranthene	B2	3.1	2.48E-07	7.30E-01	1.81E-07
Benzo[k]fluoranthene	B2	1.9	1.52E-07	7.30E-02	1.11E-08
Benzo[a]pyrene	B2	4.2	3.36E-07	7.30E+00	2.45E-06
Chrysene	B2	5	4.00E-07	7.30E-03	2.92E-09
Dibenz[a,h]anthracene	B2	0.76	6.08E-08	7.30E+00	4.44E-07
Indeno[1,2,3-cd]pyrene	B2	1.8	1.44E-07	7.30E-01	1.05E-07

ILCR associated with ingestion of soil COPCs < 375': 4.32E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Youth Trespasser and Recreational Visitor
Soil > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	Csoil mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	7.6	6.08E-07	1.50E+00	9.11E-07
Benzo[a]pyrene	0.024	1.92E-09	7.30E+00	1.40E-08

ILCR associated with ingestion of soil COPCs > 375: 9.11E-07

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate - indoor industrial worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Youth Trespasser and Recreational Visitor
Soil < 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	27.2	0.010	5.98E-07	4.26E-06	0.0200	4.00E-04	8.00E-06	**0.533**
Arsenic	7.6	0.030	5.02E-07	3.57E-06	0.4100	3.00E-04	1.23E-04	**0.029**
Benz[a]anthracene	3.7	0.130	1.06E-06					
Benzo[b]fluoranthene	3.1	0.130	8.87E-07					
Benzo[k]fluoranthene	1.9	0.130	5.43E-07					
Benzo[a]pyrene	4.2	0.130	1.20E-06					
Chrysene	5	0.130	1.43E-06					
Dibenz[a,h]anthracene	0.76	0.130	2.17E-07					
Indeno[1,2,3-cd]pyrene	1.8	0.130	5.15E-07					
						HQ associated with dermal contact of soil COPCs < 375':		**0.56**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AF (mg/cm2)	0.2	Soil-to-skin adherence factor - recreational youth (EPA, 2002)
ABS	chemical-specific	Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Youth Trespasser and Recreational Visitor
Soil > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	4.8	0.020	2.11E-07	1.50E-06	0.4100	4.0E-04	1.6E-04	**0.009**
Arsenic	7.6	0.030	5.02E-07	3.57E-06	0.4100	3.0E-04	1.23E-04	**0.029**
Benzo[a]pyrene	0.024	0.310	1.64E-08	1.17E-07	0.4100	na		

HQ associated with dermal contact of soil COPCs > 375':	**0.04**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	2,800	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFo (mg/cm^2)	0.2	Soil-to-skin adherence factor - recreational youth (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EFi (days/year)	39	Exposure frequency (EPA, 2002)
EFc (days/year)	250	Exposure frequency (site-specific)
EDi (years)	11	Exposure duration - indoor industrial worker (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight - adult (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Youth Trespasser and Recreational Visitor
Soil < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	A	7.6	0.03	2.17E-06	2.43E-06	0.4100	1.50E+00	3.66E+00	8.90E-06
Benz[a]anthracene	B2	3.7	0.13	1.06E-06	1.18E-06	0.3100	7.30E-01	2.35E+00	2.79E-06
Benzo[b]fluoranthene	B2	3.1	0.13	8.87E-07	9.92E-07	0.3100	7.30E-01	2.35E+00	2.34E-06
Benzo[k]fluoranthene	B2	1.9	0.13	5.43E-07	6.08E-07	0.3100	7.30E-02	2.35E-01	1.43E-07
Benzo[a]pyrene	B2	4.2	0.13	1.20E-06	1.34E-06	0.3100	7.30E+00	2.35E+01	3.17E-05
Chrysene	B2	5	0.13	1.43E-06	1.60E-06	0.3100	7.30E-03	2.35E-02	3.77E-08
Dibenz[a,h]anthracene	B2	0.76	0.13	2.17E-07	2.43E-07	0.3100	7.30E+00	2.35E+01	5.73E-06
Indeno[1,2,3-cd]pyrene	B2	1.8	0.13	5.15E-07	5.76E-07	0.3100	7.30E-01	2.35E+00	1.36E-06

ILCR associated with dermal contact of soil COPCs < 375': 1.17E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	2,800	Surface area - recreational youth (EPA, 2002)
AF (mg/cm2)	0.2	Soil-to-skin adherence factor - (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFi (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	11	Exposure duration - recreational youth (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Youth Tresspasser and Recreational Visitor
Soil > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	7.5	0.03	4.95E-07	5.54E-07	0.41	1.50E+00	3.66E+00	2.03E-06
Benzo[a]pyrene	0.024	0.13	6.86E-09	7.68E-09	0.31	7.30E+00	2.35E+01	1.81E-07

ILCR associated with dermal contact of soil COPCs > 375': 2.03E-06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AF (mg/cm2)	0.2	Soil-to-skin adherence factor - youth (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	11	Exposure duration - recreational youth(EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Youth Trespasser and Recreational Visitor
Sediment > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{sed} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Arsenic	15	7.63E-06	3.00E-04	**0.0254**

HQ associated with ingestion of soil COPCs > 375':	**0.025**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFi (days/year)	39	Exposure frequency
EDi (years)	11	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Youth Trespasser and Recreational Visitor
Sediment < 375' Ingestion Intake and Cancer Risk Calculaions
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	EPA Weight of Evidence	C_{sed} mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.233	1.86E-08	7.30E+00	1.36E-07

ILCR associated with ingestion of soil COPCs < 375': 1.36E-07

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFi (days/year)	39	Exposure frequency
EDi (years)	11	Exposure duration - (EPA, 2002)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Youth Trespasser and Recreational Visitor
Sediment > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATc)
ILCR = Is x SFo

Analyte	C_{sed} mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	15	1.20E-06	1.50E+00	1.80E-06

ILCR associated with ingestion of soil COPCs > 375: 1.80E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csedl (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	200	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFi (days/year)	39	Exposure frequency
EDi (years)	11	Exposure duration
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Youth Trespasser and Recreational Visitor
Sediment > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

$RfD_{ABS} = RfDo \times ABS_{GI}$

$HQ = DAD/RfD_{ABS}$

Analyte	C_{sed} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Arsenic	15	0.030	9.90E-07	7.05E-06	0.4100	3.0E-04	1.23E-04	**0.057**

HQ associated with dermal contact of soil COPCs > 375': 0.06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AFo (mg/cm^2)	0.2	Soil-to-skin adherence factor -(EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EFi (days/year)	39	Exposure frequency (EPA, 2002)
EDi (years)	11	Exposure duration
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight - adult (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Youth Trespasser and Recreational Visitor
Sediment < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{sed} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.233	0.13	6.66E-08	4.75E-07	0.3100	7.30E+00	2.35E+01	1.12E-05

ILCR associated with dermal contact of soil COPCs < 375': 1.12E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AF (mg/cm2)	0.2	Soil-to-skin adherence factor (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	11	Exposure duration
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight (EPA, 2002)
ATnc (days)	4,015	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Youth Trespasser and Recreational Youth
Sediment > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{sed} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	15	0.03	9.90E-07	1.11E-06	0.41	1.50E+00	3.66E+00	4.05E-06

ILCR associated with dermal contact of soil COPCs > 375': 4.05E-06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AF (mg/cm2)	0.2	Soil-to-skin adherence factor - youth (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	11	Exposure duration - recreational youth(EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	42	Body weight (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Youth Trespasser and Recreational Visitor
Additive Non-Cancer Hazard
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Noncancer Evaluation):

$HQ_1 = Ia/RfDi$

$HQ_2 = Iw/RfDo$

$HQ_3 = DAD/RfDadj$

Youth Trespasser and Recreational Visitor - Soil Hazard Index (HI)				
Soil < 375'				***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.000	0.000	0.047	0.560	0.607
Soil > 375'				***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.000	0.000	0.021	0.040	0.061
Youth Trespasser and Recreational Visitor - Sediment Hazard Index (HI)				
Sediment < 375'				***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.000	0.000	0.000	0.000	0.000
Sediment > 375'				***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.000	0.000	0.025	0.060	0.085
		HI associated with exposure to Soil and Sediment COPCs:		**0.75**

Input Parameters:

HQ	Hazard quotient
Ia (mg/kg-day)	Inhaled dose of COPCs
Iw (mg/kg-day)	Ingested dose of COPCs
DAD (mg/kg-day)	Dermally absorbed dose of COPCs
RfDi (mg/kg-day)	Inhalation reference dose
RfDo (mg/kg-day)	Oral reference dose
RfDadj (mg/kg-day)	Adjusted reference dose (oral RfD multiplied by the GAF to derive dermal RfD)
HI	Hazard index (sum of HQ_1, HQ_2, and HQ_3)

Youth Trespasser and Recreational Visitor
Additive Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Cancer Evaluation):

$ILCR_1 = Ia \times SFi$

$ILCR_2 = Iw \times SFo$

$ILCR_3 = DAD \times SFadj$

Youth Trespasser and Recreational Visitor - Excess Lifetime Cancer Risk (ELCR)				
Soil < 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
3.89E-11		4.32E-06	1.70E-05	2.13E-05
Soil > 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
3.32E-09		9.11E-07	2.03E-06	2.94E-06
Youth Trespasser and Recreational Visitor - Excess Lifetime Cancer Risk (ELCR)				
Sediment < 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
0.00E+00		1.36E-07	1.12E-05	1.13E-05
Sediment > 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
0.00E+00		1.80E-06	4.06E-06	5.86E-06
		ELCR associated with exposure to Soil and Sediment		**4.1E-05**

Input Parameters:

ILCR	Incremental lifetime cancer risk
SFi $(mg/kg\text{-}day)^{-1}$	Inhalation slope factor
SFo $(mg/kg\text{-}day)^{-1}$	Oral slope factor
SFadj $(mg/kg\text{-}day)^{-1}$	Adjusted slope factor (oral SF divided by the GAF to derive SF)
ELCR	Total ILCR (sum of $ILCR_1$, $ILCR_2$, and $ILCR_3$)

APPENDIX E - 2

Adult Trespasser and Recreational Visitor – Intake and Risk Calculations

Adult Trespasser and Recreational Visitor
Soil < 375' Inhalation Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Assigned Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	(1/PEF)	Ia (mg/kg-day)	Rfc mg/m^3	RfDi (mg/kg-day)	HQ
Antimony	Not Classified	27.2		1.81E+09	5.53E-10	1.84E-09	na	na	
Arsenic	A	7.6		1.81E+09	5.53E-10	5.13E-10	na	na	
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	2.50E-10	na	na	
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	2.09E-10	na	na	
Benzo[k]fluoranthene	B2	1.9		1.81E+09	5.53E-10	1.28E-10	na	na	
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	2.84E-10	na	na	
Chrysene	B2	5		1.81E+09	5.53E-10	7.88E-10	na	na	
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	5.13E-11	na	na	
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	1.28E-10	na	na	

HQ associated with inhalation of soil COPCs particulates < 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
1-V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EFc (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration - recreational adult (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - youth (EPA, 2002)
BW (kg)	70	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Adult Trespasser and Recreational Visitor
Soil > 375' Inhalation Intake and Hazard Calcuations
OU-1 Former Trap and Skeet (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Ia (mg/kg-day)	RfDi (mg/kg-day)	HQ
Antimony	Not classified	4.8		1.81E+09	1.06E+09	na	
Arsenic	A	7.6		1.81E+09	1.68E+09	na	
Benzo[a]pyrene	B2	0.02		1.81E+09	4.42E+06	na	

HQ associated with inhalation of soil COPCs particulates > 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002) (Um/Ut)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EFc (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration (EPA, 2002)
InR (m^3/day)	20	Inhalation rate (EPA, 2002)
BW (kg)	70	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Adult Trespasser and Recreational Visitor
Soil < 375' Soil Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)
PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)
Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT
HQ = Ia/RfDi

SFi (mg/kg-day) = Unit Risk (mg/m3) x 70 kg x(20 m3/day)-1 x 1000 ug/mg

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	HQ
Arsenic	A	7.6		1.81E+09	5.53E-10	2.20E-10	4.30E+00	1.50E+01	1.47E-11
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	1.07E-10	8.00E-02	2.80E+02	3.83E-13
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	6.90E-11	8.80E-02	3.08E+02	2.24E-13
Benzo[k]fluoranthene	B2	1.1		1.81E+09	5.53E-10	3.18E-11	8.80E-03	3.08E+01	1.03E-12
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	1.22E-10	8.80E-01	3.08E+03	3.95E-14
Chrysene	B2	5		1.81E+09	5.53E-10	1.45E-10	8.80E-04	3.08E+00	4.70E-11
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	2.20E-11	8.80E-01	3.08E+03	7.14E-15
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	5.50E-11	8.80E-02	3.08E+02	1.79E-13

ILCR associated with inhalation of soil COPCs particulates < 375'	**6.35E-11**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	30	Exposure duration - (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BW (kg)	70	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
Atc (days)	25,550	Averaging time - carcinogenic (70 yrs x 365 days)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area
2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Adult Trespasser and Recreational Visitor
Soil > 375' Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

SFi (mg/kg-day) = Unit Risk (mg/m^3) x 70 kg x (20 m^3/day)$^{-1}$ x 1000 ug/mg

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

ICLR = Ia x CSFi

Analyte	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	ILCR
Arsenic	7.6		1.81E+09	5.53E-10	2.20E-10	4.30E+00	1.50E+01	3.30E-09
Benzo[a]pyrene	0.024		1.81E+09	5.53E-10	6.95E-13	8.80E-01	3.08E+03	2.14E-09

ILCR associated with inhalation of soil COPCs particulates > 375'	**5.44E-09**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	30	Exposure duration - (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BW (kg)	70	body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATc (days)	25,550	Averaging time - carcinogenic ([70 yrs x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	4	Exposure Time

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Adult Trespasser and Recreational Visitor
Soil < 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	27.2	4.15E-06	4.00E-04	**0.0104**
Arsenic	7.6	1.16E-06	3.00E-04	**0.0039**
Benz[a]anthracene	3.7	#REF!	na	
Benzo[b]fluoranthene	3.1	#REF!	na	
Benzo[k]fluoranthene	1.9	#REF!	na	
Benzo[a]pyrene	4.2	#REF!	na	
Chrysene	5	#REF!	na	
Dibenz[a,h]anthracene	0.76	#REF!	na	
Indeno[1,2,3-cd]pyrene	1.9	#REF!	na	

HQ associated with ingestion of soil COPCs < 375':	**0.014**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate - indoor industrial worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Adult Trespasser and Recreational Visitor
Soil > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	4.8	7.33E-07	3.00E-04	**0.0024**
Arsenic	7.6	1.16E-06	3.00E-04	**0.0039**
Benzo[a]pyrene	0.024	3.66E-09	na	

HQ associated with ingestion of soil COPCs > 375':	**0.006**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate - indoor industrial worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration - recreational youth (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Adult Trespasser and Recreational Visitor
Soil < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$

$ILCR = Is \times SFo$

Analyte	EPA Weight of Evidence	Csoil mg/kg	Is (mg/kg-day)	chronic CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	A	7.6	4.97E-07	1.50E+00	7.46E-07
Benz[a]anthracene	B2	3.7	2.42E-07	7.30E-01	1.77E-07
Benzo[b]fluoranthene	B2	3.1	2.03E-07	7.30E-01	1.48E-07
Benzo[k]fluoranthene	B2	1.9	1.24E-07	7.30E-02	9.07E-09
Benzo[a]pyrene	B2	4.2	2.75E-07	7.30E+00	2.01E-06
Chrysene	B2	5	3.27E-07	7.30E-03	2.39E-09
Dibenz[a,h]anthracene	B2	0.76	4.97E-08	7.30E+00	3.63E-07
Indeno[1,2,3-cd]pyrene	B2	1.8	1.18E-07	7.30E-01	8.60E-08

ILCR associated with ingestion of soil COPCs < 375': 3.54E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Adult Trespasser and Recreational Visitor
Soil > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	Csoil mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	7.6	4.97E-07	1.50E+00	7.46E-07
Benzo[a]pyrene	0.024	1.57E-09	7.30E+00	1.15E-08

ILCR associated with ingestion of soil COPCs > 375: 7.46E-07

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Adult Trespasser and Recreational Visitor
Soil < 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	27.2	0.010	5.71E-07	2.88E-06	0.4100	4.00E-04	1.64E-04	**0.018**
Arsenic	7.6	0.030	4.79E-07	2.41E-06	0.4100	3.00E-04	1.23E-04	**0.020**
Benz[a]anthracene	3.7	0.130	1.01E-06					
Benzo[b]fluoranthene	3.1	0.130	8.46E-07					
Benzo[k]fluoranthene	1.9	0.130	5.19E-07					
Benzo[a]pyrene	4.2	0.130	1.15E-06					
Chrysene	5	0.130	1.37E-06					
Dibenz[a,h]anthracene	0.76	0.130	2.07E-07					
Indeno[1,2,3-cd]pyrene	1.8	0.130	4.91E-07					
			HQ associated with dermal contact of soil COPCs < 375':					**0.04**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor (EPA, 2002)
ABS	chemical-specific	Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	39	Exposure frequency (site-specific)
ED (years)	30	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Soil > 375' Dermal InTake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	4.8	0.020	2.02E-07	1.02E-06	0.4100	4.0E-04	1.6E-04	**0.006**
Arsenic	7.6	0.030	4.79E-07	2.41E-06	0.4100	3.0E-04	1.23E-04	**0.020**
Benzo[a]pyrene	0.024	0.310	1.56E-08	7.87E-08	0.4100	na		

HQ associated with dermal contact of soil COPCs > 375':	**0.03**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	30	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Adult Trespasser and Recreational Visitor
Soil < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	A	7.6	0.03	4.79E-07	1.04E-06	0.4100	1.50E+00	3.66E+00	3.79E-06
Benz[a]anthracene	B2	3.7	0.13	1.01E-06	2.18E-06	0.3100	7.30E-01	2.35E+00	5.15E-06
Benzo[b]fluoranthene	B2	3.1	0.13	8.46E-07	1.83E-06	0.3100	7.30E-01	2.35E+00	4.31E-06
Benzo[k]fluoranthene	B2	1.9	0.13	5.19E-07	1.12E-06	0.3100	7.30E-02	2.35E-01	2.64E-07
Benzo[a]pyrene	B2	4.2	0.13	1.15E-06	2.48E-06	0.3100	7.30E+00	2.35E+01	5.84E-05
Chrysene	B2	5	0.13	1.37E-06	2.95E-06	0.3100	7.30E-03	2.35E-02	6.95E-08
Dibenz[a,h]anthracene	B2	0.76	0.13	2.07E-07	4.49E-07	0.3100	7.30E+00	2.35E+01	1.06E-05
Indeno[1,2,3-cd]pyrene	B2	1.8	0.13	4.91E-07	1.06E-06	0.3100	7.30E-01	2.35E+00	2.50E-06

ILCR associated with dermal contact of soil COPCs < 375': 8.51E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	30	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,500	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

Mercury ABS from RIAS May-04
The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Sediment > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS_d

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

$CSF_{ABS} = CSF_o / ABS_{GI}$

ILCR = DAD x CSF_{ABS}

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	7.5	0.03	4.73E-07	1.02E-06	0.41	1.50E+00	3.66E+00	3.73E-06
Benzo[a]pyrene	0.024	0.13	6.55E-09	1.41E-08	0.31	7.30E+00	2.35E+01	3.33E-07

ILCR associated with dermal contact of soil COPCs > 375': 3.73E-06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AFc (mg/cm2)	0.07	Soil-to-skin adherence factor (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFi (days/year)	39	Exposure frequency (EPA, 2002)
EDy (years)	30	Exposure duration (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year] <
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Sediment > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	Csed (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Arsenic	15	2.29E-06	3.00E-04	**0.0076**

HQ associated with ingestion of soil COPCs > 375':	**0.008**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration - (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Adult Trespasser and Recreational Visitor
Sediment < 375' Ingestion Intake and Cancer Risk Calculation
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	EPA Weight of Evidence	Csed mg/kg	Is (mg/kg-day)	chronic CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.024	1.57E-09	7.30E+00	1.15E-08

ILCR associated with ingestion of soil COPCs < 375': 1.15E-08

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Adult Trespasser and Recreational Visitor
Sediment > 375' Ingestion Intake and Cancer Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	Csed mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	15	9.81E-07	1.50E+00	1.47E-06

ILCR associated with ingestion of soil COPCs > 375: 1.47E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	100	Ingestion rate (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	39	Exposure frequency
ED (years)	30	Exposure duration (EPA, 2002)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Adult Trespasser and Recreational Visitor
Sediment > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{sed} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Arsenic	15	0.030	9.45E-07	4.76E-06	0.4100	3.0E-04	1.23E-04	**0.039**

HQ associated with dermal contact of soil COPCs > 375':	**0.04**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	30	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	10,950	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Sediment < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{sed} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.233	0.13	6.36E-08	1.38E-07	0.3100	7.30E+00	2.35E+01	3.24E-06

ILCR associated with dermal contact of soil COPCs < 375': 3.24E-06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	39	Exposure frequency (EPA, 2002)
ED (years)	30	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,500	Averaging time - noncarcinogenic ([ED x 365 days/year] <
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Sediment > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS_d

DAD = (DAevent x EF x ED x SA)/(BW x ATc)

$CSF_{ABS} = CSF_o / ABS_{GI}$

ILCR = DAD x CSF_{ABS}

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	15	0.03	9.45E-07	2.04E-06	0.41	1.50E+00	3.66E+00	7.46E-06

ILCR associated with dermal contact of soil COPCs > 375': 7.46E-06

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AFc (mg/cm2)	0.07	Soil-to-skin adherence factor (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFi (days/year)	39	Exposure frequency (EPA, 2002)
EDy (years)	30	Exposure duration (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Adult Trespasser and Recreational Visitor
Additive Non-Cancer Hazard
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Noncancer Evaluation):

$HQ_1 = Ia/RfDi$

$HQ_2 = Iw/RfDo$

$HQ_3 = DAD/RfDadj$

Adult Trespasser and Recreational Visitor - Soil Hazard Index (HI)				
Soil < 375'				***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.000	0.000	0.014	0.040	0.054
Soil > 375'				***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.000	0.000	0.006	0.030	0.036
Youth Trespasser and Recreational Visitor - Sediment Hazard Index (HI)				
Sediment < 375'				***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.000	0.000	0.000	0.000	0.000
Sediment > 375'				***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.000	0.000	0.008	0.040	0.048
		HI associated with exposure to Soil and Sediment COPCs:		**0.14**

Input Parameters:

HQ	Hazard quotient
Ia (mg/kg-day)	Inhaled dose of COPCs
Iw (mg/kg-day)	Ingested dose of COPCs
DAD (mg/kg-day)	Dermally absorbed dose of COPCs
RfDi (mg/kg-day)	Inhalation reference dose
RfDo (mg/kg-day)	Oral reference dose
RfDadj (mg/kg-day)	Adjusted reference dose (oral RfD multiplied by the GAF to derive dermal RfD)
HI	Hazard index (sum of HQ_1, HQ_2, and HQ_3)

Adult Trespasser and Recreational Visitor
Additive Cancer Risk
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Cancer Evaluation):

$ILCR_1 = Ia \times SFi$

$ILCR_2 = Iw \times SFo$

$ILCR_3 = DAD \times SFadj$

Youth Trespasser and Recreational Visitor - Excess Lifetime Cancer Risk (ELCR)				
Soil < 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
6.35E-11		3.45E-06	8.51E-05	8.86E-05
Soil > 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
5.44E-09		7.46E-07	3.73E-06	4.48E-06
Youth Trespasser and Recreational Visitor - Excess Lifetime Cancer Risk (ELCR)				
Sediment < 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
0.00E+00		1.15E-08	3.24E-06	3.25E-06
Sediment > 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
0.00E+00		1.47E-06	7.64E-06	9.11E-06
		ELCR associated with exposure to Soil and Sediment COPCs:		**5.2E-06**

Input Parameters:

ILCR	Incremental lifetime cancer risk
SFi $(mg/kg\text{-}day)^{-1}$	Inhalation slope factor
SFo $(mg/kg\text{-}day)^{-1}$	Oral slope factor
SFadj $(mg/kg\text{-}day)^{-1}$	Adjusted slope factor (oral SF divided by the GAF to derive SF)
ELCR	Total ILCR (sum of $ILCR_1$, $ILCR_2$, and $ILCR_3$)

APPENDIX E - 3

Industrial Worker –
Intake and Risk Calculations

Industrial Worker
Soil < 375' Inhalation Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	(1/PEF)	Ia (mg/kg-day)	Rfc mg/m^3	RfDi (mg/kg-day)	HQ
Antimony	27.2		1.81E+09	5.53E-10	2.36E-08	na	na	
Arsenic	7.6		1.81E+09	5.53E-10	6.58E-09	na	na	
Benz[a]anthracene	3.7		1.81E+09	5.53E-10	3.20E-09	na	na	
Benzo[b]fluoranthene	3.1		1.81E+09	5.53E-10	2.68E-09	na	na	
Benzo[k]fluoranthene	1.9		1.81E+09	5.53E-10	1.65E-09	na	na	
Benzo[a]pyrene	4.2		1.81E+09	5.53E-10	3.64E-09	na	na	
Chrysene	5		1.81E+09	5.53E-10	4.33E-09	na	na	
Dibenz[a,h]anthracene	0.76		1.81E+09	5.53E-10	6.58E-10	na	na	
Indeno[1,2,3-cd]pyrene	1.9		1.81E+09	5.53E-10	1.65E-09	na	na	

HQ associated with inhalation of soil COPCs particulates < 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
1-V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration (EPA, 2002)
InR (m^3/day)	20	Inhalation rate (EPA, 2002)
BW (kg)	70	Adult body weight (EPA, 1991a)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year])
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Industrial Worker
Soil > 375' Inhalation Intake and Hazard Calcuations
OU-1 Former Trap and Skeet (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Ia (mg/kg-day)	RfDi (mg/kg-day)	HQ
Antimony	4.8		1.81E+09	1.36E+10	na	
Arsenic	7.6		1.81E+09	2.15E+10	na	
Benzo[a]pyrene	0.02		1.81E+09	5.66E+07	na	

HQ associated with inhalation of soil COPCs particulates > 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002) (Um/Ut)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
Ec (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year](Indoor/Outdoor Industrial)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Industrial Worker
Soil < 375' Soil Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)
PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)
Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT
HQ = Ia/RfDi

SFi (mg/kg-day) = Unit Risk (mg/m3) x 70 kg x(20 m3/day)-1 x 1000 ug/mg

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	ILCR
Arsenic	A	7.6		1.81E+09	5.53E-10	2.35E-09	4.30E+00	1.50E+01	1.57E-10
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	1.14E-09	8.00E-02	2.80E+02	4.09E-12
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	9.59E-11	8.80E-02	3.08E+02	3.11E-13
Benzo[k]fluoranthene	B2	1.1		1.81E+09	5.53E-10	3.40E-10	8.80E-03	3.08E+01	1.10E-11
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	1.30E-09	8.80E-01	3.08E+03	4.22E-13
Chrysene	B2	5		1.81E+09	5.53E-10	1.55E-09	8.80E-04	3.08E+00	5.02E-10
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	8.23E-10	8.80E-01	3.08E+03	2.67E-13
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	2.06E-09	8.80E-02	3.08E+02	6.68E-12

ILCR associated with inhalation of soil COPCs particulates < 375'	**6.82E-10**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (site-specific)
ED (years)	25	Exposure duration - (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
Atc (days)	25,550	Averaging time - carcinogenic (70 yrs x 365 days)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area
2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Industrial Worker
Soil > 375' Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

SFi (mg/kg-day) = Unit Risk (mg/m^3) x 70 kg x (20 m^3/day)$^{-1}$ x 1000 ug/mg

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

ICLR = Ia x CSFi

Analyte	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	ILCR
Arsenic	7.6		1.81E+09	5.53E-10	2.35E-09	4.30E+00	1.50E+01	3.53E-08
Benzo[a]pyrene	0.024		1.81E+09	5.53E-10	7.42E-12	8.80E-01	3.08E+03	2.29E-08

ILCR associated with inhalation of soil COPCs particulates > 375'	**5.81E-08**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on (Um/Ut)^3 (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (site-specific)
ED (years)	25	Exposure duration - (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
ATc (days)	25,550	Averaging time - carcinogenic ([70 yrs x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Industrial Worker
Soil < 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x AT)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	27.2	1.33E-05	4.00E-04	**0.0333**
Arsenic	7.6	3.72E-06	3.00E-04	**0.0124**
Benz[a]anthracene	3.7	1.81E-06	na	
Benzo[b]fluoranthene	3.1	1.52E-06	na	
Benzo[k]fluoranthene	1.9	9.30E-07	na	
Benzo[a]pyrene	4.2	2.05E-06	na	
Chrysene	5	2.45E-06	na	
Dibenz[a,h]anthracene	0.76	3.72E-07	na	
Indeno[1,2,3-cd]pyrene	1.9	9.30E-07	na	

HQ associated with ingestion of soil COPCs < 375':	**0.046**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Industrial Worker
Soil > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x AT)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	4.8	2.35E-06	3.00E-04	**0.0078**
Arsenic	7.6	3.72E-06	3.00E-04	**0.0124**
Benzo[a]pyrene	0.024	1.17E-08	na	

HQ associated with ingestion of soil COPCs > 375':	**0.020**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFi (days/year)	250	Exposure frequency (EPA, 2002)
EDi (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year](Indoor/Outdoor Industrial)
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Industrial Worker
Soil < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
Is = (C_{soil} x IR x CF x EF x ED)/(BW x AT)
ILCR = Is x SFo

				chronic	
Analyte	**EPA Weight of Evidence**	**Csoil mg/kg**	**Is (mg/kg-day)**	**CSFo $(mg/kg\text{-}day)^{-1}$**	**ILCR**
Arsenic	A	7.6	1.33E-06	1.50E+00	1.99E-06
Benz[a]anthracene	B2	3.7	6.46E-07	7.30E-01	4.72E-07
Benzo[b]fluoranthene	B2	3.1	5.42E-07	7.30E-01	3.95E-07
Benzo[k]fluoranthene	B2	1.9	3.32E-07	7.30E-02	2.42E-08
Benzo[a]pyrene	B2	4.2	7.34E-07	7.30E+00	5.36E-06
Chrysene	B2	5	8.74E-07	7.30E-03	6.38E-09
Dibenz[a,h]anthracene	B2	0.76	1.33E-07	7.30E+00	9.69E-07
Indeno[1,2,3-cd]pyrene	B2	1.8	3.15E-07	7.30E-01	2.30E-07

ILCR associated with ingestion of soil COPCs < 375': 9.45E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Industrial Worker
Soil > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times AT)$
$ILCR = Is \times SFo$

Analyte	Csoil mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	7.6	1.33E-06	1.50E+00	1.99E-06
Benzo[a]pyrene	0.024	4.19E-09	7.30E+00	3.06E-08

ILCR associated with ingestion of soil COPCs > 375: 1.99E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Industrial Worker
Soil < 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x AT)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	27.2	0.001	4.76E-08	1.54E-06	0.0200	4.00E-04	8.00E-06	**0.192**
Arsenic	7.6	0.030	3.99E-07	1.29E-05	0.4100	3.00E-04	1.23E-04	**0.105**
Benz[a]anthracene	3.7	0.130	8.42E-07	5.77E-10				
Benzo[b]fluoranthene	3.1	0.130	7.05E-07	4.83E-10				
Benzo[k]fluoranthene	1.9	0.130	4.32E-07	2.96E-10				
Benzo[a]pyrene	4.2	0.130	9.56E-07	6.54E-10				
Chrysene	5	0.130	1.14E-06	7.79E-10				
Dibenz[a,h]anthracene	0.76	0.130	1.73E-07	1.18E-10				
Indeno[1,2,3-cd]pyrene	1.8	0.130	4.10E-07	2.80E-10				
				HQ associated with dermal contact of soil COPCs < 375':				**0.297**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - (EPA, 2004)
AF (mg/cm^2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS	chemical-specific	Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Soil > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x AT)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	4.8	0.001	8.40E-09	2.71E-07	0.0200	4.0E-04	8.0E-06	**0.034**
Arsenic	7.6	0.030	3.99E-07	1.29E-05	0.4100	3.0E-04	1.23E-04	**0.105**
Benzo[a]pyrene	0.024	0.310	1.30E-08	4.20E-07				

HQ associated with dermal contact of soil COPCs > 375': 0.14

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - (EPA, 2004)
AFc (mg/cm2)	0.07	Soil-to-skin adherence factor - (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year])
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Industrial Worker
Soil < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	A	7.6	0.003	3.99E-08	3.90E-07	0.4100	1.50E+00	3.66E+00	1.43E-06
Benz[a]anthracene	B2	3.7	0.13	8.42E-07	8.24E-06	0.3100	7.30E-01	2.30E-01	1.89E-06
Benzo[b]fluoranthene	B2	3.1	0.13	7.05E-07	6.90E-06	0.3100	7.30E-01	2.30E-01	1.59E-06
Benzo[k]fluoranthene	B2	1.9	0.13	4.32E-07	4.23E-06	0.3100	7.30E-02	2.35E-01	9.96E-07
Benzo[a]pyrene	B2	4.2	0.13	9.56E-07	9.35E-06	0.3100	7.30E+00	2.30E+00	2.15E-05
Chrysene	B2	5	0.13	1.14E-06	1.11E-05	0.3100	7.30E-03	2.35E-02	2.62E-07
Dibenz[a,h]anthracene	B2	0.76	0.13	1.73E-07	1.69E-06	0.3100	7.30E+00	2.35E+01	3.98E-05
Indeno[1,2,3-cd]pyrene	B2	1.8	0.13	4.10E-07	4.01E-06	0.3100	7.30E-01	2.35E+00	9.44E-06

ILCR associated with dermal contact of soil COPCs < 375': 7.69E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	2,800	Surface area - (EPA, 2002)
AFo (mg/cm^2)	0.07	Soil-to-skin adherence factor - (EPA, 2004)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Soil > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times AT)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	7.5	0.03	3.94E-07	4.54E-06	0.41	1.50E+00	3.66E+00	1.66E-05
Benzo[a]pyrene	0.024	0.13	5.46E-09	6.30E-08	0.31	7.30E+00	2.35E+01	1.48E-06

ILCR associated with dermal contact of soil COPCs > 375': 1.66E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - construction worker (EPA, 2002)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Sediment > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times AT)$

$HQ = Is/RfDo$

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Arsenic	15	7.34E-06	3.00E-04	**0.0245**

HQ associated with ingestion of soil COPCs > 375':	**0.024**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFi (days/year)	250	Exposure frequency (EPA, 2002)
EDi (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year](Indoor/Outdoor Industrial)
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Industrial Worker
Sediment < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
Is = (C_{soil} x IR x CF x EF x ED)/(BW x AT)
ILCR = Is x SFo

				chronic	
Analyte	**EPA Weight of Evidence**	**Csoil mg/kg**	**Is (mg/kg-day)**	**CSFo (mg/kg-day)$^{-1}$**	**ILCR**
Benzo[a]pyrene	B2	0.233	4.07E-08	7.30E+00	2.97E-07

ILCR associated with ingestion of soil COPCs < 375': 2.97E-07

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - (EPA, 2002)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo (mg/kg-day)$^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Industrial Worker
Sediment > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	C_{sed} mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	15	2.62E-06	1.50E+00	3.93E-06

ILCR associated with ingestion of soil COPCs > 375: 3.93E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csedl (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	50	Ingestion rate - (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency
ED (years)	25	Exposure duration
BW (kg)	70	Body weight (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Industrial Worker
Sediment > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{sed} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Arsenic	15	0.030	7.88E-07	2.54E-05	0.4100	3.0E-04	1.23E-04	**0.207**

HQ associated with dermal contact of soil COPCs > 375': 0.21

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AFo (mg/cm^2)	0.07	Soil-to-skin adherence factor -(EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EFi (days/year)	250	Exposure frequency (EPA, 2002)
EDi (years)	25	Exposure duration
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Sediment < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{sed} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.233	0.13	5.30E-08	1.71E-06	0.3100	7.30E+00	2.35E+01	4.03E-05

ILCR associated with dermal contact of soil COPCs < 375': 4.03E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csed (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BW (kg)	70	Body weight (EPA, 2002)
ATnc (days)	9,125	Averaging time - noncarcinogenic ([ED x 365 days/year]
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Sediment > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times AT)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo $(mg/kg\text{-}day)^{-1}$	CSF_{ABS} $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	15	0.03	7.88E-07	9.08E-06	0.41	1.50E+00	3.66E+00	3.32E-05

ILCR associated with dermal contact of soil COPCs > 375': 3.32E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} $(mg/kg\text{-}day)^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SA (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AF (mg/cm2)	0.07	Soil-to-skin adherence factor - construction worker (EPA, 2002)
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Industrial Worker
Additive Non-Cancer Hazard
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Noncancer Evaluation):

$HQ_1 = Ia/RfDi$

$HQ_2 = Iw/RfDo$

$HQ_3 = DAD/RfDadj$

Industrial Worker - Soil Hazard Index (HI)				
		Soil < 375'		***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.00	0.00	0.05	0.29	0.34
		Soil > 375'		***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.00	0.00	0.02	0.14	0.16
Industrial Worker - Sediment Hazard Index (HI)				
		Sediment < 375'		***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.00	0.00	0.00	0.00	0.00
		Sediment > 375'		***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.00	0.00	0.02	0.21	0.23
		HI associated with exposure to Soil and Sediment COPCs:		**0.73**

Input Parameters:

HQ	Hazard quotient
Ia (mg/kg-day)	Inhaled dose of COPCs
Iw (mg/kg-day)	Ingested dose of COPCs
DAD (mg/kg-day)	Dermally absorbed dose of COPCs
RfDi (mg/kg-day)	Inhalation reference dose
RfDo (mg/kg-day)	Oral reference dose
RfDadj (mg/kg-day)	Adjusted reference dose (oral RfD multiplied by the GAF to derive dermal RfD)
HI	Hazard index (sum of HQ_1, HQ_2, and HQ_3)

Industrial Worker
Additive Cancer Risk
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Cancer Evaluation):

$ILCR_1 = Ia \times SFi$

$ILCR_2 = Iw \times SFo$

$ILCR_3 = DAD \times SFadj$

Industrial Worker - Excess Lifetime Cancer Risk (ELCR)				
Soil < 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
6.82E-10		9.45E-06	7.69E-05	8.64E-05
Soil > 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
5.81E-08		1.99E-06	1.66E-05	1.86E-05
Industrial Worker - Excess Lifetime Cancer Risk (ELCR)				
Sediment < 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
8.50E-08		1.80E-06	1.10E-04	
Sediment > 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
8.50E-08		3.30E-07	0.00E+00	
		ELCR associated with exposure to Soil and Sediment		**2.1E-05**

Input Parameters:

ILCR	Incremental lifetime cancer risk
SFi $(mg/kg\text{-}day)^{-1}$	Inhalation slope factor
SFo $(mg/kg\text{-}day)^{-1}$	Oral slope factor
SFadj $(mg/kg\text{-}day)^{-1}$	Adjusted slope factor (oral SF divided by the GAF to derive SF)
ELCR	Total ILCR (sum of $ILCR_1$, $ILCR_2$, and $ILCR_3$)

APPENDIX E - 4

Construction Worker – Intake and Risk Calculations

Construction Worker
Soil < 375' Inhalation Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Assigned Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	(1/PEF)	Ia (mg/kg-day)	Rfc mg/m^3	RfDi (mg/kg-day)	HQ
Antimony	Not Classified	27.2		1.81E+09	5.53E-10	2.36E-08	na	na	
Arsenic	A	7.6		1.81E+09	5.53E-10	6.58E-09	na	na	
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	3.20E-09	na	na	
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	2.68E-09	na	na	
Benzo[k]fluoranthene	B2	1.9		1.81E+09	5.53E-10	1.65E-09	na	na	
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	3.64E-09	na	na	
Chrysene	B2	5		1.81E+09	5.53E-10	4.33E-09	na	na	
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	6.58E-10	na	na	
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	1.65E-09	na	na	

HQ associated with inhalation of soil COPCs particulates < 375': 0.00E+00

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
1-V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	1	Exposure duration
InR (m^3/day)	20	Inhalation rate - (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year]
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Construction Worker
Soil > 375' Inhalation Intake and Hazard Calcuations
OU-1 Former Trap and Skeet (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

HQ = Ia/RfDi

$$RfDi\ (mg/kg\text{-}day) = \frac{RfC\ (mg/m^3) \times 20\ m^3/day}{70\ kg}$$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	Ia (mg/kg-day)	RfDi (mg/kg-day)	HQ
Antimony	Not classified	4.8		1.81E+09	1.36E+10	na	
Arsenic	A	7.6		1.81E+09	2.15E+10	na	
Benzo[a]pyrene	B2	0.02		1.81E+09	5.66E+07	na	
				HQ associated with inhalation of soil COPCs particulates > 375':			**0.00E+00**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on $(Um/Ut)^3$ (default, EPA 2002) (Um/Ut)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	1	Exposure duration - construction worker (site-specific)
InR (m^3/day)	20	Inhalation rate - outdoor industrial worker (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Construction Worker
Soil < 375' Soil Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)
PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)
Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT
HQ = Ia/RfDi

SFi (mg/kg-day) = Unit Risk (mg/m3) x 70 kg x(20 m3/day)-1 x 1000 ug/mg

Analyte	EPA Assigned Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	HQ
Arsenic	A	7.6		1.81E+09	5.53E-10	9.40E-11	4.30E+00	1.50E+01	6.27E-12
Benz[a]anthracene	B2	3.7		1.81E+09	5.53E-10	4.58E-11	8.00E-02	2.80E+02	1.63E-13
Benzo[b]fluoranthene	B2	3.1		1.81E+09	5.53E-10	3.84E-11	8.80E-02	3.08E+02	1.25E-13
Benzo[k]fluoranthene	B2	1.1		1.81E+09	5.53E-10	9.53E-10	8.80E-03	3.08E+01	3.09E-11
Benzo[a]pyrene	B2	4.2		1.81E+09	5.53E-10	5.20E-11	8.80E-01	3.08E+03	1.69E-14
Chrysene	B2	5		1.81E+09	5.53E-10	6.19E-11	8.80E-04	3.08E+00	2.01E-11
Dibenz[a,h]anthracene	B2	0.76		1.81E+09	5.53E-10	9.40E-12	8.80E-01	3.08E+03	3.05E-15
Indeno[1,2,3-cd]pyrene	B2	1.9		1.81E+09	5.53E-10	2.35E-11	8.80E-02	3.08E+02	7.63E-14

ILCR associated with inhalation of soil COPCs particulates < 375'	**5.77E-11**

Input Parameters:

PEF (m^3/kg)	68.63	Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	3,600	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square source[1]
(s/hr)	0.036	Seconds per hour
0.036 (g/m^2-hr)	0.25	Respirable fraction
V (unitless)	4.29	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	11.32	Mean annual windspeed (site-specific)
Ut (m/s)	0.093	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)		Function of dependent on $(Um/Ut)^3$ (default, EPA 2002)
	chemical-specific	
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)		Detected concentration of chemical
EF (days/year)	250	Exposure frequency (EPA, 2002)
ED (years)	1	Exposure duration - outdoor industrial worker (EPA, 2002)
InR (m^3/day)	20	Inhalation rate - outdoor industrial worker (EPA, 2002)
BW	70	Inhalation rate - construction worker (EPA, 2002)
CF (mg/ug)	0.001	Exposure frequency (EPA, 1991a)
Atc (days)	25,550	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDi (mg/kg-day)	chemical-specific	Averaging time - carcinogenic (70 yrs x 365 days)
HQ	chemical-specific	Inhalation reference dose
Ia (mg/kg-day)	chemical-specific	Hazard quotient
RfDi (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
Etc (hr/dy)	8	Inhalation reference dose

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) Exposure Time (EPA, 2002)
2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Construction Worker
Soil > 375' Inhalation Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

VF (m^3/kg) = (Q/C) x [(3.14 x DA x T)0.5/(2 x db x DA)] x 10^{-4} (m^2/cm^2)

PEF = Q/Cwind x (3600 / 0.036 x (1 - V) x (Um / Ut)3 x F(x)

SFi (mg/kg-day) = Unit Risk (mg/m^3) x 70 kg x (20 m^3/day)$^{-1}$ x 1000 ug/mg

Ia = Csoil x EF x ED x IR x ET x (1/VF + 1/PEF) / BW x AT

ICLR = Ia x CSFi

Analyte	EPA Assigned Weight of Evidence	C_{soil} (mg/kg)	VF (m^3/kg)	PEF (m^3/kg)	1/PEF	Ia (mg/kg-day)	Unit Risk mg/m^3	CSFi (mg/kg-day)	ILCR
Arsenic	A	7.6		1.81E+09	5.53E-10	6.58E-09	4.30E+00	1.50E+01	9.87E-08
Benzo[a]pyrene	B2	0.024		1.81E+09	5.53E-10	2.08E-11	8.80E-01	3.08E+03	6.40E-08

ILCR associated with inhalation of soil COPCs particulates > 375'	**1.63E-07**

Input Parameters:

PEF (m^3/kg)		Particulate Emission Factor (site-specific)
Q/Cwind (g/m^2-s per kg/m^3)	68.63	Inverse of the ratio of the geometric mean air concentration to the emission flux at the center of a square sourc[1]
(s/hr)	3,600	Seconds per hour
0.036 (g/m^2-hr)	0.036	Respirable fraction
V (unitless)	0.25	Fraction of vegetative cover (unitless) site-specific
Um (m/s)	4.29	Mean annual windspeed (site-specific)
Ut (m/s)	11.32	Equilvalent threshold value of windspeed at 7m (default, EPA 2002)
F(x)	0.093	Function of dependent on (Um/Ut)^3 (default, EPA 2002)
Ia (mg/kg-day)	chemical-specific	Ingested dose (intake)
Csoil (mg/kg)	chemical-specific	Detected concentration of chemical
EF (days/year)	250	Exposure frequency (site-specific)
ED (years)	1	Exposure duration - construction worker (site-specific)
InR (m^3/day)	20	Inhalation rate - construction worker (EPA, 2002)
BWa (kg)	70	Adult body weight (EPA, 1991a)
CF (mg/ug)	0.001	Conversion factor
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
HQ	chemical-specific	Hazard quotient
Ia (mg/kg-day)	chemical-specific	Inhaled dose of COPC in particulates
RfDi (mg/kg-day)	chemical-specific	Inhalation reference dose
Etc (hr/dy)	8	Exposure Time (EPA, 2002)

1 = http://rais.ornl.gov/epa/ssl1.htm (Zone VIII - Philadelphia) based on 2 acre contamination area

2 = http://rais.ornl.gov/cgi-bin/epa/ssl1.cgi

Construction Worker
Soil < 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	27.2	8.78E-05	4.00E-04	**0.2196**
Arsenic	7.6	2.45E-05	3.00E-04	**0.0818**
Benz[a]anthracene	3.7	1.19E-05	na	
Benzo[b]fluoranthene	3.1	1.00E-05	na	
Benzo[k]fluoranthene	1.9	6.14E-06	na	
Benzo[a]pyrene	4.2	1.36E-05	na	
Chrysene	5	1.61E-05	na	
Dibenz[a,h]anthracene	0.76	2.45E-06	na	
Indeno[1,2,3-cd]pyrene	1.9	6.14E-06	na	

HQ associated with ingestion of soil COPCs < 375':	**0.301**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EF (days/year)	250	Exposure frequency (EPA, 2002)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Construction Worker
Soil > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Antimony	4.8	1.55E-05	3.00E-04	**0.0517**
Arsenic	7.6	2.45E-05	3.00E-04	**0.0818**
Benzo[a]pyrene	0.024	7.75E-08	na	

HQ associated with ingestion of soil COPCs > 375':	**0.133**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Construction Worker
Soil < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATc)
ILCR = Is x SFo

Analyte	EPA Weight of Evidence	Csoil mg/kg	Is (mg/kg-day)	chronic CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	A	7.6	3.51E-07	1.50E+00	5.26E-07
Benz[a]anthracene	B2	3.7	1.71E-07	7.30E-01	1.25E-07
Benzo[b]fluoranthene	B2	3.1	1.43E-07	7.30E-01	1.04E-07
Benzo[k]fluoranthene	B2	1.9	8.76E-08	7.30E-02	6.40E-09
Benzo[a]pyrene	B2	4.2	1.94E-07	7.30E+00	1.41E-06
Chrysene	B2	5	2.31E-07	7.30E-03	1.68E-09
Dibenz[a,h]anthracene	B2	0.76	3.51E-08	7.30E+00	2.56E-07
Indeno[1,2,3-cd]pyrene	B2	1.8	8.30E-08	7.30E-01	6.06E-08

ILCR associated with ingestion of soil COPCs < 375': 2.49E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDi (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Construction Worker
Soil > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	Csoil mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	7.6	3.51E-07	1.50E+00	5.26E-07
Benzo[a]pyrene	0.024	1.11E-09	7.30E+00	8.08E-09

ILCR associated with ingestion of soil COPCs > 375: 5.26E-07

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDi (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Construction Worker
Soil < 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	27.2	0.010	1.63E-07	5.27E-06	0.0200	4.00E-04	8.00E-06	**0.450**
Arsenic	7.6	0.030	4.56E-08	1.47E-06	0.4100	3.00E-04	1.23E-04	**0.012**
Benz[a]anthracene	3.7	0.130	9.62E-08	3.11E-06				
Benzo[b]fluoranthene	3.1	0.130	8.06E-08	2.60E-06				
Benzo[k]fluoranthene	1.9	0.130	4.94E-08	1.60E-06				
Benzo[a]pyrene	4.2	0.130	1.09E-07	3.53E-06				
Chrysene	5	0.130	1.30E-07	4.20E-06				
Dibenz[a,h]anthracene	0.76	0.130	1.98E-08	6.38E-07				
Indeno[1,2,3-cd]pyrene	1.8	0.130	4.68E-08	1.51E-06				
				HQ associated with dermal contact of soil COPCs < 375':				**0.46**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFc (mg/cm2)	0.2	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS	chemical-specific	Dermal absorption fraction - chemical specific (RAIS, 2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor
Mercury ABS from RIAS	May-04	

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Construction Worker
Soil > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Antimony	4.8	0.020	1.92E-08	6.20E-07	0.4100	4.0E-04	1.6E-04	**0.004**
Arsenic	7.6	0.030	4.56E-08	1.47E-06	0.4100	3.0E-04	1.23E-04	**0.012**
Benzo[a]pyrene	0.024	0.310	1.49E-09	4.80E-08	0.4100	na		

HQ associated with dermal contact of soil COPCs > 375':	**0.02**

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFc (mg/cm2)	0.2	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Construction Worker
Soil < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	A	7.6	0.03	2.96E-07	7.93E-06	0.4100	1.50E+00	3.66E+00	2.90E-05
Benz[a]anthracene	B2	3.7	0.13	1.44E-07	3.86E-06	0.3100	7.30E-01	2.35E+00	9.09E-06
Benzo[b]fluoranthene	B2	3.1	0.13	1.21E-07	3.23E-06	0.3100	7.30E-01	2.35E+00	7.61E-06
Benzo[k]fluoranthene	B2	1.9	0.13	7.41E-08	1.98E-06	0.3100	7.30E-02	2.35E-01	4.67E-07
Benzo[a]pyrene	B2	4.2	0.13	1.64E-07	4.38E-06	0.3100	7.30E+00	2.35E+01	1.03E-04
Chrysene	B2	5	0.13	1.95E-07	5.21E-06	0.3100	7.30E-03	2.35E-02	1.23E-07
Dibenz[a,h]anthracene	B2	0.76	0.13	2.96E-08	7.93E-07	0.3100	7.30E+00	2.35E+01	1.87E-05
Indeno[1,2,3-cd]pyrene	B2	1.8	0.13	7.02E-08	1.88E-06	0.3100	7.30E-01	2.35E+00	4.42E-06

ILCR associated with dermal contact of soil COPCs < 375': 3.81E-05

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	2,733	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFo (mg/cm^2)	0.1	Soil-to-skin adherence factor - outdoor industrial worker (RAGS Part E, 2004)
AFc (mg/cm2)	0.3	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFi (days/year)	250	Exposure frequency (EPA, 2002)
EFo (days/year)	225	Exposure frequency (EPA, 2002)
EFc (days/year)	250	Exposure frequency (site-specific)
EDi (years)	25	Exposure duration - indoor industrial worker (EPA, 2002)
EDo (years)	25	Exposure duration - outdoor industrial worker (EPA, 2002)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,

Construction Worker
Soil > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	7.5	0.03	4.50E-08	2.08E-08	0.41	1.50E+00	3.66E+00	7.59E-08
Benzo[a]pyrene	0.024	0.13	6.24E-10	2.88E-10	0.31	7.30E+00	2.35E+01	6.78E-09

ILCR associated with dermal contact of soil COPCs > 375': 7.59E-08

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFo (mg/cm^2)	0.2	Soil-to-skin adherence factor - outdoor industrial worker (RAGS Part E, 2004)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Construction Worker
Sediment > 375' Ingestion Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATnc)

HQ = Is/RfDo

Analyte	C_{soil} (mg/kg)	Is (mg/kg-day)	RfDo (mg/kg-day)	HQ
Arsenic	15	4.84E-05	3.00E-04	**0.1614**

HQ associated with ingestion of soil COPCs > 375':	**0.161**

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
RfDo (mg/kg-day)	chemical-specific	Oral reference dose
HQ	chemical-specific	Hazard quotient

Construction Worker
Sediment < 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
Is = (C_{soil} x IR x CF x EF x ED)/(BW x ATc)
ILCR = Is x SFo

Analyte	EPA Weight of Evidence	Csoil mg/kg	Is (mg/kg-day)	chronic CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Benzo[a]pyrene	B2	0.023	1.06E-09	7.30E+00	7.74E-09

ILCR associated with ingestion of soil COPCs < 375': 7.74E-09

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Construction Worker
Sediment > 375' Ingestion Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:
$Is = (C_{soil} \times IR \times CF \times EF \times ED)/(BW \times ATc)$
$ILCR = Is \times SFo$

Analyte	Csoil mg/kg	Is (mg/kg-day)	CSFo $(mg/kg\text{-}day)^{-1}$	ILCR
Arsenic	15	6.92E-07	1.50E+00	1.04E-06

ILCR associated with ingestion of soil COPCs > 375: 1.04E-06

Input Parameters:

Is (mg/kg-day)	chemical-specific	Ingested dose
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
IR (mg/day)	330	Ingestion rate - construction worker (EPA, 2002)
CF (kg/mg)	0.000001	Conversion factor
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	Averaging time - carcinogenic (70 years x 350 days/year)
SFo $(mg/kg\text{-}day)^{-1}$	chemical-specific	Oral slope factor
ILCR	chemical-specific	Incremental lifetime cancer risk

Construction Worker
Sediment > 375' Dermal Intake and Hazard Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

DAevent = Csoil x CF x AF x ED x EV x ABS

DAD = (DAevent x EF x ED x SA)/(BW x ATnc)

RfD_{ABS} = RfDo x ABS_{GI}

HQ = DAD/RfD_{ABS}

Analyte	C_{soil} (mg/kg)	ABS	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	RfDo (mg/kg-day)	RfD_{ABS}	HQ
Arsenic	15	0.030	9.00E-08	2.91E-06	0.4100	3.0E-04	1.23E-04	**0.024**

HQ associated with dermal contact of soil COPCs > 375': 0.02

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
RfD_{ABS}(mg/kg-day)		Absorbed reference dose
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFc (mg/cm2)	0.2	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS		Dermal absorption fraction - chemical specific (RAIS, 2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
HQ	chemical-specific	Hazard quotient
GAF	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs
na = not available

Construction Worker
Sediment < 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	EPA Weight of Evidence	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Benzo[a]pyrene	B2	0.233	0.13	6.06E-09	2.79E-09	0.3100	7.30E+00	2.35E+01	6.58E-08

ILCR associated with dermal contact of soil COPCs < 375': 6.58E-08

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFc (mg/cm2)	0.2	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATnc (days)	365	Averaging time - noncarcinogenic ([ED x 365 days/year](Construction)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Construction Worker
Sediment > 375' Dermal Intake and Cancer Risk Calculations
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations:

$DAevent = Csoil \times CF \times AF \times ED \times EV \times ABS_d$

$DAD = (DAevent \times EF \times ED \times SA)/(BW \times ATnc)$

$CSF_{ABS} = CSF_o / ABS_{GI}$

$ILCR = DAD \times CSF_{ABS}$

Analyte	C_{soil} (mg/kg)	ABS_d	DAevent (mg/cm^2-event)	DAD (mg/kg-day)	ABS_{GI}	CSFo (mg/kg-day)$^{-1}$	CSF_{ABS} (mg/kg-day)$^{-1}$	ILCR
Arsenic	15	0.03	9.00E-08	4.15E-08	0.41	1.50E+00	3.66E+00	1.52E-07

ILCR associated with dermal contact of soil COPCs > 375': 1.52E-07

Input Parameters:

DAevent (mg/cm^2-event)		Dose absorbed per event
DAD (mg/kg-day)		Dermally absorbed dose
CSF_{ABS} (mg/kg-day)$^{-1}$		Absorbed cancer slope factor
RfDo (mg/kg-day)		Oral reference dose - chemical specific
ABS_{GI} (unitless)		Fraction of contaminant absorbed in GI tract - chemical specific (RAGS Part E, EPA 2004)
Csoil (mg/kg)	chemical-specific	Maximum detected concentration of chemical
CF (kg/mg)	0.000001	Conversion factor
SAa (cm^2-year/kg)	3,300	Surface area - outdoor industrial worker and construction worker (EPA, 2002)
AFc (mg/cm2)	0.2	Soil-to-skin adherence factor - construction worker (EPA, 2002)
ABS_d		Dermal absorption fraction - chemical specific (EPA,2007)
EFc (days/year)	250	Exposure frequency (site-specific)
EDc (years)	1	Exposure duration - construction worker (site-specific)
EVo = (events/day)	1	Event frequency (RAGS Part E, EPA, 2004)
BWa (kg)	70	Body weight - adult (EPA, 2002)
ATc (days)	25,550	
HQ	chemical-specific	Hazard quotient
ABS_{GI}	chemical-specific	Gastrointestinal absorption factor

The As RfDd is based on a GIAF of 0.41 (IRIS, 1998).
3.2% for a dose of 0.6 ug/cm2 as a default ABS for arsenic
1% value as a conservative assumption of ABS for other inorganics,
10% value as a conservative assumption of ABS for semivolatile organics,
13% value as a conservative assumption of ABS for PAHs

Construction Worker
Soil and Sediment Additive Non-Cancer Hazard Index
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Noncancer Evaluation):

$HQ_1 = Ia/RfDi$

$HQ_2 = Iw/RfDo$

$HQ_3 = DAD/RfDadj$

Construction Worker - Soil Hazard Index (HI)				
		Soil < 375'		***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.00	0.00	0.29	0.46	0.75
		Soil > 375'		***Additive Hazard***
Soil Particulate Inhalation (HQ1)	Soil Vapor Instrusion (HQ_+)	Soil Ingestion (HQ2)	Soil Dermal Contact (HQ3)	
0.00	0.00	0.10	0.02	0.12
Construction Worker - Sediment Hazard Index (HI)				
		Sediment < 375'		***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.00	0.00	0.00	0.00	0.00
		Sediment > 375'		***Additive Hazard***
Sed Particulate Inhalation (HQ1)	Sed Vapor Instrusion (HQ_+)	Sed Ingestion (HQ2)	Sed Dermal Contact (HQ3)	
0.00	0.00	0.10	0.02	0.12
		HI associated with exposure to Soil and Sediment COPCs:		**0.99**

Input Parameters:

HQ	Hazard quotient
Ia (mg/kg-day)	Inhaled dose of COPCs
Iw (mg/kg-day)	Ingested dose of COPCs
DAD (mg/kg-day)	Dermally absorbed dose of COPCs
RfDi (mg/kg-day)	Inhalation reference dose
RfDo (mg/kg-day)	Oral reference dose
RfDadj (mg/kg-day)	Adjusted reference dose (oral RfD multiplied by the GAF to derive dermal RfD)
HI	Hazard index (sum of HQ_1, HQ_2, and HQ_3)

Construction Worker
Soil and Sediment Additive Cancer Risk
OU-1 Former Trap and Skeet Site (FGGM-83)
Fort Meade, MD

Equations (Cancer Evaluation):

$ILCR_1 = Ia \times SFi$

$ILCR_2 = Iw \times SFo$

$ILCR_3 = DAD \times SFadj$

Construction Worker - Excess Lifetime Cancer Risk (ELCR)				
Soil < 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
5.77E-11		2.49E-06	3.81E-05	4.06E-05
Soil > 375'				***Additive Risk***
Soil Inhalation ($ILCR_1$)	Soil Vapor Instrusion ($ILCR_+$)	Soil Ingestion ($ILCR_2$)	Soil Dermal Contact ($ILCR_3$)	
1.63E-07		5.26E-07	7.59E-08	3.15E-07
Construction Worker - Excess Lifetime Cancer Risk (ELCR)				
Sediment < 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	
0.00E+00		7.74E-09	6.58E-08	7.35E-08
Sediment > 375'				***Additive Risk***
Sed Inhalation ($ILCR_1$)	Sed Vapor Instrusion ($ILCR_+$)	Sed Ingestion ($ILCR_2$)	Sed Dermal Contact ($ILCR_3$)	Sed Dermal Contact ($ILCR_3$)
0.00E+00		1.04E-06	1.52E-07	1.19E-06
		ELCR associated with exposure to Soil and Sediment COPCs:		**4.2E-05**

Input Parameters:

ILCR	Incremental lifetime cancer risk
SFi $(mg/kg\text{-}day)^{-1}$	Inhalation slope factor
SFo $(mg/kg\text{-}day)^{-1}$	Oral slope factor
SFadj $(mg/kg\text{-}day)^{-1}$	Adjusted slope factor (oral SF divided by the GAF to derive SF)
ELCR	Total ILCR (sum of $ILCR_1$, $ILCR_2$, and $ILCR_3$)