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Final

U.S. Army Corps of Engineers
Louisville District

Remedial Investigation
Former Hanna City Air Force Station
Remedial Investigation/Feasibility Study/Proposed Plan/ Record of Decision Project
Hanna City, Peoria County, Illinois

Prepared for
U.S. Army Corps of Engineers

Louisville District Contract No. W912QR-04-D-0030
Delivery Order 0019 and
Louisville District Contract No. W912QR-08-D-0014
Delivery Order 0003

Prepared by
GEO Consultants, LLC
325 Kentucky Avenue
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March 2010

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Prepared for the
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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

GEO Consultants, LLC (GEO) has completed the Final Remedial Investigation report for the Former Hanna City Air Force Station Remedial Investigation/Feasibility Study/Proposed Plan/Record of Decision Project, Hanna City, Peoria County, Illinois. Notice is hereby given that an Independent Technical Review (ITR) has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the ITR, compliance with established policy, principles and procedures was verified. This included review of procedures to be used to create a product that meets the customer's needs consistent with law and existing U.S. Army Corps of Engineers policy.

03/17/2010

Craig Rightmire, P.G. — Date
ITR Team Member

Todd Calhoun, P.G. — Date
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Kim Morris — Date
Quality Assurance Manager

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

None

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

Jeff Douthitt, P.E. — Date
President, GEO Consultants, LLC

CONTENTS

TABLES vi
APPENDICES vi
ACRONYMS and ABBREVIATIONS vii
EXECUTIVE SUMMARY x

1. INTRODUCTION 1
1.1 PURPOSE OF REPORT 1
1.2 SITE BACKGROUND 2
1.2.1 Site Description 2
1.2.2 Site History 2
1.2.3 Previous Investigations 3
1.3 REPORT ORGANIZATION 5

2. FIELD INVESTIGATION 7
2.1 SURFACE SOIL SAMPLING 7
2.2 SUBSURFACE SOIL SAMPLING 8
2.3 GROUNDWATER SAMPLING FROM MONITORING WELLS 9
2.3.1 Temporary Monitoring Well installation 9
2.3.2 Groundwater Sampling 9
2.3.3 Temporary Monitoring Well Abandonment 10
2.4 DECONTAMINATION OF DRILLING AND SAMPLING EQUIPMENT 10
2.5 MANAGEMENT AND DISPOSAL OF INVESTIGATIVE-DERIVED WASTE 10
2.6 FIELD QUALITY CONTROL PROCEDURES AND DOCUMENTATION 10
2.6.1 Field Quality Control (QC) Samples 10
2.6.2 Field Performance Audits 11
2.6.3 Corrective Actions 11
2.6.4 Changes in the Field Program 11
2.7 SAMPLE CUSTODY, HANDLING, AND HOLDING TIMES 11
2.7.1 Documentation of Custody 11
2.7.2 Sample Labeling and Numbering 11
2.7.3 Holding Times and Turnaround Time 11

3. PHYSICAL CHARACTERISTICS 12
3.1 SURFACE FEATURES 12
3.2 CONTAMINANT SOURCES 12
3.3 METEOROLOGY 12
3.4 SURFACE WATER AND SEDIMENT 13
3.5 GEOLOGY 13
3.6 SOIL AND VADOSE ZONE 15
3.7 HYDROGEOLOGY 15
3.8 DEMOGRAPHICS 16
3.9 ECOLOGY 17

4. CONTAMINATION ASSESSMENT 18
4.1 LABORATORY ANALYSIS AND SAMPLE QUALITY ASSURANCE/QUALITY CONTROL 18
4.2 PRESENTATION OF ANALYTICAL RESULTS 19
4.3 PRELIMINARY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS 19
4.3.1 Health-Based ARARs 20

4.3.2 Maximum Contaminant Levels 21
4.3.3 Maximum Contaminant Level Goals 21
4.3.4 Illinois Groundwater Standards 21
4.3.5 Illinois Groundwater and Soil Standards 21
4.3.6 USEPA Regional Screening Levels 21
4.3.7 Drinking Water Health Advisories 22
4.4 NATURE AND EXTENT OF CONTAMINATION 22
4.5 GROUNDWATER 23
4.5.1 Volatile Organic Compounds 23
4.5.2 Metals 23
4.5.3 Semi-volatile Organic Compounds 24
4.5.4 Pesticides 24
4.5.5 Polychlorinated Biphenyls 24
4.6 SOIL 24
4.6.1 Volatile Organic Compounds 25
4.6.2 Metals 25
4.6.3 Semi-volatile Organic Compounds 26

5. CONTAMINANT FATE AND TRANSPORT 35
5.1 SUMMARY OF CONTAMINANTS OF CONCERN (COC**S**) 35
5.2 CONTAMINANT PRESISTENCE 36
5.2.1 Metals in Groundwater 36
5.2.2 PAHs in Soil 37
5.2.3 Arsenic in Soil 37
5.3 POTENTIAL PATHWAYS OF MIGRATION 37
5.4 CONTAMINANT MIGRATION 39
5.4.1 Adsorption 39
5.4.2 Dissolution and Precipitation 40
5.4.3 Advection and Dispersion 40

6. BASELINE HUMAN HEALTH RISK ASSESSMENT 42
6.1 INTRODUCTION 42
6.2 HAZARD IDENTIFICATION 42
6.2.1 Review of Available Data and Assessment of Data Quality and Usability 43
6.2.2 Data Quality Assessment 44
6.2.3 Risk Screening 46
6.3 EXPOSURE ASSESSMENT 48
6.3.1 Conceptual Site Risk Model 48
6.3.2 Exposure Equations 49
6.3.3 Exposure Point Concentrations 49
6.3.4 Exposure Parameters and Exposure Calculation Results 50
6.4 TOXICITY ASSESSMENT 50
6.4.1 Carcinogenic Effects 51
6.4.2 Non-cancer Effects 51
6.5 RISK CHARACTERIZATION 52
6.5.1 Cancer Risk 52
6.5.2 Non-cancer Health Effects 54
6.6 UNCERTAINTY ANALYSIS 55
6.6.1 Land and Groundwater Use 55
6.6.2 Uncertainties in Risk Screening and Exposure Point Concentrations 56
6.6.3 Uncertainties from Unavailable Non-carcinogenic Toxicity Values 57
6.6.4 Uncertainties from Unavailable Carcinogenic Toxicity Values 57

6.6.5 Impacts of Road Runoff and Vehicular Traffic on Surface Soils 57
6.7 HUMAN HEALTH RISK ASSESSMENT SUMMARY AND CONCLUSIONS 57

7. SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT 61
7.1 INTRODUCTION 61
7.2 PROBLEM FORMULATION/DATA EVALUATION 61
7.2.1 Results of the Ecological Site Reconnaissance 61
7.2.2 Data Evaluation 62
7.3 ECOLOGICAL CONCEPTUAL SITE RISK MODEL AND EXPOSURE ASSESSMENT 63
7.3.1 Ecological conceptual site model 63
7.3.2 Exposure data 63
7.4 ECOLOGICAL EFFECTS ASSESSMENT AND RISK CHARACTERIZATION 64
7.4.1 Ecological Screening Values (ESVs) and Illinois/TACO Background Concentrations 64
7.4.2 Assessment of Candidate Chemicals of Potential Ecological Concern (COPEC) 65
7.5 UNCERTAINTY ASSESSMENT 69
7.5.1 Uncertainties in Problem Formulation 70
7.5.2 Uncertainties in Exposure Assessment 70
7.5.3 Uncertainties in Effects Assessment 70
7.5.4 Uncertainties in Risk Screening and COPEC Identification 71
7.6 SUMMARY 71

8. SUMMARY AND CONCLUSIONS 74
8.1 SUMMARY 74
8.1.1 Field Activities 74
8.1.2 Contamination Assessment 75
8.1.3 Fate and Transport of Contaminants 79
8.1.4 Risk Assessment 80
8.2 CONCLUSIONS 83
8.2.1 Data Limitations and Recommendations for Future Work 85
8.2.2 Recommended Remedial Action Objectives 86

9. REFERENCES 88

TABLES

Table 2-1. Areas of Potential Concern and associated data points for surface soil samples..... 8
Table 2-1. Areas of Potential Concern and associated data points for surface soil samples..... 8
Table 2-2. Areas of Potential Concern and associated data points for subsurface soil samples 8
Table 2-3. Areas of Potential Concern and associated data points for groundwater samples..... 10
Table 3-1. Federally endangered, threatened, proposed, and candidate species of Peoria County..... 17
Table 3-2. State listed endangered and threatened species of Peoria County 17

**Note: Other tables referenced in the text are located in Appendix B, at the end of this document.*

APPENDICES

Appendix A Figures
Appendix B Tables
Appendix C Boring Logs from the Remedial Investigation and Well Drilling Logs for Wells Within 0.5 Miles of the HCAFS
Appendix D Laboratory Data Reports
Appendix E Remedial Investigation Well Sampling Logs
Appendix F Groundwater Field Parameters from Remedial Investigation
Appendix G Ecological Reconnaissance Report
Appendix H Data Validation reports from the Site Inspection (TtEC) and Remedial Investigation (GEO)
Appendix I Human Health Risk Assessment Equations for Estimating Exposure and Risk from Mutagenic Carcinogens Using Age-Dependent Adjustment Factors.
Appendix J ProUCL 4.0 and Exposure Calculation Results

ACRONYMS and ABBREVIATIONS

ABS_{GI}	gastro-intestinal absorption factor
amsl	above mean sea level
AOPC	Area of Potential Concern
ARAR	applicable, relevant, and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
Bldg	building
BTEX	benzene, toluene, ethylbenzene, and xylene
Cal EPA	California Environmental Protection Agency
CDI	Chemical Daily Intake
CELRL	U.S. Army Corps of Engineers, Louisville District
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CL	Lean Clay
CLP	Contract Laboratory Program
COC	Contaminant of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
Cs	contaminant soil concentration
CSF	cancer slope factor
CSRM	conceptual site risk model
Cw	groundwater concentration
DAD	Dermal Absorbed Dose
DO	dissolved oxygen
DoD	U.S. Department of Defense
DWHA	Drinking Water Health Advisories
EB	Equipment Blank
Eco-SSL	Ecological Soil Screening Levels
EC	exposure concentration
ECSRM	Ecological Conceptual Site Risk Model
Eh	oxidation reduction potential
EPC	exposure point concentration
EPRI	Electric Power Research Institute
ESL	Ecological Screening Level
ESV	ecological screening value
EU	Exposure Unit
FAA	Federal Aviation Administration
FD	Field Duplicate
FS	Feasibility Study
ft	feet/foot
g/cm^3	grams per cubic centimeter
gal	gallon
GEO	GEO Consultants, LLC
HCAFS	Former Hanna City Air Force Station
HHRA	Human Health Risk Assessment
HI	hazard index
HMW	high-molecular weight
HQ	hazard quotient
IAC	Illinois Administrative Code

IDoC	Illinois Department of Corrections
IDW	Investigation-Derived Waste
Illinois EPA	Illinois Environmental Protection Agency
ILCR	Incremental Lifetime Cancer Risk
in.	inch(s)
IRIS	Integrated Risk Information System
ISGS	Illinois State Geological Survey
IUR	Inhalation Unit Risk
LCS	laboratory control sample
LCG	Louisville Chemistry Guidelines
LMW	low-molecular weight polycyclic aromatic hydrocarbons
LQSMS	Louisville Quality System Manual Supplement
LUST	leaking underground storage tank
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDC	maximum detected concentration
mg/kg	milligrams per kilogram
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NCP	National Contingency Plan
ORNL	Oak Ridge National Laboratory
ORP	Oxygen Reduction Potential
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PID	photo ionization detector
PPRTV	Provisional Peer-Reviewed Toxicity Value
PRG	Preliminary Remediation Goals
PRP	Potentially Responsible Party
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
RPD	relative percent difference
RSL	Regional Screening Level
SARA	Superfund Amendments and Reauthorization Act
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SSI	Supplemental Site Inspection
SWAT	Special Weapons and Tactics
TACO	Tiered Approach to Correction Action Objectives
TCE	trichloroethylene
TEF	toxicity equivalency factor
TSS	total suspended solids

TtEC	TetraTech EC, Inc.
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCS	Unified Soils Classification System
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compounds
WP	Work Plan

EXECUTIVE SUMMARY

GEO Consultants, LLC (GEO) was contracted by the U.S. Army Corps of Engineers (USACE), Louisville District (CELRL) (Contract Number W912QR-04-D-0030, Delivery Order 0019 and Contract Number W912QR-08-D-0014, Delivery Order 0003), to conduct the Remedial Investigation (RI) for the Former Hanna City Air Force Station (HCAFS) and to prepare the required documents.

The HCAFS is a 42.89-acre parcel located approximately 10 miles west of the city of Peoria and two miles west of the Village of Hanna City in Peoria County, Illinois. The property is located in Section 4 of Township 8 North, Range 6 East in the Logan Township. The site can be reached from Peoria, Illinois by traveling west on State Highway 116 (Farmington Road), through Hanna City, Illinois, then north onto the site access road. As a result of Potential Responsible Party (PRP) issues and current use of a portion of the site by the Federal Aviation Administration (FAA), only 38.456 acres of the site are included in this current investigation. This portion, Tract 1, was occupied by the Illinois Department of Corrections (IDoC) Hanna City Work Camp and was used as a minimum security prison. The facility has been closed since October 2002. The Illinois Senate passed a bill in April 2008 that mandated the transfer of the facility to Peoria County for public use. The property transfer was completed on July 10, 2009. The site, as of August 2009, is being used by the Peoria County Sheriff's Office for Special Weapons and Tactics (SWAT) training. The County anticipates that this use will continue. Any other future use of the site is not yet known.

In 1992, USACE, Chicago District conducted a preliminary evaluation of the HCAFS consisting of site reconnaissance and interviews with former and site personnel who were current at the time. Areas of potential concern (AOPCs) were identified that required further study. Further details of the Preliminary Assessment are not available. Five underground storage tanks (USTs) were excavated and removed by IDoC during the period of 1997 to 2002. At least one of the tank locations has not yet been closed as a regulatory issue.

In 1996, Parsons performed a Site Inspection (SI) at specific areas at the HCAFS and one background area. The areas included the seven AOPCs discussed in this RI [i.e., three Coal Ash Storage Areas (A, B, and C), Main Entrance, Vehicle Wash Rack, Maintenance Building, and Paint Shed]. The other areas included in the SI were the Tile Field, the Septic Tank, and the lagoon associated with the Former Village of Hanna City Water Treatment System [the water supply well associated with the treatment system was taken out of use in 1987 by the Illinois Environmental Protection Agency (Illinois EPA) due to elevated levels of naturally occurring radon]. In response to Illinois EPA's request for additional sampling, TetraTech EC Inc. conducted a Supplemental Site Inspection (SSI) in April 2006.

Based on the results of the SI and SSI, pesticides, polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs) were ruled out as Contaminants of Concern (COCs) at the HCAFS. Polynuclear aromatic hydrocarbons (PAHs) in groundwater were also ruled out as COCs. In addition, the Tile Field/Septic Tank was ruled out as an area of concern. The COCs that remained are:

- PAHs in surface soil in all areas of concern and in subsurface soil at the Vehicle Wash Rack,
- Arsenic in the subsurface soil at Coal Storage Areas A, B, and C and the Paint Shed, and
- Metals in groundwater for the site as a whole.

The field program for this RI was designed based on the results of the previous studies. The RI Work Plan (WP) identified five Exposure Units (EUs) for investigation. Groundwater is considered as one EU for the entire site. For investigation of surface and subsurface soils, five EUs were designated: Coal Area

A, Coal Area B, Coal Area C (including Coal Area C, the Maintenance Building and the Paint Shed), the Vehicle Wash Rack, and the Main Entrance.

The RI field and related activities included collection of surface soil samples on August 25, 2008 and November 18, 2008. The November sampling event was performed after receipt of the August analytical data and was designed to provide additional characterization beyond that initially proposed and to further delineate and confirm August data points, which were above Tiered Approach to Correction Action Objectives (TACO) screening levels. In total, 54 soil samples were collected. Fifty-four subsurface samples were collected and 10 temporary monitoring wells were installed and sampled.

One of the objectives of groundwater sampling for this RI was to test the hypothesis that metals in groundwater are associated with suspended particulates. To that end, both filtered and unfiltered samples were collected. Results of analysis of these samples showed that all metals that exceeded the standard, with the exception of manganese, were found only in the unfiltered samples and, therefore, are associated with the suspended particulates and are not dissolved in groundwater. Manganese was the only metal to exceed the Illinois TACO Class I Groundwater Remediation Objective in both filtered and unfiltered samples; the concentrations in filtered samples were slightly lower than in unfiltered samples. Manganese concretions, rounded masses of manganese, are common in the soil types that occur at the HCAFS and are generally associated with soils developed from coal-bearing rocks such as those that occur at the HCAFS. In addition, manganese occurs in a soluble form under the current site conditions, and there are no known specific sources of manganese, based on the likely activities associated with radar tracking conducted at the HCAFS. Therefore, manganese is likely to be naturally occurring in the groundwater. This has not been confirmed, as there are no analysis results available for groundwater upgradient of the HCAFS.

Additional groundwater constituents that have been identified in unfiltered samples collected for this RI over the criteria are iron, aluminum, vanadium, and lead. Aluminum was reported above the criteria in two unfiltered samples. Iron was reported above the criteria in one unfiltered sample. All filtered sample results for these constituents were below the criteria. Both aluminum and iron were reported above the criteria in previous investigations. Aluminum and iron are likely naturally occurring. Lead was also reported above the criteria in previous investigations, but was not reported above the detection limit in the samples collected for this RI. No explanation can be found for the occurrence of vanadium in groundwater as a result of site use. Vanadium is, however, associated with shale and the bedrock below the HCAFS has been described as shale.

Analysis of surface soil samples for PAHs show reported concentrations above screening criteria for benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, chrysene and dibenzo(a,h)anthracene. Sources of PAHs in soil include road runoff and accumulation of snow along road-sides after plowing, as well as vehicular emissions, incomplete burning of coal, and petroleum spills. There are possible sources of PAHs specific to individual EUs; however, the road runoff, melting of plowed snow and vehicular emissions appears to be a site-wide source. A possible source for elevated PAHs in surface soil at Coal Areas A, B, and C is residual contamination from the former coal storage. Additional possible sources at the Coal Area C EU are a drain that emerges from the Maintenance Building, residual contamination from a former underground fuel storage tank location, and residual contamination from former storage of contaminated soil that was likely excavated during an underground fuel storage tank removal. There was no PAH source identified for the Main Entrance, besides the road runoff, melting of plowed snow, and vehicle emissions. Possible additional sources of elevated PAHs in the surface soil at the Vehicle Wash Rack include vehicle maintenance and loss of coal being transported to Coal Area A. Based on a review of the available literature and the distribution of concentrations of PAHs at the HCAFS, it appears that vehicular emissions and normal road use is, at least, a significant source of PAHs in the surface soil. As a matter of definition of release under

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 101(22), to which CERCLA 104 gives authority to respond, as well as a common sense issue, an exemption to PAHs adjacent to roads exists in the CERCLA program. The applicable CERCLA exclusion for the HCAFS is stated in 42 USC Section 9601, 22(B), which defines one form of exclusion as "emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station."

Subsurface soil samples were collected for PAH analysis at the Vehicle Wash Rack EU. The only exceedances of the TACO Tier 1 criteria identified are for benzo(a)pyrene in only the four to five foot (ft) sample interval at two locations. Based on the low levels of PAHs found in the remaining subsurface samples, it is reasonable to conclude that the exceedances identified in previous investigations were isolated occurrences.

Because elevated arsenic concentrations were found in the subsurface soil in previous investigations, GEO collected soil samples at depths of two to three ft and four to five ft below ground surface (bgs). It is assumed that human and ecological receptors can potentially be exposed to soils up to five ft in depth. Samples from each depth were collected from seven locations at Coal Storage Area A, seven locations at Coal Storage Area B, four locations at Coal Storage Area C, and three locations at the Paint Shed. The background concentration for counties within metropolitan areas (13 mg/kg) was reached or exceeded in twelve of the 58 samples. Arsenic concentrations in the samples collected for this RI ranged from seven mg/kg to 16.2 mg/kg. At none of the four locations where duplicate samples were collected and analyzed for arsenic were both the primary and duplicate sample analysis results above the background concentration. The shallow unconsolidated deposits at the HCAFS are part of the Glasford formation, in which groundwater is documented to have high arsenic concentrations. Although no analysis of the aquifer material could be located, the presence of arsenic in the groundwater in this formation strongly suggests that arsenic is naturally present in the formation. In addition, coal seams have been documented in the shallow bedrock in the vicinity of the HCAFS. There is no known source of arsenic associated with site use which, combined with the presence of possible natural sources of arsenic, suggest that the arsenic is naturally occurring, or diffuse sources resulted in broad low level distribution.

The available pathways for PAHs in surface soil are surface transport via surface runoff and snow melt. Particulate re-suspension and atmospheric transport are possible pathways for PAHs in both surface and subsurface soils if the soil is disturbed by excavation or tilling. Surface soils containing PAHs are subject to atmospheric transport when the soils are disturbed and dust is produced. Arsenic in subsurface soils would also be subject to atmospheric transport if the soil is disturbed.

A baseline Human Health Risk Assessment (HHRA) was conducted to evaluate potential human health risks resulting from exposure to soil and groundwater contamination if no remedial action is taken at the HCAFS. The potentially exposed populations that were evaluated were correctional facility inmates and workers (use of the site as a correctional facility is a possibility), and adult and child residents, if the HCAFS becomes available for unrestricted land use. Based on the HHRA, risks are greater than 10^{-4} for the resident adult and child receptors from exposure to soil at all the EUs. At all EUs, the risk is below 10^{-4} for correctional facility inmates and workers. PAHs in surface soil contributed more than 90% of the risks from exposure to soil at all the EUs. Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10^{-4}, primarily from arsenic. Concentrations of arsenic, iron, and magnesium above the Illinois Groundwater Standards have been documented as characteristic of the natural groundwater quality in the Glasford Formation, which is at or near the surface at the HCAFS. The risk from arsenic was calculated using the maximum concentration (21 µg/L) measured in groundwater samples from the SI, SSI, and the RI. More recent groundwater samples collected in November 2008, as part of the RI, contained lower levels of metals. Arsenic levels were less than 10 µg/L, the Maximum Contaminant Level (MCL). The lower metals concentrations in the RI samples is likely from lower suspended solids in the RI samples, when compared to the SI and SSI samples and are therefore more

representative of site groundwater. The RI samples were collected using appropriate low-flow sampling techniques to minimize disturbance of the aquifer material and high suspended solids. Thus, the low levels of arsenic in the RI samples indicate that a naturally mobile fraction of arsenic in site groundwater (including dissolved plus adsorbed on colloidal material) is not present at levels above the MCL. In addition, use of groundwater for potable water supply is not permitted in the Village of Hanna City.

A Screening Level Ecological Risk Assessment (SLERA) was performed to evaluate ecological risks from current and potential-future exposure to contamination at the HCAFS if no remedial action is taken, and to determine if a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. The conclusion of the SLERA is that there are a number of metal Chemicals of Potential Ecological Concern in the HCAFS soil, based on calculated hazard quotients (HQs) that were greater than one. However, the HQs are likely to be conservative or comparable to background ecological risks because these were calculated using maximum detected concentrations (MDCs) that were either outliers or comparable to regional soil background values for Illinois. Hazards are greatest for the avian and mammalian ground insectivores. The birds observed during the ecological reconnaissance and the mammals likely to be present (e.g., shrews) at the HCAFS consist of herbivores and/or ground insectivores that may be exposed to metals in site soil. However, use of MDCs in HQ calculations results in very conservative risk estimates, especially for birds, which are exposed to soils while foraging for food and which more likely to forage in large areas. This is relevant to risks from lead and zinc, which appear to be elevated in localized areas but on average are comparable to or below the TACO regional background values. Organisms observed during the ecological reconnaissance consist of common bird species and the eastern cottontail rabbit. There are no records of State-listed threatened or endangered species within 0.5 miles of the HCAFS. Because there are no important ecological resources in and within 0.5 miles of the site, it is not recommended that a baseline ecological risk assessment be conducted for the site. The scope and results of the SLERA are sufficient to serve as a basis for decisions regarding future remedial actions at the HCAFS.

Based on the above considerations, the recommended remedial action objective is to reduce the human health risk posed by surface soils to acceptable levels for residential or industrial/commercial-use. The actual extent of remediation will then be determined as part of remedial design after collection and analysis of the additional data to be collected to determine the lateral extent of surface soil contamination. Because there is evidence that vehicle emissions and road runoff may be sources of PAHs at the HCAFS, a site-specific background study will be conducted before remediation to determine concentrations of PAHs in surface soils that can be attributed to vehicular traffic and road effects. The background concentrations will be used in delineating areas requiring remediation. Groundwater sampling will also be conducted to determine background concentrations of manganese in groundwater at the HCAFS. The groundwater background study will be used to confirm that the elevated manganese groundwater concentrations measured during the investigations are due to natural conditions.

1. INTRODUCTION

The Remedial Investigation (RI) presented in this report characterizes the nature, extent of, and risks associated with groundwater and soil contamination at the Former Hanna City Air Force Station (HCAFS, Figure 1-1), Hanna City, Peoria County, Illinois, as part of a continuing effort to assess contaminated media at the HCAFS site. Previous studies have demonstrated that the soil and groundwater may have been affected by historical site use.

GEO Consultants, LLC (GEO) has been contracted by the U.S. Army Corps of Engineers (USACE), Louisville District (CELRL) (Contract Number W912QR-04-D-0030, Delivery Order 0019 and Contract Number W912QR-08-D-0014, Delivery Order 0005), to conduct the RI and to prepare the required documents. The regulatory agency involved in this project is the Illinois Environmental Protection Agency (Illinois EPA) and the property owners are represented by the Illinois Department of Corrections (IDoC) and the Federal Aviation Administration (FAA). The executing agency for this project is CELRL. The RI was conducted in accordance with a Work Plan (WP) (GEO 2008d) that was prepared by USACE and GEO, and reviewed by Illinois EPA.

1.1 PURPOSE OF REPORT

The objectives of this RI are to accomplish the following:

- Determine the vertical and horizontal extent of contamination in the media of concern,
- Identify the contaminant migration pathways and receptors, and
- Assess the risk to human health and the environment posed by the contaminants.

It was also necessary to develop a database that, with the data available from previous studies, would support meeting these objectives.

The RI focuses on the following Areas of Potential Concern (AOPCs) within the HCAFS (Figure 1-2):

- three coal/coal Ash Storage Areas, herein referred to as Coal Areas A, B and C.
- areas around the Maintenance Building [IDoC Building (Bldg) 206].
- area around the Paint Shed (IDoC Bldg 205).
- area around the Vehicle Wash Rack (IDoC Bldg 307, Motor Pool).
- area around the Main Entrance (suspected location for a filling station or septic tank).

The area around the Tile Field/Septic Tank and the suspected magnetron tube disposal area (Figure 1-2) were eliminated from the AOPC list based on the results of previous investigations [TetraTech EC, Inc. (TtEC) 2008]. The water treatment lagoon (Figure 1-2) was not included in the RI because of issues regarding other Potentially Responsible Parties (PRPs).

This RI Report summarizes previous contamination assessment activities, and also presents the methods and results of the current field investigation, sample analyses, data verification and risk assessment. The soil and groundwater impacts associated with the use of the site as a radar tracking and investigation facility are evaluated and summarized; fate and transport of the contaminants are discussed; and recommendations are made for further activities, if required.

1.2 SITE BACKGROUND

1.2.1 Site Description

The HCAFS is a 42.89-acre parcel located approximately 10 miles west of the city of Peoria and two miles west of Hanna City in Peoria County, Illinois (Figures 1-1 and 1-2 in Appendix A). The property is located in Section 4 of Township 8 North, Range 6 East in the Logan Township. The site can be reached from Peoria, Illinois by traveling west on State Highway 116 (Farmington Road), through Hanna City, Illinois, then north onto the site access road. The site lies on relatively flat ground with elevations ranging from approximately 740 to 756 feet (ft) above mean sea level (amsl) and is located on top of a gentle north-south trending ridge. The surface water bodies within the HCAFS include two inactive wastewater treatment ponds and a former water treatment lagoon (see Figure 1-2).

The major portion of the HCAFS is the 38.5 acre parcel (Tract 1; Figure 1-2), which has been owned since 1969 and used by the IDoC as a correctional facility/minimum security prison until 2002, when the facility was closed. This tract includes approximately thirty unused one and two-story buildings, poorly maintained roads and parking lots, and open fallow fields. Building construction is brick, block, veneer, or metal. The wastewater treatment ponds (Figure 1-2) were not present in an aerial photograph from 1969 (shortly after the HCAFS was deactivated, Figure 1-4); thus these ponds were not originally part of the HCAFS.

Tract 2 (3.4 acres; Figure 1-2) was owned and occupied by the Village of Hanna City as a water treatment facility until it was shut down in 1987. The lagoon located in Tract 2 was part of the HCAFS (Figure 1-4), but was also used by the Village of Hanna City water treatment system. Tract 3 (1.03 acre; Figure 1-2) is currently used by the FAA as a navigation facility.

1.2.2 Site History

The U.S. Government acquired the property for use by the U.S. Air Force (USAF) as a radar tracking and investigation facility from 1952 to 1968. In 1968, the property was declared as excess to the needs of the USAF. The property was then transferred to the General Services Administration in 1969, and the entire site was assigned to the Department of Health, Education, and Welfare. In November 1969, the property was disposed of as three separate tracts through quitclaim deeds. These transfers, as well as brief descriptions of subsequent property use, are described below (TtEC 2008):

- Tract 1, 38.456 acres (including 30 buildings), was quitclaimed to the State of Illinois. Tract 1 was occupied by the IDoC Hanna City Work Camp and was used as a minimum security prison (TtEC 2008). The facility was closed in October 2002. In accordance with Public Act 95-0982 of the Illinois General Assembly, on July 10, 2009, the property was transferred to Peoria County for public use. As of August 2009, the property is being used, at irregular intervals, by the Peoria County Sheriff's Office for Special Weapons and Tactics (SWAT) training. According to the County, this use is expected to continue, but future use of the property is uncertain. In the future, a Feasibility Study (FS) will be conducted by Peoria County to determine the best use of the property.
- Tract 2, 3.364 acres (including a water treatment plant and lagoon, and several buildings, see property boundary in Figure 1-2) was quitclaimed to the Village of Hanna City to be used as a water supply system. The water supply well (1864 ft depth, located approximately 600 ft west of the HCAFS) and water treatment facility was operational until 1987, when the water supply well was closed by Illinois EPA due to elevated levels of naturally occurring radon. No operations are presently ongoing at Tract 2. As a result of previous investigations, the lagoon has been categorized as having PRP issues under Comprehensive Environmental

Response, Compensation, and Liability Act (CERCLA) Section 9607(a) (3) and, therefore, will not be part of this RI.

- Tract 3, consisting of 1.03 fee acres and containing the radar tower and three related buildings (see property boundary in Figure 1-2) was transferred to the FAA. The FAA currently uses this tract of land and buildings as a navigation facility.

Surrounding land use is rural/agricultural with a few buildings in the site vicinity. There are two groups of farm buildings, including residences and barns, immediately adjacent to the southwest corner of the HCAFS.

1.2.3 Previous Investigations

The following is a summary of the three investigations and studies that are known to have been performed at the site. This information was adapted from TtEC (2008) as the individual reports prepared prior to the Supplemental Site Inspection (SSI) were not made available for review at the time of preparation of this report and limited details exist.

1.2.3.1 Preliminary Assessment

In 1992, USACE, Chicago District conducted a Preliminary Assessment of the HCAFS consisting of site reconnaissance and interviews with former and current site personnel. AOPCs were identified that required further study (Vickers 1996).

1.2.3.2 Underground storage tank removal

Five underground storage tanks (USTs) were historically present at the HCAFS: a UST near Bldg 202 (IDoC Control Building), a UST near the Maintenance Building (Bldg 206), a UST near Bldg 305 (IDoC Housing Unit #3), a UST near Bldg 307 (IDoC Motor Pool by IDoC) in the Vehicle Wash Rack AOPC, and a UST within the property currently used by the FAA (see Figure 1-3 for locations). The following describes the status of each of the USTs according to available documentation obtained from the Illinois EPA's Leaking Underground Storage Tank (LUST) program for the Hanna City Work Camp and the FAA (both are under LPC #1430405005). All four tanks listed under the Hanna City Work Camp were removed in 1993 and 1997, and the UST within the FAA property was removed by FAA in 2003.

- The 1500 gallon (gal) gasoline UST near Bldg 202 (called the "Control Building" by IDoC, Figure 1-2 and Figure 2-1) may have been installed by the U.S. Department of Defense (DoD) (IDoC, 1992). This tank was removed by a contractor for IDoC in 1993 (Beling 1998a). Soil samples were collected from the walls and the floor of the UST excavation, in accordance with Illinois EPA requirements, and were analyzed for benzene, toluene, ethylbenzene, and xylene [BTEX (Beling 1998a)]. None of these chemicals were detected (detection limit one μg/kg) in the soil samples. Furthermore, the UST passed an integrity test immediately before the UST was removed (Beling 1998a), indicating that leaks from this UST were unlikely. Thus, the site for this UST is assumed to be closed.
- The former 500 gal diesel UST near Bldg 305 (Housing Unit #3, Figure 2-3) was installed by IDoC (IDoC, 1992). A surface spill associated with the tank's pipeline occurred in 1993 (Beling, 1997). In 1997, the tank was removed and the spill area was over-excavated to remove soil contaminated by the surface spill (Beling 1997). Groundwater monitoring wells were installed in and within 100 ft of the surface spill area. Groundwater and soil sample results were below clean-up criteria (Beling 1998c). Illinois EPA approved "No Further Remediation" for this former UST site (TtEC 2008).

- There is no evidence that the former 9725 gal diesel UST in the property owned by FAA (Figure 1-3) was installed by DoD. This tank was abandoned in-place in the 1970s by back-filling with clean sand (TtEC 2008). The UST was removed by FAA in June 2003 but soil samples collected from the tank excavation contained polycyclic aromatic hydrocarbons (PAHs) that exceeded cleanup criteria. A site investigation was conducted in December 2004, wherein soil samples were collected from 20 ft boreholes in and around the former UST location and 20 ft deep groundwater monitoring wells were installed (Parsons 2005). Groundwater and soil sample analysis results were below clean-up criteria. Illinois EPA approved "No Further Remediation" for this former UST site in May 2006 (Illinois EPA 2006).
- The 2000 gal gasohol UST near Bldg 206 (the Maintenance Building, see Figure 1-2) was installed by IDoC (IDoC 1992). This tank was removed by a contractor in 1993 (Beling 1998a). Soil samples were collected from the walls and the floor of the UST excavation in accordance with Illinois EPA requirement. No contaminants were detected in the soil samples. The UST passed an integrity test immediately before the UST was removed (Beling 1998a), indicating that leaks from this UST were unlikely. Thus, the site for this UST is assumed to be closed. This UST has been replaced by above-ground storage tanks that were still present during the RI field activities at the site.
- The 2000 gal gasoline UST near Bldg 307 (also called the "Motor Pool", in the vicinity of the Vehicle Wash Rack AOPC, see Figure 1-2) may have been installed by DoD (IDoC 1992). However, according to the Illinois EPA LUST records associated with this UST, the last use date was believed to be December 31, 1983 (Beling 1997). When the tank was removed in 1993, BTEX was detected at concentrations above the cleanup objectives in the excavation floor sample. The area was over-excavated. Five groundwater monitoring wells were installed around the excavation and were sampled during four events. With the exception of benzene in one monitoring well, petroleum constituents were not found above regulatory action levels. However, Illinois EPA LUST documents indicate that this UST site has not been closed as a regulatory issue.

Due to the beneficial use of the USTs by IDoC, further investigation and remediation of the former tank locations were ineligible for funding under DoD's Defense Environmental Restoration Program – Formerly Used Defense Sites program. Therefore, the tank sites were considered as No DoD Action Identified sites.

1.2.3.3 Site Inspection and Supplemental Site Inspection

In 1996, Parsons performed a Site Inspection (SI) at specific areas at the HCAFS and one background area (TtEC 2008). The areas included the seven AOPCs included in this RI (i.e., three Coal Areas A, B and C, Main Entrance, Vehicle Wash Rack, Maintenance Building, and Paint Shed). The other areas included in the SI were the Tile Field, the Septic Tank, and the Lagoon (see Figure 1-2 for area locations; the water treatment lagoon is within the Former Village of Hanna City Water Supply). Soil and groundwater samples were collected from the areas using a direct push probe. Soil samples were analyzed for volatile organic compounds (VOCs), metals, PAHs, pesticides, polychlorinated biphenyls (PCBs), and basic soil parameters (percent solids, pH, moisture content, ash content, organic carbon content, bulk density, and specific gravity). Groundwater samples were analyzed for VOCs, PAHs, pesticides, PCBs, and metals (total and soluble).

In response to Illinois EPA's request for additional sampling, TtEC conducted a SSI in April 2006 (TtEC 2008). Soil and groundwater samples were collected from the same areas sampled during the SI, with the exception of the Lagoon, where further investigations and activities were halted in 2002 due to PRP issues stemming from its use by the Village of Hanna City as part of water supply plant operations.

Soil and groundwater samples were analyzed for the same suite of compounds as the SI samples, with the exception of pesticides.

The analytical results from the SI and SSI were compared to Illinois EPA's Tiered Approach to Corrective Action Objectives (TACO, IAC Section 742) criteria. The major findings from the SI and SSI are as follows (TtEC 2008; GEO 2008d):

- Of the pesticides analyzed during the SI, only 4,4-DDD and 4,4-DDT were detected and only in one surface soil sample at levels significantly below the TACO Tier 1 Residential criteria. No pesticides were detected in any of the groundwater samples. Thus, pesticides have been ruled out as Chemicals of Potential Concern (COPCs) for the HCAFS.
- PCBs were not detected in any of the groundwater and soil samples collected during the SI and SSI. Detection limits for the analytical methods used were below TACO Tier 1 criteria. Thus, PCBs have been ruled out as COPCs for the HCAFS.
- A number of VOCs were detected in the soil and groundwater samples collected during the SI and SSI, but all measured concentrations were below the TACO Tier 1 residential criteria. Thus, VOCs have been ruled out as COPCs for the HCAFS.
- PAHs were detected in the soil and groundwater samples collected during the SI and SSI. None of the groundwater detections exceeded the TACO Class I groundwater criteria. However, a number of PAHs exceeded the TACO residential soil criteria for surface and subsurface soils, mostly in the surface soil samples. PAHs are COPCs at the HCAFS because of the TACO residential criteria exceedances. More detailed discussion of these results is presented in Section 4 of this RI Report.
- Of the metals measured in the surface and subsurface soil samples, only arsenic exceeded the TACO Tier 1 residential soil criteria. The construction worker inhalation criterion for mercury was exceeded in two surface soil samples. Metals were found in unfiltered groundwater samples. Given the soil and groundwater results from the SI and SSI, metals are considered to be COPCs at the HCAFS. Section 4 of this document presents a more detailed discussion of these results
- All analytes were below TACO residential soil and Class I groundwater criteria in soil and groundwater samples collected from the Tile Field/Septic Tank. Thus, this area is no longer considered an AOPC.

In addition to collecting soil and groundwater samples, a metal detector and surface radiation survey in the Magnetron Tube Disposal Area was also conducted as part of the SI. Two small anomalies were identified by the metal detector survey and may correspond to a buried metal object the size of a drum. In the areas where the anomalies were detected, hand shovels were used to excavate to a depth of approximately four ft below ground surface (bgs). No buried objects were found. Furthermore, a surface radiation survey in this area registered dose rates that were either zero millirem/hour or within site background levels.

1.3 REPORT ORGANIZATION

The organization of this report is in accordance with U.S. Environmental Protection Agency (USEPA) Guidance for Conducting RIs and FSs Under CERCLA.

- Section 1 is an introduction that presents an overview of the report.
- Section 2 discusses the site investigation methods, results, analytical data, and data verification used in the current study.

- Section 3 presents general information on the site and the surrounding area. This section focuses on the geology and hydrogeology of the site, based on the relevant literature and information from the current and previous investigations.
- Section 4 presents the nature and extent of the contamination. This section discusses soil and groundwater data resulting from the current investigation and the data set previously developed by others for the site. These data identify the contaminants detected in these media at the site. A discussion of the distribution of these contaminants is also provided.
- Section 5 discusses the fate and transport of the contaminants in the subsurface.
- Section 6 presents the results of the Human Health Risk Assessment (HHRA), which was performed using the relevant analysis results from previous studies and the results from the current investigation. This section focuses on the risk posed by soils and groundwater on the site.
- Section 7 presents the results of the Screening Level Ecological Risk Assessment, which was also performed using the relevant analysis results from previous and current studies, as well as the results of an ecological reconnaissance of the site. This section focuses on the ecological risks posed by surface on the site.
- Section 8 is a summary of the RI Report and presents conclusions based on the RI effort.
- Section 9 is a list of references used in preparing the RI Report.

2. FIELD INVESTIGATION

This section provides a summary of the field investigations performed for the RI at the HCAFS. These activities were conducted in accordance with the approved WP (GEO 2008d) and Sampling and Analysis Plan [SAP (GEO 2008b)]. Field activities are summarized in Sections 2.1 through 2.7. Specifically, these are:

- surface soil sampling (Section 2.1)
- subsurface soil sampling (Section 2.2)
- groundwater sampling at monitoring wells (Section 2.3)
- decontamination of drilling and sampling equipment (Section 2.4)
- management and disposal of Investigation-Derived Waste [IDW (Section 2.5)]
- field Quality Control (QC) procedures and documentation (Section 2.6)
- sample custody, handling, and holding times (Section 2.7).

All sampling locations were cleared of underground utilities prior to commencement (Blood Hound Underground Utility Locators and JULIE, Illinois One-Call, http://www.illinois1call.com/) and located by Global Positioning System to sub-feet accuracy upon completion.

2.1 SURFACE SOIL SAMPLING

Surface soil samples were collected during two events, August 25, 2008 and November 18, 2008. The August sampling event was performed in accordance with the WP and SAP. The November sampling event was performed after receipt of the August analytical data and was designed to provide additional characterization beyond that proposed in the WP and SAP. The November sampling event also sought to further delineate and confirm August data points, which were above TACO screening levels. A summary of the data points collected during both sampling events is provided in Table 2-1 below. Figures depicting surface soil sample collection locations are provided in Figures 2-1 through 2-5 in Appendix A.

Samples were collected by removing approximately one square ft area of the ground cover (i.e., grass or other vegetation) and top soil to a depth of approximately 0.5 ft bgs. Once exposed, the area was scanned with a 10.6 eV photo ionization detector (PID). No readings were observed above background levels. A pre-cleaned and disposable high density polyethylene scoop was then used to collect the soil specimen which was then placed in the sample container. Upon completion, the sod was placed back over the excavated area.

Table 2-1. Areas of Potential Concern and associated data points for surface soil samples

		Number of Data Points			
		SI/SSI	RI		
AOPC	COPCs		August 2008	November 2008	Total
Coal Area Storage A	PAH	1	7	1	9
Coal Area Storage B	PAH	1	7	3	11
Coal Area Storage C	PAH	1	7	2	10
Main Entrance	PAH	2	6	1	9
Vehicle Wash Rack	PAH	3	6	2	11
Maintenance Building	PAH	3	6	1	10
Paint Shed	PAH	3	5	0	8

AOPC—Area of Potential Concern
COPC—Chemical of Potential Concern
PAH—polycyclic aromatic hydrocarbons
RI—Remedial Investigation
SI—Site Inspection
SSI—Supplemental Site Inspection

2.2 SUBSURFACE SOIL SAMPLING

All subsurface soil samples were collected on November 19, 2008, in accordance with the WP and SAP. A summary of the data points collected during the RI is provided in Table 2-2 below. Figures depicting subsurface soil sampling locations are provided in Figures 2-6 through 2-9 in Appendix A. Soil borings were advanced with the use of decontaminated direct-push sampling equipment. Samples were collected from depths of two to three ft bgs and four to five ft bgs from each boring (boring logs are provided in Appendix C).

Table 2-2. Areas of Potential Concern and associated data points for subsurface soil samples

		Number of Data Points		
AOPC	COPCs	SI/SSI	RI	Total
Coal Area Storage A	arsenic	3	14	17
Coal Area Storage B	arsenic	3	14	17
Coal Area Storage C	arsenic	3	14	17
Vehicle Wash Rack	PAH	2	12	14

Samples for pH analysis were collected at the AOPCs where arsenic is a COPC
Subsurface samples were collected from 2 to 3 and 4 to 5 ft bgs at all AOPCs.
AOPC—Area of Potential Concern
COPC—Chemical of Potential Concern
PAH—polycyclic aromatic hydrocarbons
RI—Remedial Investigation
SI—Site Inspection
SSI—Supplemental Site Inspection

Subsurface soil samples were collected utilizing direct-push methods. Decontaminated samplers equipped with new acetate liners were initially advanced to a depth of four ft bgs to provide the first interval, followed by collection from four to five ft bgs. Once the samplers were advanced to their desired depth, the tooling was removed and the acetate liner extracted and capped on both ends. Upon completion of the boring, the acetate liners were opened and the soil core exposed. The entire soil core length was scanned with a PID and a representative sample from the collection interval was placed in a plastic bag

and analyzed with the PID after approximately 15 minutes to obtain a headspace reading; all readings are recorded on the boring logs. Upon completion of the boring, chipped bentonite was placed in the bore hole by gravity methods to a depth of approximately 0.5 ft bgs.

Soil cores were continuously logged according to Unified Soils Classification System (USCS) and recorded on USACE Engineering Form 5056A. Soil boring logs are provided in Appendix C. The soils at the site, as investigated to a depth of five ft bgs, can be classified into two distinct horizons. The upper horizon consists of the same dark brown to black silty clay described as the surface soils above and ranging in thickness from 1.2 to 2.3 ft. The lower horizon is a silty clay that is brown in color, plastic, damp-to-moist, and medium-to-stiff, with occasional gray mottling and iron and manganese concretions. The lower horizon can be described by the USCS as Lean Clay (CL). No free water was encountered during the advancement of any soil borings.

2.3 GROUNDWATER SAMPLING FROM MONITORING WELLS

2.3.1 Temporary Monitoring Well installation

Temporary monitoring wells constructed of one inch diameter Schedule 40 polyvinyl chloride (five ft of 0.010 inch slotted screen and 15 ft of solid casing) were installed at the selected groundwater sampling locations on November 19, 2008. The wells were installed by advancing two inch decontaminated steel casing fitted with an expendable drive point by direct-push methods to a depth of 20 ft bgs. Once the target depth was reached, the well was lowered inside the steel casing and the casing was then retracted approximately 0.5 ft to dislodge the expendable drive point. Filter pack sand was then placed inside the steel casing by gravity methods to fill the annulus between the well material and the boring while continuously removing the steel casing until the entire five ft screen interval was covered. The remainder of the casing was then removed and an approximate 0.5 ft layer of chipped bentonite was placed in the hole by gravity methods to create an annular seal. Upon completion of all monitoring well installation, the wells were initially purged with a peristaltic pump and dedicated Teflon-lined polyethylene tubing. All wells purged dry during this event prior to removing three well volumes.

2.3.2 Groundwater Sampling

All groundwater samples were collected on November 20, 2008. A summary of data points collected during the site investigations are provided below in Table 2-3. Groundwater sampling locations are provided on Figure 2-10 in Appendix A. Samples were collected using a peristaltic pump and dedicated Teflon-lined polyethylene tubing and analyzed for the COPCs identified in Table 2-3. Due to the concern that the wells would pump dry during sampling, a minimum of one and no more than two sets of water quality parameters [e.g., temperature, pH, specific conductance, Dissolved Oxygen (DO), Oxygen Reduction Potential (ORP), and turbidity] were collected at three-minute intervals during low-flow purging, prior to sampling without allowing stabilization. This is a variation from the original SAP design of three sets of parameters at five minute intervals. Measured water quality parameters are provided in tabular form in Appendix F. COPCs were collected in the order of unfiltered metals, filtered metals, and then total suspended solids (TSS). Due to the high silt content in historical samples and observed during initial purging, we can assume the high silt content is usual for shallow wells at the HCAFS and, therefore, both unfiltered and filtered (0.45 µm) samples were collected.

Table 2-3. Areas of Potential Concern and associated data points for groundwater samples

AOPC	COPCs	Number of Data Points		
		SI/SSI	RI	Total
Coal Area Storage A	metals[1]/TSS	3	1	4
Coal Area Storage B	metals[1]/TSS	3	1	4
Coal Area Storage C	metals[1]/TSS[2]	3	1	4
Vehicle Wash Rack	metals[1]/TSS	3	3	6
Paint Shed	lead[1]/TSS	3	4	7

[1] Filtered and unfiltered samples collected
[2] Sample HCCCGW06 was not submitted for TSS analysis due to insufficient volume
AOPC—Area of Potential Concern
COPC—Chemical of Potential Concern
RI—Remedial Investigation
SI—Site Inspection
SSI—Supplemental Site Inspection

2.3.3 Temporary Monitoring Well Abandonment

Upon completion of sampling activities, the temporary monitoring wells were completely removed from the borings and the borehole filled with chipped bentonite by gravity methods to 0.5 ft bgs.

2.4 DECONTAMINATION OF DRILLING AND SAMPLING EQUIPMENT

Non-disposable drilling and sampling equipment used in this task was cleaned by a scrub brush and a phosphate-free detergent (e.g., Liquinox or equivalent), which was followed by a potable water rinse. Three rinseate blanks were collected for laboratory analysis; one each from surface soil sampling equipment, subsurface soil sampling equipment/monitoring well installation tooling, and groundwater sampling tubing.

2.5 MANAGEMENT AND DISPOSAL OF INVESTIGATIVE-DERIVED WASTE

IDW generated during the field effort consisted of personal protective equipment/plastic, approximately 0.7 ft^3 of soil cuttings, and approximately 20 gal of purge/decontamination water. All were stored in separate drums, which are currently in the process of being disposed of by Illinois Environmental, Inc.

2.6 FIELD QUALITY CONTROL PROCEDURES AND DOCUMENTATION

2.6.1 Field Quality Control (QC) Samples

Equipment Blanks (EB) were collected by pouring deionized water over the soil sampling equipment and the dedicated tubing used during groundwater sample collection. Preservation and analysis of field EBs was identical to that of the associated environmental samples. Analysis results for EBs are presented in Tables 2-4 and 2-5 in Appendix B.

A **temperature blank** was sent with each cooler of samples to verify that the cooler temperature was maintained at 4°C.

Field Duplicate (FD) samples were collected at a rate of one duplicate for up to every 10 environmental samples (10 FDs were collected) of the same matrix. The results of analysis of FDs are shown on the analytical summary tables in Appendix B. The duplicate samples were collected from the

same location and at the same time as the original environmental sample and analyzed by Empirical Laboratories.

Matrix spike (MS)/matrix spike duplicates (MSD) sample pairs were collected at a rate of one duplicate pair for up to every 20 environmental samples (six MS/MSD pairs collected) for analysis by Empirical Laboratories. Five of the pairs were collected for soil and one was collected for groundwater.

Quality Assurance (QA) samples, or split samples, were collected at a rate of one split for up to every 20 environmental samples (eleven samples collected) of the same matrix. Six of the samples were collected by splitting soil samples and four were collected by splitting groundwater samples. The split samples were collected from the same location and at the same time as the original environmental sample. They were shipped to CT Laboratories.

2.6.2 Field Performance Audits

GEO ensured quality in the field work by following the USACE three-phase control process (Section 3.3.4. of USACE EM 200-1-3), where the three phases consist of the preparatory phase, initial phase, and follow-up phase. No field audits were performed during this sampling event.

2.6.3 Corrective Actions

No deviations from the specified procedures within approved project plans that warranted or allowed corrective actions were necessary. The deviations that did occur resulted from the low productivity of the monitoring wells and there were no corrective actions possible.

2.6.4 Changes in the Field Program

During this field investigation, the number of water quality parameters collected to achieve stabilization prior to groundwater sample collection was reduced to a minimum of one, but no more than two sets of parameters due to the concern that the wells would purge dry prior to sample collection.

2.7 SAMPLE CUSTODY, HANDLING, AND HOLDING TIMES

2.7.1 Documentation of Custody

Chain-of-custody forms were completed following requirements in *Appendix F, Sample Documentation and Shipment Instructions* of USACE EM 200-1-3 (USACE 2001). Chain-of-custody forms are provided with the analytical data summary reports presented in Appendix C of this report.

2.7.2 Sample Labeling and Numbering

Sample labeling and numbering procedures were consistent with labeling practices provided in Section 3.6.10 of the project SAP (GEO 2008b).

2.7.3 Holding Times and Turnaround Time

Each analytical method has a specified holding time for the field samples. The laboratory successfully analyzed all samples within the maximum holding times, as provided by the specific method.

3. PHYSICAL CHARACTERISTICS

3.1 SURFACE FEATURES

The site lies on relatively flat ground with elevations ranging from approximately 740 to 756 ft amsl and is located on top of a gentle north-south trending ridge (Figure 1-1 for topographic map). The surface water bodies within the HCAFS include two wastewater treatment ponds (installed after the HCAFS was deactivated) and the water treatment lagoon, which has not been operational since the Hanna City Water Supply was shut down in 1987. As noted earlier, the water treatment lagoon is not being investigated in this RI due to PRP issues. The wastewater treatment ponds have not been used since the Hanna City Work Camp was closed in 2002.

Drinking water is supplied to the surrounding residents from the Illinois of America Water Company.

3.2 CONTAMINANT SOURCES

Based on the SI and SSI, the impacted media at the site are surface soil, subsurface soil, and groundwater. There is no record or evidence of any significant releases or spills while the HCAFS was an active radar tracking facility. The previous data suggest that the contamination at the site is primarily the result of small releases that occurred over time during normal site operations at the Vehicle Wash Rack, Maintenance Building, and Paint Shed, as well as possible runoff or infiltration from the coal storage areas. Investigations at the Main Entrance were prompted by a suspected septic tank or fuel station (Vickers 1996). The Main Entrance is adjacent to Farmington Road and may be influenced by runoff and snowmelt from the road.

Five USTs were removed from the site in the late 1990s by IDoC. Post removal sampling at the location of a 500 gal diesel fuel tank near Bldg 305 (see Figure 1-2 for location, this building was not part of the original HCAFS facility) indicated contaminants remained in the floor of the excavation for tank removal. However, the area was over-excavated and five groundwater monitoring wells were installed around the excavation and sampled during four events. With the exception of benzene in one monitoring well, petroleum constituents were not found above regulatory action levels. In any case, the tank locations are not considered to be part of this investigation. Post excavation sampling of the location of a 9725 gal diesel tank near Bldg 404 showed concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene above the standard (TtEC 2008). This tank was closed as a regulatory issue in 2006.

Although the HCAFS is located in the middle of a sparsely populated area, the site itself has probably had a high level of vehicular traffic over the past 50 to 60 years; first as a radar tracking facility for the DoD, then as the site of a correctional facility for the IDoC, until the facility was closed in 2002. Evidence of the high level of vehicular traffic when the site was occupied by IDoC is present in the onsite fueling system (the gasohol tanks in Coal Area C), and the number of waste oil drums observed during the SSI field sampling in 2006 (see photographs in TtEC 2008). Thus, vehicular emissions are another possible source of diffuse PAHs observed in surface soils at the HCAFS.

3.3 METEOROLOGY

Illinois lies midway between the Continental Divide and the Atlantic Ocean and some 500 miles north of the Gulf of Mexico. Based on information from the Illinois Water survey (as reported by the Illinois Agricultural Statistics Service), Illinois' climate is continental with cold, generally dry winters, with warm, humid summers that are frequently short in duration. Illinois’ weather experiences relatively large-magnitude fluctuations in temperature, humidity, precipitation, and wind direction. Illinois' weather

and climate depends on the frequency and duration of air originating over Canada and the Arctic, the Pacific Ocean, and the Gulf of Mexico. During winter, air from the first two areas dominate Illinois, whereas the latter dominates from late spring through early fall. Spring and fall experience the greatest day-to-day fluctuations.

Since the Gulf of Mexico is the primary source of water vapor, northern Illinois generally receives less precipitation than does the south, as it is further from the source. Summers in northern Illinois are somewhat cooler and less humid than those of the far south, and the duration of summer-like weather is some four weeks shorter than that of the south. Conversely, winters of northern Illinois are longer and colder than those of the south.

Annual precipitation in Hanna City is 34.89 inches, with average snowfall of 26.3 inches. The record year for precipitation in the area is 1990, when 55.35 inches were recorded in Peoria. The driest year on record is 1988, when only 22.16 inches were recorded. The record snowfall occurred in 1977 and was recorded at Peoria with 52.3 inches. In 2004, 186 days were recorded as fair. There were 210 fair days in 2005, 208 in 2006 and 219 fair days in 2007.

According to the National Weather Service, January is normally the coldest month. The normal average is 22° F (-6° C). The normal high in January is 30° F (-1° C) and the normal low is 14° F (-10° C). The warmest month is July. The average temperature is 75° F (24°C). The normal high temperature is 86° F (30°C) and the normal low in July is 65° F (18° C). The highest temperature recorded in Peoria was 113° F (45°C) in July of 1936. The record low temperature was -27° F (-33° C), recorded in July 1884. The earliest freeze date recorded at Peoria is September 20, 1991. The latest freeze date is May 25, 1925.

Although Illinois is relatively flat, winds are neither particularly strong nor persistent. Wind speeds in Illinois average eight to 12 miles per hour. The strongest winds usually occur during the day and from winter through early spring. The weakest winds usually occur in the summer and early fall.

3.4 SURFACE WATER AND SEDIMENT

All of Peoria County is in the Illinois River drainage basin. The city of Peoria, 10 miles east of the HCAFS, is the largest city on the Illinois River. Approximately one quarter of a mile northwest of the site is the head of an unnamed tributary of Nixon Run (Figure 1-1), which flows north and then east to the Kickapoo Creek. Near the head of the tributary is a dammed pond, which appears to be a farm pond. Also less than one quarter mile to the southeast is an unnamed tributary to Copperas Creek. Surface water run-off from the site flows either to the unnamed tributary of Nixon Run to the northwest, or the unnamed tributary of Copperas Creek to the southeast (Figure 1-1).

The HCAFS lies on relatively flat ground with elevations ranging from approximately 740 to 756 ft amsl and is located on top of a gentle north-south trending ridge. Most of the run off from the site appears to drain into Nixon Run (described above). The surface water bodies within the HCAFS include two wastewater treatment ponds (not part of the original HCAFS) and the water treatment lagoon, which has not been operational since the Hanna City Water Supply was shut down in 1987. As noted earlier, the water treatment lagoon is not being investigated in this RI due to PRP issues. Much of the site seems to be covered with permeable surface. There are some paved areas, but the majority of the site is not paved and the paving that does exist is in poor condition with many cracks and broken areas.

3.5 GEOLOGY

The HCAFS lies in the Illinoisan Till Plain physiographic province. The Illinoisan and Wisconsin glacial stages formed most of the present surface materials and landforms in the area. The underlying geology is Pennsylvanian bedrock overlain by glacial deposits, which are overlain by loess (windblown

silt). The Pennsylvanian-age Modesto Formation bedrock in the vicinity of the site consists of shale, sandstone, and limestone, with occasional thin seams of coal. This bedrock formation is approximately 180 ft thick and has low permeability. The glacial deposits that immediately overlie bedrock in the area are part of the Glasford formation and consist of glacial outwash. These deposits are comprised of unsorted calcareous pebbly silt and clay with some localized lenses of sand and gravel and can be up to 75 ft in thickness (Hardy and Weibel 2008). The surficial materials are pro-glacial wind loess deposits that were eroded by wind during both the Illinois and Wisconsin glacial episodes, when westerly winds eroded silt from the floodplains of the Illinois and Mississippi River valleys, floodplains of other river valleys, and from the numerous outwash channels and floodplains, including the outwash channel that is the modern Kickapoo Creek. These sediments, which are composed of the Roxana Silt and the overlying Peoria Silt, formed the blanket deposit of loess that occurs throughout the region. The Roxana was deposited during the earlier Athens Subepisode of the Wisconsin Episode, whereas the Peoria was deposited during later Michigan Subepisode (Hardy and Weibel 2008). According to Dr. Weibel (personal communication August 2009), co-author of the Surficial Geology of the Oak Hill Quadrangle (Hardy and Weibel 2008), the post-Illinoian formations present in the Oak Hill triangle are not likely to be present in the Hanna City area, which is south of the limit of Wisconsin glacial episode. Since they are pro-glacial wind blown sediments, Roxana and Peoria silts could be present in the site area.

The bottom layer is the Roxana silt and consists of pinkish brown leached silt, which can range up to five ft in thickness. The top layer is the Peoria loess, which can range up to 15 ft in thickness. It consists of tan silts, with small amounts of clay and minor amounts of sand. In Oak Hill, Illinois, located approximately nine miles northwest of Hanna City, the Peoria and Roxana silts have been described in detail (Hardy and Weibel 2008). They are described as silt, silt loam, and silty clay loam**;** dark gray to yellowish brown; massive; soft to friable; non-calcareous in uppermost part; and generally calcareous in lower part. They are weakly cemented, dark reddish brown. Ferro-manganese oxide concretions are common and the typical thickness is three to 20 ft.

The Glasford formation is described as massive; yellowish brown to dark brownish gray; calcareous; firm to hard; and contains thin interbeds of sand, silt, or clay. The typical thickness of the Glasford is reported to be five to 75 ft (Hardy and Weibel 2008).

According to the SSI (TtEC 2008), the shallow unconsolidated stratigraphy at the HCAFS can be divided into two main units: loess deposits and glacial till (TtEC 2008). Loess is described as comprising the uppermost 15 to 20 ft of the unconsolidated deposits and consists of tan-to-brown-to-gray mottled silt and very fine sand with some clay. Rootlets are present within the upper 10 ft of the loess. The clays generally possess low to medium plasticity. Occasional thin sand lenses are also reported as present within the loess deposits. Borings drilled during this RI encountered silty clay, generally ranging from brown-to-dark brown in color. Manganese concretions were widely observed in this material. Based on site-specific boring logs and conversations with Dr. Weibel, it cannot be determined if the Roxana and Peoria silts are present above the Glasford, or if the Glasford alone is present above the bedrock. The occurrence of manganese nodules is consistent with the published descriptions of the Roxana and Peoria silts, but is also consistent with the Glasford formation. Such nodules were formed at the top of the Glasford by weathering of the Glasford during the Sangamon Interglacial episode (Weibel, 2009; personal communication). Based on the description provided above, the manganese nodules are considered to be indigenous to the site.

Logs of wells drilled in the vicinity of the HCAFS and obtained from the Illinois State Geologic Survey (ISGS 2009) report brown silty clay or yellow clay or blue clay above bedrock. The well locations are shown in Figure 3-1 and the logs are provided in Appendix C. These descriptions are consistent with the descriptions of the surficial material encountered in the onsite borings. The logs for Well B and Well F report sand at 19 to 21 ft, and 25 to 26 ft bgs, respectively. The wells encountered bedrock at 26 to 34 ft

bgs. The bedrock is described as shale. In Well A, which was logged to 415 ft, coal seams were noted at 42 to 45 ft, 110 to 111 ft, 173 to 175 ft, and 243 to 245 ft. The log for Well C reports a coal seam at 87 to 99 ft. All other wells terminated at 71 ft or less. These descriptions of bedrock are consistent with the Pennsylvanian bedrock formations reported for this area.

Boring logs from this current RI work are presented in Appendix C.

3.6 SOIL AND VADOSE ZONE

According to the Soil Survey of Peoria County, Illinois (2009), the soils that cover most of the HCAFS are Ipava silt loam and Sable silty clay loam. Tama silt loam is found in a small area in the northwest corner of the site. The Ipava series consists of very deep, somewhat poorly drained soils formed in loess on uplands. It is somewhat poorly drained with a low to medium potential for surface runoff. The upper 10 inches of the soil profile is described as dry; having a moderate fine and medium subangular blocky structure; friable; moderately acid; abrupt smooth boundary. From 18 inches bgs through the rest of the soil profile, iron depletions and masses of iron are found in the matrix. Starting at 31 inches bgs iron-manganese concretions and masses of oxidized iron are found in the matrix and iron-manganese staining is reported. The Sable series consists of very deep, poorly drained, moderately permeable soils formed in loess on nearly level broad summits of moraines and stream terraces. The soil is described as dry. The structure is moderate, very fine, angular, and blocky. The soil is slightly acid with very weakly cemented iron-manganese concretions throughout. Below 23 inches, the soil is neutral with iron-manganese accumulations and iron depletions in the matrix. The Tama series soils are very deep, well-drained soils formed in loess on uplands. The Tama series soils are strongly acidic with redoximorphic concentrations.

During the initial SI performed by Parsons Engineering in 1996 (TtEC 2008), a total of 10 soil samples were collected for analysis of grain size. Eight of the samples were from the loess deposits and two samples were from the glacial till. Laboratory analyses of the soils indicated that the loess deposits consist primarily of silt and clay (greater than 98 percent) with minor amounts of fine sand (one to two percent). The glacial till consists primarily of silty clay (greater than 75 percent), with small amounts of sand (one to 22 percent) and traces of gravel (up to two percent). The bulk density of the soils ranged from 0.57 grams per cubic centimeter (g/cm^3) to 1.96 g/cm^3 and averaged 1.29 g/cm^3. Specific gravity of the soils ranged from 2.43 g/cm^3 to 2.81 g/cm^3 and averaged 2.7 g/cm^3 (TtEC 2008).

During surface soil sampling conducted for this RI, the surface soils at the site were described as silty clay, which is dark brown-to-black in color, slightly-plastic to plastic in plasticity, damp-to-moist in moisture content, and medium-to-stiff in consistency. They contain small-to-medium amounts of organic material. They can be described by the USCS as CL/Organic Clay.

The subsurface soils at the site, as investigated to a depth of five ft bgs, were classified into two distinct horizons. The upper horizon consists of the same dark brown-to-black silty clay described for the surface soils and ranges in thickness from 1.2 to 2.3 ft. The lower horizon is silty clay, which is brown in color, plastic, damp-to-moist, and medium-to-stiff, with occasional gray mottling and iron and manganese concretions. The lower horizon can be described by the USCS as CL. This is consistent with the soils mapped at the HCAFS by the soil survey described above.

3.7 HYDROGEOLOGY

As described in Section 3.5, the groundwater source above bedrock is the Glasford formation. The Glasford aquifer is reported to have elevated arsenic concentrations throughout its extent. Geochemical conditions appear to be controlling arsenic solubility, with organic carbon apparently playing a key role (Illinois EPA 2006). Concentrations of arsenic, iron and manganese above the Illinois Groundwater

Standards have been documented by Holm et al. (2004), as characteristic of the natural groundwater quality in the Glasford Formation. There are many private wells in the Glasford Aquifer and some of the highest arsenic concentrations were found in groundwater samples from this aquifer (Holm et al. 2004).

There are only a few wells within 0.5 miles of the HCAFS (Figure 3-1). This indicates that groundwater in the vicinity of the site is not used as a major water source. On March 1, 2005, the Village of Hanna City passed Ordinance 5-03-01, which prohibits the use of groundwater for potable water supply in the Village. According to the Ordinance, the reason for this prohibition is that certain properties within the Village had been used for commercial and industrial purposes and, as a result, "the groundwater beneath the Village may exceed Class I groundwater quality standards for potable resource groundwater, as set forth in 35 Illinois Administrative Code 620 or Tier I residential remediation objectives." A 1864 ft deep water supply well and water treatment facility was operated on the HCAFS by the Village of Hanna City until 1987, when the water supply well was closed by the Illinois EPA due to elevated levels of naturally occurring radon (TtEC 2008).

The water table at the site ranged in depth from four to 10 ft bgs during the SI, 0.7 to five ft bgs during the SSI in 2006 (TtEC 2008). The site is located on a gentle, north-south trending ridge that forms a shallow groundwater divide. Shallow groundwater flow on the eastern portion of the site is towards the southeast and on the western portion of the site to the southwest, mimicking the surface topography. Groundwater gradients across the site averaged 0.095 ft. Groundwater appeared to be slightly mounded in the vicinity of the abandoned tile field (TtEC 2008). It is not known when the septic tank/tile field was abandoned.

The loess deposits have a low permeability and yield very little water. During the probe sampling conducted as part of the SSI, recharge was observed to be adequate to yield sufficient water for collecting samples for organics and inorganics analyses (TtEC 2008).

Potentiometric surface maps, prepared by Beling Consultants in 1998 and 1999 as part of the groundwater monitoring program for LUST incident 931687, show that groundwater at the site flows to the southeast.

During groundwater sampling conducted for this RI, the temporary wells pumped dry during well purging.

According to the National Cooperative Soil Survey published online by the U.S. Department of Agriculture [USDA (Undated)], the saturated hydraulic conductivity of the soil types found at the Hanna City facility range from 0.12 to 1.2 m/day.

3.8 DEMOGRAPHICS

As discussed earlier, the site is located approximately 10 miles west of Peoria, Illinois and two miles west of Hanna City, Illinois, in Peoria County. There are currently no full-time residents or employees on the site, though the 38 acres of the site that are in the process of being ceded to the State are being considered for reuse. The future use of the site has not yet been decided. Based on an April 1998 aerial photograph, the surrounding area appears to be agricultural and open land with wooded areas located primarily along stream banks. There are also scattered residences in the surrounding area. The nearest residence is immediately across State Highway 116 (Farmington Road) from the site.

At the time of the 2000 census, the population of Hanna City was 1013 in 398 households. More recent data (City-Data.com) report that the July 2007 population was 980.

3.9 ECOLOGY

In November 2008, EnviroScience conducted an ecological reconnaissance of the HCAFS. The findings of an ecological reconnaissance are summarized in Section 7 (Screening Level Ecological Risk Assessment), and the site visit report is presented in Appendix G. The site consists mainly of new field habitat with landscaped trees and shrubs.

According to the Illinois Department of Natural Resources (contacted by EnviroScience), the Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Inventory sites, dedicated Illinois Nature Preserves, or registered land and water reserves in the vicinity of the site. Shown below on Table 3-1 and 3-2 are the threatened and endangered species list for Peoria County by the U.S. Fish and Wildlife Service and the State of Illinois. None of these species were identified as being present on the sites.

Table 3-1. Federally endangered, threatened, proposed, and candidate species of Peoria County

Common name	Scientific name	Status	Habitat
Indiana bat	*Myotis sodalis*	Endangered	1. Caves, mines (hibernacula); 2. small stream corridors with well developed riparian woods; upland forests (foraging)
Eastern prairie fringed orchid	*Platanthera leucophaea*	Threatened	Mesic to wet prairies
Decurrent false aster	*Boltonia decurrens*	Threatened	Disturbed alluvial soils

Source: U.S. Fish and Wildlife Service, 2009

Table 3-2. State listed endangered and threatened species of Peoria County

Common name	Scientific name	State status	Last date observed
Lake Sturgeon	*Acipenser fulvescens*	Endangered	April 28, 2007
Pale False Foxglove	*Agalinis skinneriana*	Threatened	September 16, 2004
Decurrent False Aster	*Boltonia decurrens*	Threatened	September 09, 2006
Spotted Coral-root Orchid	*Corallorhiza maculata*	Threatened	June 14, 2001
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	March 28, 2007
Least Bittern	*Ixobrychus exilis*	Threatened	June 19, 2004
Loggerhead Shrike	*Lanius ludovicianus*	Threatened	July 27, 2007
King Rail	*Rallus elegans*	Endangered	May 26, 1988
Arrowwood	*Viburnum molle*	Threatened	October 29, 2004

Source: Illinois Natural Heritage Database, December 2008

4. CONTAMINATION ASSESSMENT

4.1 LABORATORY ANALYSIS AND SAMPLE QUALITY ASSURANCE/QUALITY CONTROL

The quality of a data set is measured by certain characteristics of the data. Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The objectives of the RI and the intended use of the data define the goals. All of the data tables referenced in this section are found in Appendix B, unless stated otherwise.

Precision characterizes the amount of variability and bias in the inherent data set. Precision describes the reproducibility of measurements of the same parameter for a sample under the same or similar conditions. Precision is expressed as a range (the difference between two measurements of the same parameter) or as a relative percentage difference [RPD (the range relative to the mean, expressed as a percentage)]. Range and RPD values were calculated according to the Contract Laboratory Program (CLP) protocols. The laboratory duplicates were analyzed and no precision problems were encountered. An additional measure of precision is analysis of split samples by an independent laboratory. Table 4-1 (Appendix B) shows the comparison of split samples and primary samples for analysis of PAH in soil. A similar comparison for the results of arsenic analysis in soil is presented in Table 4-2; comparison of groundwater results from split samples is presented in Table 4-3.

Accuracy is the comparison between experimental and known or calculated values expressed as a percent recovery (%R). Percent recoveries are derived from analysis of standards spiked into deionized water (standard recovery) or into actual samples (matrix spike or surrogate spike recovery).

Control limits for accuracy are set at the mean, plus or minus three times the standard deviation of a series of %R values. Organic %R values are set at the mean plus or minus two times the standard deviation.

Accuracy of aqueous and solid samples was evaluated by use of surrogate and MS at the CLP-required incidences. CLP acceptance criteria and corrective actions apply. Out-of-criteria results were reviewed for data applicability as a part of data verification.

The data obtained during the RI represents actual conditions at the sampling location. The SAP (GEO 2008b) and WP (GEO 2008d) were designed so that the samples collected were an accurate representation of actual site conditions. The rationales discussed in the WP and Quality Assurance Project Plan (QAPP) portion of the SAP presented sample representativeness of the sampled environmental matrix. Sampling activities conformed to the protocols specified in the planning documents. The use of SW-846 analytical protocols and data deliverables ensured that analytical results and deliverables are representative and that they were both performed and reported consistently.

Comparability of data is achieved by using standardized sampling and analysis methods and data-reporting format. Both analytical procedures and sample collection techniques maximize the comparability of the data. Using consistent units also ensures that data is comparable. Laboratory data is expressed in Standard International Units, usually micrograms per liter (µg/L), milligrams per kilogram (mg/kg), or micrograms per kilogram (µg/kg). Additionally, consideration is given to environmental conditions that could influence analytical results.

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness was calculated by the following equation:

usability = # of valid measurements / # of measurements planned * 100.

For relatively clean, homogeneous matrices, 100% completeness is expected. However, as matrix complexity and heterogeneity increase, completeness may decrease. Where data quality objectives are compromised, effects on the overall investigation must be considered. Whether any particular sample is critical to the investigation was evaluated in terms of the sample location, the parameter in question, the intended use of the data, and the risk associated with the error. The data set for the HCAFS RI sampling conducted by GEO, and including the data from previous sampling, is 100% complete and achieves the goals set in the QAPP.

The data was verified and data qualifiers assigned according to the CLP, USEPA, and CELRL Louisville Quality System Manual Supplement (LQSMS) and the DoD Quality Systems Manual (QSM) for Environmental Laboratories data validation protocols. The list of applicable data qualifiers is presented on the relevant data. The data validation letters identify problems encountered during laboratory analysis that resulted in the assignment of the qualifiers (Appendix H). One set of analysis for PAHs in surface soil in a duplicate sample was rejected during data validation. The primary sample results were accepted. The data set was, therefore, not impacted.

Field QA/QC samples consist of FD, field blanks, trip blanks, and MS/MSD. The results of the analysis of the FD/EB for PAHs and inorganic analysis have been presented in Tables 2-4 and 2-5, respectively.

4.2 PRESENTATION OF ANALYTICAL RESULTS

Groundwater samples were collected from each of the three Coal Storage Areas, the Paint Shed and the Vehicle Wash Rack. Samples were analyzed for Total Suspended Solids and unfiltered and filtered samples were analyzed for metals based on the results of previous investigations, which showed results above the Illinois standard. Surface soil samples were collected from each Exposure Unit (EU) for PAH analysis, based on exceedances identified in previous studies. Subsurface samples were collected from each of the coal storage areas for arsenic analysis and from the Vehicle Wash Rack for PAH analysis. The analysis parameters and sample locations were based on the results of previous studies. The locations and rationales for sample collection have been presented in more detail in the WP and are also summarized in Section 2 of this report

Analytical results are presented in tables for the relevant media and analytes, as identified in Section 4.4.

4.3 PRELIMINARY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

All hazardous waste sites, including Federal facilities, must comply with CERCLA 1980 and the Superfund Amendments and Reauthorization Act of 1986, Sections 120 and 121. These sections mandate that the cleanup of hazardous substances, pollutants, or IDW comply with requirements or standards under State or Federal environmental laws that are applicable, relevant, and appropriate requirements (ARARs) for the substances or circumstances at the site. More stringent State laws take precedence over less stringent Federal laws in cases where standards are promulgated by both.

Applicable requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site" (53 FR 51394). Relevant and appropriate requirements are "those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not applicable to a hazardous

substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site" (53 FR 51394).

The selection of ARARs for a particular site depends on the hazardous substances present, the site characteristics and location, and the remedial actions selected. The requirements are referred to as chemical-, location-, or action-specific.

“Chemical-specific requirements set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants” (52 FR 32496). These requirements generally set protective cleanup levels for the Contaminants of Concern (COCs) in the designated media or allow the incorporation of safe discharge levels for the remedial action. Chemical-specific standards have been established under a number of statutes, including the Resource Conservation and Recovery Act (RCRA), the Safe Drinking Water Act (SDWA), the Clean Water Act, and the Clean Air Act. However, standards have been established for only a limited number of chemicals. In the absence of chemical-specific ARARs, it is often necessary to use non-promulgated chemical-specific advisories or guidance documents to identify cleanup remedies that are protective of human health and the environment.

Location-specific requirements "set restrictions upon the concentrations of hazardous substances or the conduct of activities solely because they are in special locations" (53 FR 51394). These may include sites within a 100 year floodplain, sites within a wetland, sites on archaeologically significant locations, and others.

Action-specific ARARs are "technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes or requirements to conduct certain actions to address particular contaminants at a site" (53 FR 51394). Action-specific ARARs may specify performance standards or technologies, as well as specific environmental levels for discharged or residual chemicals, once a remedial action is selected. For example, conduct of a remedial action would invoke the Occupational Safety and Health Administration regulations for protection of site workers.

ARARs will be used to identify potential remedial goals for the various media at the Hanna City facility. ARARs are refined as the RI/FS process progresses and remedial actions are identified and evaluated. The FS will present a list of ARARs for review by Illinois EPA. The preliminary list of Federal and State ARARs is presented in Table 4-4.

4.3.1 Health-Based ARARs

This section discusses the regulatory standards or guidelines related to specific chemicals. The chemical-specific ARARs will be presented for the compounds detected during the RI in the sections in which the analytical results are presented. Various Federal and State regulations were reviewed to identify the chemical-specific ARARs. Chemical-specific ARARs for each medium are presented for the compounds that were detected in that medium.

The enforceable regulatory standards for exposure to groundwater contaminants are the Federal maximum contaminant levels (MCLs) and the Illinois groundwater standards. However, MCLs and Illinois groundwater standards have not been specified for several of the chemicals of concern.

Therefore, relevant regulatory guidelines were used for comparative purposes to infer health risks and environmental impacts. These regulatory guidelines include MCLs, USEPA Drinking Water Health Advisories, and USEPA Regional Screening Levels. The environmental criteria are briefly described below.

4.3.2 Maximum Contaminant Levels

MCLs are enforced standards established by USEPA's Office of Drinking Water. They are promulgated for drinking water under the SDWA and are designed for the protection of human health. MCLs are legally enforceable standards that apply to public water systems. The Federal MCLs appear in 40 CFR 141. MCLs are based on laboratory or epidemiological studies and are applicable to drinking water sources supplying a minimum of 25 persons. They are designed for prevention of human health effects associated with lifetime exposure (70 years) of an average adult (weighing 70 kg) consuming two liters of water per day, but they also reflect technical limits of removing the contaminant from water. These standards are also based on the fraction of toxicant expected to be absorbed by the gastrointestinal tract.

4.3.3 Maximum Contaminant Level Goals

Maximum contaminant level goals (MCLGs) are non-enforceable guidelines based entirely on health effects. MCLGs are generally specified as zero for carcinogenic substances, based on the assumption of non-threshold toxicity, and do not consider the technical or economic feasibility of achieving these goals. Therefore, the MCLGs are often more stringent than the MCLs. When MCLs are not available, MCLGs are useful for assessing water contamination. The MCLs have been set as close to the MCLGs as considered technologically and economically feasible.

4.3.4 Illinois Groundwater Standards

Illinois groundwater standards are codified under the Illinois Administrative Code (IAC), Title 35, Section 620. The Illinois standards are enforceable groundwater quality standards. USEPA has delegated to the State authority for primacy on groundwater issues in the State.

4.3.5 Illinois Groundwater and Soil Standards

The Illinois EPA has also developed the TACO (35 IAC 742). TACO provides look-up tables of contaminant concentration information sufficient for the purposes of a screening risk assessment. The tables in TACO present acceptable concentrations for both soil and groundwater under various exposure scenarios. These acceptable contaminant concentrations are individually calculated using methodologies consistent with USEPA’s Risk Assessment Guidance for Superfund. The TACO tables are also consistent with the available Federal Soil Screening Levels (SSLs). In Section 4.4, TACO standards are used for comparison with contaminant concentrations.

4.3.6 USEPA Regional Screening Levels

USEPA Regional Screening Levels (RSLs) (USEPA 2008) are risk-based concentrations intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements. There are more than 600 RSLs for contaminants in soil, air, and tap water. They are viewed as preliminary clean-up goals for an individual chemical, but in this context, they are best viewed as dynamic and subject to change because they are generic and based on direct contact exposures that may not address site-specific conditions and/or indirect exposure pathways. For planning purposes, these human health-based Preliminary Remediation Goals (PRGs) should always be considered in conjunction with ARAR-based PRGs (e.g., MCLs), ecological benchmarks, and “background” conditions before establishing a final cleanup level for a particular site.

4.3.7 Drinking Water Health Advisories

Drinking Water Health Advisories (DWHAs) are guidelines developed by the USEPA Office of Drinking Water for non-regulated contaminants in drinking water. These guidelines are designed to consider both acute and chronic toxic effects in children (with an assumed body weight of 10 kg) who consume one liter of water per day and in adults (assumed body weight of 70 kg) who consume two liters of water per day. DWHAs are generally available for acute (one day), subchronic (10 day), and chronic (longer term or lifetime) exposure scenarios. These guidelines are designed to consider only threshold effects and, thus, are not used to set acceptable levels for known or probable human carcinogens.

4.4 NATURE AND EXTENT OF CONTAMINATION

The verified analytical data generated during the RI reveals the nature and extent of environmental contamination in groundwater and soil at the HCAFS, which is discussed in this section. The complete verified analytical database developed during the course of the RI is included in Appendix B.

The sampling locations are shown in Figures 2-1 through 2-10 in Appendix A.

The partitioning of natural constituents and contaminants among solid, liquid, and gas phases and their transfer from one phase to another depends on the thermodynamics and kinetics of different types of chemical processes. Thermodynamic processes and reaction kinetics are strongly influenced by subsurface environmental conditions such as temperature, pH, ORP, and dissolved constituents. Field screening data are presented in Appendices C.

In the discussions that follow, the samples collected for this RI are identified using three distinct fields (XXXX #### tt) in the following pattern:

XXXX = site location designation

HCCA = Hanna City Coal Area A
HCCB = Hanna City Coal Area B
HCCC = Hanna City Coal Area C
HCME = Hanna City Main Entrance
HCVW = Hanna City Vehicle Wash Rack
HCMB = Hanna City Maintenance Building
HCPS = Hanna City Paint Shed

= unique four digit sample number specific to the sampling location. The following prefixes will be used followed by the sampling location number designation.

SS = surface soil
SB = subsurface soil
GW = groundwater

tt = sample Type:

01 = primary sample
02 = duplicate (QC) sample
03 = QA sample

Samples from the SI and SSI are identified using the numbers used from the original document.

4.5 GROUNDWATER

The objective of the RI groundwater sampling was to collect samples to provide data that will supplement information gathered during the SI and SSI in order to support a baseline risk assessment based on the combined data. For groundwater, the entire site is considered as one EU for all site receptors. The RI groundwater results, combined with the groundwater data from the SI and SSI from the Coal Areas, Vehicle Wash Rack and Paint Shed AOPCs, are to be used to arrive at exposure estimates for the groundwater pathway. Groundwater samples were also analyzed to confirm that metals found in groundwater during the SI and SSI were associated with suspended particles and were not dissolved.

4.5.1 Volatile Organic Compounds

A number of VOCs were detected in the groundwater samples collected during the SI and SSI, but all measured concentrations were below the TACO Tier 1 residential criteria. Thus, as described in the WP for this RI, VOCs were ruled out as COPCs for groundwater at the HCAFS.

A number of VOCs were detected in the soil and groundwater samples collected during the SI and SSI, but all measured concentrations were below the TACO Tier 1 residential criteria. Based on these results, VOCs were not considered to be COPCs for the HCAFS and, therefore, were not further considered in this RI. The analytical results of previous groundwater investigations are presented in Appendix B.

4.5.2 Metals

Groundwater samples were collected for metals analysis during both the SI (1996, 2002) and the SSI (2006). Metals in unfiltered groundwater samples that exceeded TACO groundwater criteria [which are identical to Illinois Groundwater Standards (35 IAC 620)] included iron, lead, manganese, and vanadium. The MCL for arsenic is 10 µg/L (lower than the TACO criterion of 50 µg/L). Some arsenic concentrations in the groundwater samples exceeded the MCL, but were below the TACO criterion (Table 4-5). Filtered groundwater samples analyzed during the SI showed significantly reduced aluminum concentrations when compared with the associated unfiltered groundwater samples. Iron, lead, manganese, and vanadium in these filtered groundwater samples were found to be below the TACO Class I groundwater criteria (with the exception of manganese in the filtered sample from Coal Area C). As stated in the WP for this RI, the results suggested that the elevated levels of iron, lead, manganese and vanadium are likely associated with particulates in the groundwater samples. TtEC (2008) also made a similar observation.

It should be noted that samples collected during the SSI were reported to have been collected by low-flow methods, but were reported to be very turbid. During the RI, due to the poor production of the wells, purging in most cases could not be completed to reach a consistent value of 10 nephelometric turbidity units (please see Section 2.3.2 for a discussion of RI sampling methods). However, the RI samples were less turbid than the previous samples because of the low-flow methods used. Comparison of the results of analysis of unfiltered RI samples and previous samples shows that the metal concentrations are significantly lower in the unfiltered RI samples than in the previously collected samples (see Section 6.6.2 for further discussion).

In November 2008, GEO installed three groundwater sampling points at the Vehicle Wash Rack (HCVWGW04, 05, and 07), four at the Paint Shed (HCPSGW02, 03, 04, and 05), and one at each of the Coal Storage Areas (HCCAGW06, HCCBGW09, and HCCCGW06). Duplicate filtered and unfiltered samples were collected at HCVWGW04 and confirmed the hypothesis that metals in groundwater are associated with suspended particulates. The filtered sample is designated by the letter F at the end of the sample number. The analysis results were compared to the lower of the Illinois EPA TACO Class I

groundwater criteria and the USEPA MCL. The results on Table 4-5 show that, with the exception of the filtered duplicate sample from location HCVWGW04, both filtered and unfiltered samples from the Vehicle Wash Area and Coal Storage Area A exceed the Illinois Class I Groundwater Remediation Objectives for manganese. Both the filtered and unfiltered samples from Coal Storage Area B were below the criteria. The unfiltered sample from Coal Storage Area C exceeded the criteria for aluminum and manganese. The results from the filtered sample were below the criteria for both of these metals. In all cases the manganese concentration was lower in the filtered samples than in the unfiltered samples from the same location. The only other analysis result that exceeds the standard was the result for aluminum from the unfiltered sample from location HCVWGW04; the result of analysis of the filtered sample is below the standard. The results for barium and iron are below the standard and show small-to-substantial decreased concentrations in the filtered samples relative to the unfiltered samples.

The detection limits for antimony, beryllium, and thallium were above the Illinois Class I groundwater remediation goal. All the results for these metals were below the detection limit. Results of previous analysis of samples presented in the SI and SSI showed that concentrations of these constituents were below the criteria and none of the three metals were considered to be COPCs for the site.

Groundwater samples collected during the SI (sample collection in 1996) and the SSI (sample collection in 2006) were found to contain concentrations above the Illinois Groundwater Remediation Objective for lead in the unfiltered samples. Analysis results for filtered samples collected during this RI showed that the criteria were not exceeded. With one exception, all the lead results from both the filtered and unfiltered samples were reported as not found above the detection limit. The lead concentration reported for the unfiltered sample from location HCVWGW04 is 3.7 µg/L, which is above the detection limit but below the standard.

The samples collected from the Vehicle Wash Rack were analyzed only for lead. None of the samples collected for this RI had results above the detection limit.

4.5.3 Semi-volatile Organic Compounds

PAHs were detected in groundwater samples collected during the SI and SSI. None of the groundwater detections exceeded the TACO Class I groundwater criteria. Therefore, PAHs were not considered to be COPCs for this RI.

4.5.4 Pesticides

No pesticides were detected in any of the groundwater samples collected during the SI or SSI. Thus, pesticides were ruled out as COPC for the HCAFS and were not included in groundwater sample analysis in the RI.

4.5.5 Polychlorinated Biphenyls

PCBs were not detected in any of the groundwater samples collected during the SI and SSI. The detection limits for the analytical methods used were below TACO Tier 1 criteria. On this basis, PCBs were ruled out as COPCs for the HCAFS. Groundwater analysis for PCBs was not included in the RI.

4.6 SOIL

As part of this current RI, both surface and subsurface soil samples were collected for analysis in order to supplement the data from the SI and SSI so that the combined data sets can be used to conduct a baseline risk assessment and to determine the nature and extent of contamination for each EU. EUs are defined as the likely area(s) in which a receptor will be affected by a potential contaminant in a given medium. For the purposes of surface and subsurface soil, the following are addressed as separate EUs:

- Coal Storage Area A
- Coal Storage Area B
- Coal Storage Area C (the Maintenance Building and the Paint Shed are considered as one EU due to their proximity to each other)
- Main Entrance
- Vehicle Wash Rack

4.6.1 Volatile Organic Compounds

VOCs were detected in the soil samples collected during the SI and SSI, but all measured concentrations were below the TACO Tier 1 residential criteria. As a result, VOCs were ruled out as COPCs for surface and subsurface soil at the HCAFS.

4.6.2 Metals

Of the metals measured in the surface and subsurface soil samples collected during the SI and SSI, only arsenic exceeded the TACO Tier 1 residential soil criteria. These exceedances were observed in two soil subsurface soil samples collected in Coal Area A. In order to determine the vertical extent of elevated arsenic concentrations, GEO collected subsurface soil samples at depths of two to three ft and four to five ft bgs. Samples from each depth were collected from seven locations at Coal Storage Area A (HCCASB01, 02, 03, 04, 05, 06, and 07), seven locations at Coal Storage Area B (HCCBSB01, 02, 03, 04, 05, 06, and 09), four locations at Coal Storage Area C (HCCCSB01, 02, 06, and 07), and three locations at the Paint Shed (HCPSSB03, 05, and 06). Including duplicate samples, a total of forty-six samples were collected from 20 locations and analyzed for arsenic. Four samples, including one duplicate, were also analyzed for pH.

The background concentration for counties within metropolitan areas (13 mg/kg) was reached or exceeded in 12 of the 58 samples. Arsenic concentrations in the samples collected for this RI ranged from seven mg/kg to 16.2 mg/kg. At none of the four locations where duplicate samples were collected and analyzed for arsenic (HCCASB04, HCCBSB04, HCCCSB06, and HCPSSB03), were both the primary and duplicate sample analysis results above the background concentration. The arsenic results from analysis of the subsurface soil samples are summarized and compared to the background concentration for metropolitan counties in the subsections that follow. Analysis results are presented in Table 4-6.

The coal storage areas possibly contributed to the arsenic concentrations in soil, but it must also be noted that in wells drilled in the vicinity of the HCAFS (see Section 3.5 for a more detailed discussion), coal seams have been reported in the shallow bedrock. These coal seams may also be contributors of arsenic in the soil for all EUs at the HCAFS. It should also be noted that groundwater in the Glasford formation has been documented to have high arsenic concentrations. According to Holm et al. (2004), the arsenic concentrations in 13 wells completed in the Glasford formation in Tazewell and Champaign Counties ranged from non-detect to 190 µg/L, with the average concentration being 28.8 µg/L. Although no analysis of the aquifer material could be located, the presence of arsenic in the groundwater in this formation strongly suggests that arsenic is naturally present in the formation.

4.6.2.1 Coal Area A

Of the seven locations sampled at Coal Area A during this RI, the arsenic concentrations exceeded the criteria only at the two to three ft depth for the duplicate sample from location HCCASB04. The sample collected at the four to five ft depth at this same location also exceeded the criteria. At locations HCCASB01, HCCASB02, HCCASB03, HCCASB05, HCCASB06 and HCCASB07, the reported concentrations of arsenic were below criteria at both depths. Results are also available from three samples

collected during the SI and SSI. Sample analysis results from locations CA01 (five to eight ft) and CA SB01 (5 to 8 ft) are above the criteria. The sample analysis result from location CA SB02 (four to five ft) is below the criteria.

As shown on Figure 4- 1, in Appendix A, the distribution of arsenic in the soil at Coal Area A does not indicate a particular pattern. According to Illinois EPA, the background arsenic concentration in soil in counties in metropolitan areas is 13 mg/kg (11.3 mg/kg outside metropolitan areas) and the average concentration in the soil at Coal Area A is 11.6 mg/kg. The lack of a pattern in arsenic distribution, and because the average concentration is largely below the background concentration, suggests that the arsenic levels in soil at Coal Area A are reflective of natural conditions, rather than resulting from release of arsenic at the site. This does not rule out the possibility that the coal storage pile has contributed arsenic to the soil.

4.6.2.2 Coal Area B

The only samples collected during this RI from Coal Area B, for which the reported results exceed the arsenic background concentration are the shallow (two to three ft) sample at location HCCBSB01 and the deeper (four to five ft) sample at location HCCBSB03. Four subsurface soil samples were analyzed for arsenic as part of the SI and the SSI. The results for all of these samples were below the background concentrations.

The average arsenic concentration in the soil at Coal Area B is 9.52 mg/kg and the distribution of arsenic does not show a pattern (Figure 4-2). As described above for Coal Area A, the concentrations in Coal Area B appear to be reflective of background concentrations and a possible contribution from coal storage.

4.6.2.3 Coal Area C

The analysis result for the sample collected at location HCCSB06 from two to three ft bgs exceeds the background concentration. The reported concentration for the duplicate sample (HCCSB0602) is below the background concentration. The sample collected at four to five ft at this same location is also above the background concentration. The sample collected from four to five ft at location HCCCSB07 also has a reported arsenic concentration above the background concentration. The average concentration of arsenic at this site is 10.4 mg/kg. As shown on Figure 4-3, there does not appear to be a pattern to the distribution of arsenic in the soil. However, locations HCCCBS06 and 07 are located closest to the assumed location of the coal storage area. As has been described for the other two Coal Areas, it appears that the arsenic found in the soil at Coal Area C represents background conditions with the potential for some contribution from the coal storage pile.

Analysis results from the Paint Shed, which is part of the HCCC EU, show that the background concentration was exceeded in three of six samples. In an additional sample set collected at HCPSSB03 (four to five ft bgs), the primary sample exceeded the criteria, but the duplicate sample did not. The average concentration, including the primary sample mentioned above, is 13.18 mg/kg. Although the concentrations reported for the three samples are slightly above the background concentration of 13 mg/kg, it is probable that they also represent background conditions. There is no known source of arsenic associated with the Paint Shed.

4.6.3 Semi-volatile Organic Compounds

Sampling and analysis of shallow soil conducted during the SI and SSI showed the presence of PAHs exceeding the criteria for all sites being considered in this current RI. The criteria that have been used are the lower of the Illinois EPA TACO Soil Component of the Class I Groundwater Ingestion

Exposure Route Values and the USEPA Region 9 RSL Values. The PAHs with the lowest criteria are benzo(a)pyrene and dibenzo(a,h)anthracene, which exceeded the criteria in all samples. The PAHs that exceeded criteria in some samples are benzo(a)anthracene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene. Some of the elevated PAHs were found in the vicinity of the former location of a 2000 gal gasohol UST, which was removed in 1993. In addition, a contaminated soil storage pile was also reported to be in the vicinity. The type of soil stored is unknown, but it may have been a staging area for soil removed when the tank was removed. In order to determine the extent of surface soil contamination and to support the baseline risk assessment, GEO collected surface soil samples at Coal Area A (eight samples), Coal Area B (11 samples), the Coal Area C EU (21 samples), the Vehicle Wash Rack (eight samples), and the Main Entrance (seven samples). The sample analysis results for each EU are presented in the subsections that follow. Analysis results for PAHs are presented for each EU in Tables 4-7 through 4-12.

A summary of facility-wide distribution patterns of semi-volatile organics in surface soil is presented, following the EU-specific discussion.

4.6.3.1 Coal Area A

Coal Area A is located in the northwest quadrant of the Hanna City facility. It is approximately 300 ft west of the Vehicle Wash Rack. An underground 500 gal diesel storage tank, removed in 1997, was located approximately 300 ft south of Coal Area A. The tank site was closed in 1998. During this RI, surface soil samples were collected for PAH analysis. The analysis results are presented on Table 4-7.

The total concentration of total PAHs range from 191.4 to 34,994 µg/kg. The results of analysis of surface soil samples for PAH are presented in Table 4-7. The only sample for which reported results did not exceed any criteria was HCCASS06. Benzo(a)pyrene concentrations exceed the criteria in all samples, except HCCASS06, which had the lowest concentration of total PAHs. Concentrations of benzo(a)anthracene exceed the criteria in samples HCCASS02, HCCASS03, HCCASS08, and CA02. The concentration of benzo(b)fluoranthene in sample HCCASS01 is equal to the criteria and the criteria is exceeded in samples HCCASS02, HCCASS03, HCCASS05, HCCASS08, and CA02. The only sample that exceeded the criteria for benzo(k)fluoranthene is HCCASS08. The criteria for indeno(1,2,3-cd)pyrene is exceeded in samples HCCASS02, HCCASS08, and CA02. All samples, except for HCCASS04, HCCASS06 and HCCASS07, exceed the criteria for dibenzo(a,h)anthracene.

The highest concentrations of PAHs and the largest number of exceedances are found in samples HCCASS08 and CA02. The concentrations in these samples are over 20 times higher than in the samples with the next highest concentrations. These two samples were collected within 20 ft of each other in the area that is thought to be the location of the coal storage pile. This suggests that these samples are representative of residual contamination from coal storage. These samples are also located close to the road and parking area. Runoff from these areas is also a potential source of the reported PAH concentrations. The concentrations of PAHs in other samples may be the result of migration, possibly via runoff, from the coal area or from road runoff, as well. The distribution of PAH exceedances and total PAH concentrations are shown on Figures 4-4 and 4-5, respectively. The concentration of PAHs in sample HCCASS03 suggests that spreading of coal or coal ash along the road and/or road runoff could be a source of low level PAHs in the surface soils of this area. Wind blown dust from the coal storage pile is also a possible source. In general, as seen on Figure 4-4, the PAH concentrations are lower on the western portion of the site than on the eastern portion. Since Coal Storage Area A is in the northwest corner of the HCAFS, the portion of HCCA that shows the lower reported PAH concentrations is also the greatest distance from all roads and other active areas.

4.6.3.2 Coal Area B

Coal Area B is located in the southeastern quadrant of the site approximately 200 ft north of West Farmington Road. Only surface soil samples were collected for PAH analysis at this EU. As shown on Table 4-8, all samples had reported results exceeding criteria for at least one PAH. Benzo(a)pyrene concentrations exceed the criteria in all samples. Benzo(a)anthracene concentrations exceed the criteria in all samples with the exception of sample HCCBSS08. Similarly, the criteria for benzo(b)fluoranthene are exceeded in all samples except for those from HCCBSS08 and HCCBSS10. With the exception of the duplicate sample HCCBSS02, HCCBSS08, and HCCBSS10, all sample results exceed the criteria for Indeno(1,2,-cd)pyrene. The criteria for benzo(k)fluoranthene are exceeded only in the primary sample HCCBSS02, the duplicate sample result is below the criteria, and sample HCCBSS03. The results for all samples, except HCCBSS08 and HCCBSS10, exceed the criteria for dibenzo(a,h)anthracene. The distribution of PAH exceedances in surface soil are shown on Figure 4-6 in Appendix A.

As shown on Figure 4-7, the highest concentration of total PAHs at this site, 177,080 µg/kg, occurs in sample HCCBSS03, which is located in the center of the site area. Sample HCCBSS02, approximately 35 ft northeast of HCCBSS03, has a reported concentration of total PAHs of 49,251 µg/kg and sample HCCBSS01, approximately 20 ft east of HCCBSS03, 14,354 µg/kg. The remaining samples have reported concentrations of total PAHs ranging from 1739 to 8446 µg/kg. It should be noted that the reported concentration in HCCBSS02 is 49,251 µg/kg. However, the reported concentration in the duplicate sample from that location is 2334.2 µg/kg. The standard deviation for total PAHs for the entire population of sample results is 48,014.79, while the standard deviation for all sample results, excluding those from HCCBSS03 and both sets of results from HCCBSS02, is 3802.57. This demonstrates the significant difference between the sample results at these two locations and the results from samples collected at all other locations.

As described above, in general, concentrations of total PAHs decrease away from the high concentrations at HCCBSS03 and HCCBSS02. The lowest concentrations of total PAHs are reported for HCCBSS08 (1037.9 µg/kg) and HCCBSS10 (1739 µg/kg). HCCBSS08 is located approximately 110 ft south of HCCBSS03; HCCBSS10 is located approximately the same distance north of HCCBSS03.

The areal distribution of reported PAH concentrations in the surface soil suggest that, similar to Coal Area A, the primary source of PAHs at Coal Area B is residual material from the storage pile. Because of the proximity of HCCB to Farmington Rd to the south, it is expected that PAHs would also be found in the surface soil south of HCCB, between HCCB and the road.

4.6.3.3 Coal Area C

Coal Area C is located in the southeast quadrant of the HCAFS, north of Coal Area B. There are two settlement ponds, remaining from a former water treatment plant, to the east of the EU. These settlement ponds, as previously stated, are not part of this RI. The Coal Area C EU includes Coal Area C, the Maintenance Building, and the Paint Shed. These sites were combined into one EU due to their proximity to each other. This is also the area where a 2000 gal gasohol UST was removed in 1993 and a stock pile of contaminated soil was located, according to a drawing included in Beling 1998a (reproduced in Figure 4-8). The results of surface soil sampling and analysis conducted in conjunction with the SI and SSI exceeded the criteria. Additional sampling of the surface soils in this area was conducted as part of this RI to determine the extent of contamination and to provide sufficient data to support a baseline risk assessment.

All of the surface soil samples collected during this RI in the HCCC EU exceed the TACO Tier 1 criteria for residential soil. The distribution of PAH exceedances is shown on Figure 4-9. The reported concentrations for benzo(a)pyrene and dibenzo(a,h)anthracene exceed the respective criteria for all

samples collected. These two constituents have the lowest criteria of all of the PAHs. The criterion for benzo(a)anthracene is exceeded in samples from 25 locations out of 29 locations sampled. Analysis results for benzo(b)fluoranthene exceed the criteria for 28 samples, while the criteria for Indeno(1,2,3-cd)pyrene results exceed the criteria at 22 locations. Benzo(k)fluoranthene exceed the criteria at three locations. One of the exceedances was for sample PS SS03 (collected in April 2006 as part of the SSI effort), which is a duplicate of sample PS SS02, for which the result is not above the criteria. Reported results for chrysene exceed the criteria in samples from two locations. It should be noted that, although duplicate samples from sample location HCCCSS05 exceed the criteria, the primary sample does not. The other sample that exceeds the chrysene criteria is HCMBSS06. The criterion for naphthalene is exceeded only for sample CA 05 which was collected in 1996. The concentration of naphthalene is significantly higher than in any other sample, suggesting that this exceedance is an anomaly.

As shown on Figure 4-10 and Table 4-9, the highest concentrations of total PAHs are reported for samples HCCCSS05 (208,400 µg/kg) and HCMBSS06 (243,550 µg/kg). It should be noted that a duplicate sample for HCCCSS05 was analyzed and the result was 210,350 µg/kg. This suggests that the concentration reported for the primary sample was not an anomaly. Sample HCCCSS09 was collected within 10 ft of HCCCSS05 and the reported concentration for this sample is 61,465.9 µg/kg. As shown on Figure 4-10, the location of these samples is adjacent to a parking area and is in the vicinity of an area previously identified (Beling 1998a) as the location of a contaminated soil pile and the gasohol tank mentioned above. The past use in these areas may have contributed to the high PAH concentrations in these samples.

Sample HCMBSS06, with a reported concentration of total PAHs of 243,550 µg/kg, was collected adjacent to a drain that emerges from the Maintenance Building. Sample HCMBSS07 was collected from a location across a drain from HCMBSS06 and has a reported concentration of total PAHs of 11,480 µg/kg. The drain, which originates from an open floor drain that runs east-west through the maintenance bay of the building, is a possible source of the high PAHs in this vicinity.

The distribution of PAH concentrations does not show a clear enough pattern to quantify the contribution of the various possible sources. There does seem to be a general trend across this EU of higher concentrations of PAHs near parking areas and roads. PAHs are commonly found in road runoff and have been found in snow up to 50 meters away from roads (Lopes 1998). This indicates the possibility that a source of PAHs to the surface soil is road runoff or snow plowed from the road to the edge of these areas.

4.6.3.4 Main Entrance

The Main Entrance is the entrance area from West Farmington Road to the HCAFS. Only surface soil samples were collected for PAH analysis at the Main Entrance EU. PAHs were detected in surface soil samples above criteria in the Main Entrance. In order to determine the extent of elevated PAH occurrences and to develop a data base sufficient to support a baseline risk assessment, seven additional surface soil samples (plus one duplicate sample) were collected and analyzed for PAHs, as part of this RI. An additional goal of the sample collection was to identify possible source(s) for the PAHs, as this area is not near any of the known sources such as the former locations of the coal storage piles or USTs.

The reported results, as shown on Table 4-10, from all samples exceed the criteria for benzo(a)pyrene. Samples from all locations, but two exceeded the criteria for dibenzo(a,h)anthracene. Figure 4-11 presents the distribution of PAH criteria exceedances. Reported results from samples HCMESS01 and HCMESS06 exceed criteria only for benzo(a)pyrene. Concentrations for all other PAHs are below criteria. The criteria is exceeded at six sample locations for benzo(b)fluoranthene and at five locations for benzo(a)anthracene and indeno(1,2,2-cd)pyrene. At only one location is the criterion for benzo(k)fluoranthene exceeded.

The total concentration of PAHs at the sampled locations range from 532.5 µg/kg in sample HCMESS01 to 79,881 µg/kg in sample MESS01 (collected in 2006 for the SSI). The distribution of elevated PAH concentrations, shown on Figure 4-12, does not suggest a particular pattern of occurrence. Though, all sampling locations, because of the layout of the site, are near parking areas or roads and thus could reflect transport of PAHs onto the site from runoff and piling on plowed snow at the edges of the vehicle areas.

As a matter of definition of a release under CERCLA 101(22), to which CERCLA 104 gives authority to respond, as well as a common sense issue that an exemption to PAHs adjacent to roads exist in the CERCLA program.

PAH contamination was so prevalent and far afield from the original areas of concern that it could not have been caused by a "release", and should thus be considered an "exclusion" to the definition. A CERCLA exclusion in this instance is defined as "(B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine [42 USC §9601, 22(B)]." CERCLA defines the term "release" as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment [including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant (42 USC §9601, 22)].

It should be noted that, although the application of this exemption is most clear for the Main Entrance EU, it is also potentially applicable to other EUs at the HCAFS.

4.6.3.5 Vehicle Wash Rack

Both surface and subsurface soil samples were collected for PAH analysis at the Vehicle Wash Rack EU. The results are discussed separately below:

Surface Soil

The Vehicle Wash Rack is located on the northern portion of the HCAFS, east of Coal Area A, and adjacent to the location of a 2000 gal gasoline UST. This tank was removed in 1993, but as of September 2008, the tank site was not closed as a regulatory issue. The tank site has remained an open issue due to possible residual contamination in the former tank basin. As previously stated, this tank is not specifically being investigated as part of this RI, but it is a potential source of PAHs for the Vehicle Wash Rack site.

The results of sampling and analysis of surface soil conducted at this site during the SI and SSI reported exceedances of the criteria for specific PAHs. In order to determine the extent of elevated PAHs and to develop a data base sufficient to support a baseline risk assessment, GEO collected samples at eight additional locations, as part of this RI. The analysis results are presented on Tables 4-11(a).

The reported results from all samples exceed the criteria for residential soils for benzo(a)pyrene. Samples from all locations, but two (HCVWSS01 and HCVWSS09), exceed the criteria for benzo(b)fluoranthene and dibenzo(a,h)anthracene. Indeno(1,2,3-cd)pyrene concentrations exceed that criteria of 150 µg/kg at all sample locations, except HCVWSS01, HCVWSS03 and HCVWSS09. The criterion for benzo(k)fluoranthene is exceeded at HCVWSS06 and HCVWSS08. The distribution of PAHs exceeding the criteria is shown on Figure 4-13.

The total concentration of PAHs in reported analysis results at this site range from 217.3 µg/kg at sample HCVWSS09 to 100,931 µg/kg at sample HCVWSS08. The distribution of total PAHs is shown on Figure 4-14. The highest reported concentrations of PAHs in surface soils at this site occur adjacent to the road that connects the site to Coal Area A to the west. The lowest concentrations occur in the samples

collected at the greatest distance from the road. This suggests the possibility of PAHs either resulting from loss of material as it was being transported to or from the Coal Area or, as discussed above, for other sites at the Hanna City facility, via wind blown dust, runoff, or snow piles associated with the road rather than, or in addition to, vehicle wash operations.

Subsurface Soil

In addition to collecting surface soil samples at the Vehicle Wash Rack for PAH analysis, GEO also collected two subsurface samples for PAH analysis at each of the seven locations. Samples were collected from two to three ft and from four to five ft bgs. These samples were collected because the reported results for one sample, and its duplicate, collected at this site during the SI and SSI were above the criteria for benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(b)fluoranthene, and benzo(a)anthracene in the four to five ft sample, at sample location VW01. The purpose of the subsurface sampling was to determine the extent of PAH contamination in subsurface soil at the Vehicle Wash Rack and to obtain a data base sufficient for a baseline risk assessment.

The reported results of the RI sampling and analysis presented in Table 4-11(b) are below the detection limit for most samples. The only exceedances of the criteria identified are for benzo(a)pyrene in only the four to five ft sample interval at two locations. The criterion for benzo(a)pyrene is 15 µg/kg, which is also the reported concentration in the sample at HCVWSB04. The reported concentration in the sample at HCVWSB05 is 35 µg/kg. Based on the low levels of PAHs found in the remaining subsurface samples, it is reasonable to conclude that the exceedances identified are isolated occurrences.

4.6.3.6 Facility –wide PAH distribution in surface soil

The sampling conducted during the SI, SSI, and RI at the HCAFS have shown PAH concentrations that exceed human health screening levels in surface soils at the Coal Area EUs, at the Vehicle Wash Rack EU, and at the Main Entrance EU. Possible sources of the PAHs are previously stored coal or coal ash, vehicle maintenance activity, and suspected former USTs at the Coal Areas, Vehicle Wash Rack, and Main Entrance EUs, respectively. PAHs are found throughout the environment in air, water, and soil Agency for Toxic Substances and Disease Registry (ATSDR 1995). De La Torre-Roche et al. (2009) conducted “a comprehensive determination of soil-borne polycyclic aromatic hydrocarbons (PAHs) in El Paso, Texas”. Based on this effort, they found that the distribution of PAHs with four or more rings (NOTE: these correspond to the PAHs of concern found in the surface soil at the HCAFS) suggested to De La Torre-Roche et al. (2009) that the source of PAHs in soil was from pyrogenic activities (residential burning, vehicle emissions, or power generation). Although the HCAFS is located in a generally rural area, the facility-use has been similar to an urban or an industrial/commercial site. As noted in Section 1, the site was used by the Air Force as a radar tracking and investigation facility from 1952 to 1968. From approximately 1969 to 2002 the site was used by the IDoC for a minimum security prison. Photographs taken during the SSI (TtEC 2008) show above-ground storage tanks for vehicle fuels and used oil drums owned by IDoC near the Paint Shop Building, which is within Coal Area C EU. This indicates that vehicle maintenance was performed by IDoC, which also likely resulted in vehicular traffic within the HCAFS that was higher than typical levels in rural areas. Currently, the site is used by Peoria County for law enforcement training. All of these site uses have required regular access by motor vehicles, with accompanying vehicle emissions and road runoff. In order to examine the possibility that such emissions are contributors to the PAHs in the surface soil at the HCAFS, it is necessary to discuss the distribution of PAHs across the site, rather than as associated with specific EUs. The following discussion focuses on the occurrence of benzo(a)pyrene because it is the compound that most frequently exceeds standards and has the greatest impact on the risk evaluation.

Figures 4-15 and 4-16 show the distribution of benzo(a)pyrene across the HCAFS. On Figure 4-15, sample locations indicated in blue are those where the concentration of benzo(a)pyrene is below the

TACO residential cleanup objective (90 µg/kg), while on Figure 4-16, the locations shown in blue are those where the concentration of benzo(a)pyrene is below the TACO industrial/commercial cleanup objective (800 µg/kg). Inspection of Figure 4-15 shows that the highest proportion of samples with concentrations below the residential objective occurs at the northern end of the facility, furthest from State Highway 116 (Farmington Road), and at the end of the main road of the facility. The EUs in this area are Coal Area A and the Vehicle Wash Rack. The lowest proportion of the occurrence of these low concentrations is at the Coal Area B EU, which is located approximately 100 ft from Farmington Road. Since, based on the available information, site activities were similar at the two coal areas, it is expected that the distribution of benzo(a)pyrene concentrations would be similar. The lack of similarity suggests the possibility of an additional source of benzo(a)pyrene on the southern portion of the HCAFS. At the Main Entrance EU, a suspect UST (see Figure 4-15 AND 4-16 for location) is the assumed source of PAH contamination. However, there are sample locations at the Main Entrance EU that are further than 100 ft from the suspect UST, making it unlikely that they were impacted by spills associated with the UST, that have benzo(a)pyrene concentrations exceeding the residential criterion of 90 µg/kg and the industrial criterion of 800 µg/kg (Figure 4-15). Inspection of Figure 4-16 shows that the benzo(a)pyrene concentration is below the TACO industrial/commercial objective at 47 locations and above the objective at 18 locations. Note that with six exceptions, all locations at which the industrial/commercial objective is exceeded are immediately adjacent to the road. At the Coal Area B EU, three samples exceeded the objective and all three are more than 10 ft from a road. These samples were collected from a low area that appears to be a collection point for runoff. At Coal Area C EU, a cluster of samples with benzo(a)pyrene concentrations that exceeded 800 µg/kg was collected on the east side of the Maintenance Building (Figure 4-16). These samples were collected near an outlet for a drain that originated from the Maintenance Building.

According to Bradley et al. (1994), the concentration of benzo(a)pyrene found in urban soils in New England ranged from below the detection limit to 13 mg/kg, and was found above the detection limit in 57 of 62 samples. Bradley et al. (1994) also found that, based on testing for equality of variance and means, the difference between the total PAH concentrations near pavement (average of 22 mg/kg) and the total PAH concentration away from pavement (eight mg/kg) was statistically significant.

Electric Power Research Institute (EPRI 2000) conducted a literature review of PAHs in soil. The objective of the review was “to identify typical levels of background PAHs in environmental media, particularly surface and near surface soils” (EPRI 2000). A summary of benzo(a)pyrene concentrations presented in the EPRI review is shown below:

Sample Description	Average benzo(a)pyrene concentration (mg/kg)
New England Urban Soils*	1.32
Jackson, Michigan Urban Soils (school samples)	1.03
Jackson, Michigan Urban Soils (residential samples)	0.610
Six Rural New England Soils:	
Forest Soil	0.040
Forest Soil	0.040
Forest Soil	0.240
Forest Soil	1.30
Garden Soil	0.09
Plowed Field Soil	0.90
Rural Soil Samples in Wales	0.029
Urban Soil Samples in Wales	0.545
Norwegian Forest Surface Soils	0.023

Source: EPRI 2000 [*attributed to Bradley et al (1994)]

For purposes of comparison, a similar summary of benzo(a)pyrene concentrations in each of the EUs at the HCAFS shows:

Exposure Unit	Average benzo(a)pyrene concentration at the HCAFS (mg/kg)
Coal Area A	1.03
Coal Area B	2.72
Coal Area C	3.0
Vehicle Wash Rack	1.4
Main Entrance	0.97

Comparison of the two data sets shows that the concentration of benzo(a)pyrene at the Coal Area B, Coal Area C, and Vehicle Wash Rack EUs are above the range of the concentrations shown in the data presented in the EPRI review. However, it should be noted that the data set reported in EPRI does not present specific information regarding sample locations. As stated in the above discussion of PAHs in the surface soil of each of the EUs, an acknowledged source of PAHs is vehicular traffic. When PAH concentrations near roads are examined, it becomes apparent that surface soils near roads do have increased concentrations of PAHs.

Choi et al. (2009) have shown there is a relationship between PAHs in soil and proximity to roads. According to Choi et al. (2009), “Sampling sites that are closer to major traffic arteries and local settlements have higher soil concentrations and a higher relative abundance of heavier PAHs than truly remote sites at higher elevations.” Bryselbout et al. (2000) conducted sampling and analysis of PAH concentrations in soil along road side slopes in a mountainous (non-urban) area of Canada. This study found that the concentration of benzo(a)pyrene in soil two meters up the side slope was 33,924 µg/kg

(33.9 mg/kg). The concentration in the soil at four meters up the side slope was 6188 µg/kg (6.2 mg/kg), and at six meters the concentration was 12,241 µg/kg (12.2 mg/kg). None of the benzo(a)pyrene concentrations reported at the HCAFS exceed the maximum concentration reported by Bryselbout (2000).

In 2002, EPRI published the results of sampling and analysis conducted to examine the distribution of PAHs in soils in populated areas. Samples were collected from shallow soils at two depth intervals: 0 to 2.54 cm (0 to one inch) and 2.54 to 15 cm (one inch to six inches) below grade. Although the areas sampled for this study have a population density of greater than 1000 people per square mile, the results have relevance to the issues at the HCAFS, since the study included sampling of road rights-of-way and municipal facilities. Municipal facilities were defined as used for public areas such as police stations, fire stations, and town buildings (EPRI 2002). Municipal facilities are included in this discussion since there are some similarities to historic land uses at the HCAFS. The concentrations of benzo(a)pyrene reported for 57 samples from rights-of-way ranged from 2.06 to 3580 µg/kg (0.002 to 3.6 mg/kg). It is notable that the range of concentrations reported by EPRI are significantly lower than the concentrations reported by Bryselbout (2000) and are, therefore, considered to be conservative. The concentrations for the 61 samples from municipal facilities ranged from below the detection limit to 11,700 µg/kg (0 to 11.7 mg/kg). Comparison with the average concentrations for benzo(a)pyrene at the HCAFS shown above indicates that the concentrations at the HCAFS are well within this range.

Zehetner et al. (2009) investigated the distribution patterns of contaminants in topsoil across a highway-forest interface near Vienna, Austria, in order to assess their spatial distribution. They found that all contaminants, including PAHs, reached background concentrations between five and 10 meters (16.4 ft and 38.2 ft) from the road curb. Harrison and Johnston (1985), however, examined the deposition PAHs and other contaminants at distances away from the M-6 motorway in England. They reported that 11 PAHs were found up to 220 meters (721 ft) from the road, although background concentrations were reached at 40 to 50 meters (131.2 ft to 164 ft) from the road edge. It should be noted that all the EUs at the HCAFS are within 100 ft of a road.

Based on the above discussion, it is reasonable to conclude that normal road use has contributed PAHs to the surface soil at the HCAFS. For three of the EUs (Coal Area A, Vehicle Wash Rack, and the Main Entrance), the road and vehicular traffic are, at least, the major source of PAHs. Even at the Coal Area B EU, roads are likely to also be a major contributor, since the sample locations that exceed the TACO objective are located in an area that appears to be a collection point for surface runoff. At the Coal Area C EU, the distribution of benzo(a)pyrene suggests that roads and vehicular traffic contribute to PAH exceedances because, with the exception of the samples collected near a drain outlet from the Maintenance Building, the highest concentrations occur adjacent to the roads. Although no specific sources of PAHs have been identified at the Maintenance Building, the possibility of PAHs having been used in the building cannot be ruled out, based on the current data. As noted above, the documented range of transport of PAHs from roads is up to 164 ft and the exceedances at the Coal Area C EU fall well within this range.

5. CONTAMINANT FATE AND TRANSPORT

5.1 SUMMARY OF CONTAMINANTS OF CONCERN (COCs)

The nature and extent of contamination identified by the investigations conducted to date at the HCAFS are discussed in Section 4. Prior to development of the sampling approach for this RI, a conceptual site model was developed based on the data obtained during the previous sampling episodes. Based on the SI and SSI results, the model presented a simplified depiction of conditions at the site with respect to the contaminant sources, migration pathways, and important chemical and physical processes. According to that model, the primary transport mechanisms are for surface soil and subsurface soils. The model assumes that the COPCs are PAHs and metals (also based on the SI and SSI results). These contaminants can be deposited in place in coal storage areas, transported through air-borne and water-borne particulates with sorbed chemicals, or through dissolution in infiltrating water. With the inclusion of the data collected during this RI, this information is further developed in this section to enhance understanding of how past operations may have impacted the surrounding environment and potential receptors, and realistically describe current and potential migration in the future, as well as the resulting levels of contamination. The results of the fate and transport analysis are the basis for quantifying current and future levels of contaminant exposure by human and ecological receptors.

The process of evaluating fate and transport mechanisms requires assumptions based on professional judgment. This judgment is especially important when information such as the specific sources of the contaminants is not known.

Section 5.2 discusses contaminant persistence. Section 5.3 identifies and discusses potential contamination migration pathways. Section 5.4 describes the processes related to contaminant migration.

The COPCs that were identified in the WP (GEO 2008d) were: metals in groundwater, arsenic in subsurface soil at the Coal/Coal Ash Storage Areas, PAHs in the surface soil at all of the EUs, and PAHs in the subsurface soil at the Vehicle Wash Rack EU. Based on the results of sampling conducted for this RI, the most significant of these are PAHs in surface soils. The PAH compounds most consistently detected above the Illinois EPA standards are benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. In subsurface soils, only benzo(a)pyrene was found above the Illinois EPA standard in two locations sampled for this RI. There are several potential sources for these compounds: the coal storage areas, residual contamination from USTs, operations at the Vehicle Wash Rack, and runoff from streets and roads. The exact source(s) cannot be identified. Arsenic was found in the subsurface soil above the Illinois EPA standard. However, the average arsenic concentrations are below or slightly above the background concentration for Illinois soils. Arsenic was not found above Illinois EPA criteria in any of the filtered groundwater samples.

Inorganic contaminants found above the Illinois EPA criteria in groundwater include aluminum, arsenic, iron, and lead in unfiltered samples. Manganese was identified above the criteria in both filtered and unfiltered samples. Iron, aluminum, and lead had also been found to exceed the Illinois EPA standard in previous sampling events and are addressed briefly. These previous results largely are associated with unfiltered samples and therefore may represent as the effects of suspended particles on groundwater quality.

Shallow groundwater at the site, from the surface to roughly 15 ft bgs, has been reported to flow to the east/southeast (Beling 1999). Based on the site topography, there may be a groundwater divide near the middle of the site, with a groundwater flow path to the northwest.

5.2 CONTAMINANT PRESISTENCE

Several transformation processes are believed to affect the persistence of chemicals in the environment. Persistence is the tendency of a contaminant to remain, over time, unchanged in composition, as well as chemical and physical state. The primary processes affecting contaminant persistence in the environment include the following:

- Abiotic transformation and degradation processes such as hydrolysis, photolysis, and oxidation/reduction reactions; and
- Biological transformation and degradation processes.

Transformation and degradation processes are discussed below for classes of organic and inorganic compounds detected at the site.

5.2.1 Metals in Groundwater

Persistence of a contaminant in groundwater depends on the chemical structure of the contaminant, the microbial population, the nutrients available, the aquifer composition and structure, and the chemistry of the water. Metals in a groundwater system undergo fixation and adsorption, which effect their persistence and mobility; precipitation has the most significant effect on fixation. Persistence of a contaminant in groundwater is also affected by the transport rate of the water, including groundwater gradient and precipitation/recharge (Dzurik 2003). Manganese generally occurs in groundwater as soluble manganous bicarbonate (HDR). Manganese and its compounds, with a half-life of over 200 days, are persistent in both water and in soil. The half-life of manganese compounds in water is over 200 days (Vincoli 1996).

The extent to which manganese dissolves in groundwater depends on the oxidation reduction potential (Eh) and pH. The pH of the groundwater at the HCAFS ranges from 6.5 to 7.5, while Eh measured during the November 2008 sampling event ranged from -60 to 112 mV, with an average value of 36 mV (i.e., relatively reducing). Under these geochemical conditions, the highly soluble Mn^{2+} is the predominant species, according to published stability diagrams for soluble and solid forms of Mn (Stumm and Morgan 1981).

Thus, the naturally occurring manganese nodules that are characteristic of the soils that have been mapped at the HCAFS, and that have been observed in the soil at the HCAFS, are likely an ongoing source of manganese to groundwater. Therefore, it can be anticipated that manganese will persist in groundwater at the HCAFS.

The mobility and persistence of iron in groundwater is also strongly dependent on Eh and pH. Based on the Eh and pH conditions described above, the predominant species of iron is Fe^{2+}, which is also soluble. The DO content of the groundwater at the HCAFS, however, is relatively high for groundwater, ranging from 2.58 to 4.83 mg/L. At DO concentrations above 1 mg/L, iron will begin to precipitate, which provides an explanation for the significantly higher iron concentrations in unfiltered samples, when compared to the concentrations in filtered samples (Castle 2007).

The maximum solubility of lead in hard water is about 30 µg/L at pH>5.4 and the maximum solubility of lead in soft water is approximately 500 µg/L at pH>5.4 (ATSDR 2007). In the environment, the divalent form (Pb2+) is the stable ionic species of lead. The adsorption of lead to organic matter, clay and mineral surfaces, and co-precipitation and/or sorption by hydrous iron and manganese oxides increases with increasing pH (ATSDR 2007). At pH values above six, lead is either adsorbed on clay surfaces or forms lead carbonate (McLean 1992), Most lead is retained strongly in soil, and very little is

transported through runoff to surface water or leaching to groundwater, except under low pH conditions (ATSDR 2007).

The limited conditions of lead solubility provide an explanation for the elevated lead levels in unfiltered samples, as compared to the concentrations in the filtered samples. Based on the pH levels of the groundwater at the HCAFS, it is unlikely that lead will enter the dissolved phase.

Aluminum in groundwater has similar properties to lead in that its solubility decreases as pH increases and it is removed from solution at pH of five to six (ATSDR 2008). As with lead, it is unlikely that aluminum will enter the dissolved phase, but it is likely to persist in the solid phase.

5.2.2 PAHs in Soil

PAHs are persistent in soil both because of their low solubility and because natural processes of degradation are inefficient for PAHs. Dissolution is not a significant process because the PAHs have low solubility. PAHs, because they are hydrophobic, tend to be adsorbed onto soil particles, which reduces their availability for biodegradation (Mulder 1999). According to Al-Turki (2009), photooxidation has limited effect simply because, once the PAHs are in the soil, they are usually not exposed to sunlight. In degradation studies of soils contaminated with PAHs, the half-life values ranged from six to 16 years (Al-Turki 2009). A recent study of the effect of regular tillage and cropping on the dissipation of PAHs in soil determined that rates of dissipation are slow and that little significant decrease in PAH concentration was seen after the first six months (Saison 2004).

Based on the nature and behavior of PAHs in soil, one can expect that they will be persistent in the surface and subsurface soil at the HCAFS.

5.2.3 Arsenic in Soil

Both abiotic and biotic processes may affect the speciation of metals in soil or groundwater. Although speciation may affect metal mobility, it does not affect metal persistence. Metals will remain in the environment in one form or another. Arsenic is largely immobile in agricultural soils and tends to concentrate and remain in soil indefinitely (ATSDR 2007). Arsenic exists in soil as either arsenate or arsenite. Arsenic forms insoluble precipitates with iron, aluminum, and calcium, and adsorbs on iron oxyhydroxides, magnesium oxides, and other soil minerals. The most influential factor affecting arsenic adsorption is the iron content of the soil (ATSDR 2007); it should be noted that the soils at the HCAFS are high in iron. Maximum adsorption of arsenite (As^{+3}) occurs at pH of three to four with a gradual decrease in adsorption as pH increases. Adsorption of arsenite is also pH dependent. At higher pH, arsenite predominates in the soil. Based on the Eh/pH of the groundwater, the stable form of arsenic would be arsenite (Geological Survey of Japan 1988)) and the maximum adsorption of arsenite has been found to occur at pH seven (McLean 1992). At higher pH, the solubility of arsenic is increased and it is more subject to leaching. Given that the pH of the soil at the HCAFS ranges from 6.7 to 7.2, one can expect that arsenic in the soil will be persistent. This expectation is reinforced by the fact that arsenic has been found reported above the detection limit in only a small number of the groundwater samples from the HCAFS.

5.3 POTENTIAL PATHWAYS OF MIGRATION

In general, numerous potential migration pathways exist in areas contaminated with hazardous materials. Such migration routes include, but are not limited to, groundwater, surface water, overland migration of dissolved or adsorbed contaminants, and lateral migration of gases through the subsurface and atmospheric migration, via particulate or volatile emissions.

As a result of the nature and extent of contamination and the site-specific conditions, the potential migration pathways of contaminants at the site fall into the following categories: vertical and horizontal migration through the unsaturated and saturated zones; surface transport of shallow soil contaminants via surface runoff and snow melt; and particulate re-suspension and atmospheric transport in a prevailing downwind direction, or during activities that result in soil disturbance. The PAHs at the HCAFS facility have impacted surface soils and all of the migration routes are possible. It is unknown at this time if the inorganic constituents in groundwater are naturally occurring or the result of site activities. However, transport in groundwater is considered in Section 5.4. A potential migration route for arsenic found in the subsurface soil is to groundwater via dissolution.

The following discussion evaluates the potential routes of migration from the EUs.

Metals in groundwater

Vertical and lateral migration in groundwater: Of the metals identified above, only manganese appears to occur in the dissolved phase, according to the Illinois EPA standard in groundwater. The migration pathway of manganese, therefore, is along the groundwater pathway, as discussed further in Section 5.4.3. Iron, lead, and aluminum appear not to be in the dissolved phase. Therefore, under current conditions, lateral migration in groundwater is a limited pathway. However, as discussed below in Section 5.4.2, should the DO in the groundwater decrease, iron and manganese could dissolve and the groundwater pathway could become significant. Lead and aluminum are unlikely to enter the soluble phase without a significant increase in the pH of the system and, therefore, lateral migration in groundwater is not a potential pathway.

PAHs in surface soils

Vertical and horizontal migration through the unsaturated and saturated zones: This pathway is considered unlikely at the HCAFS given the hydrophobic nature of PAHs and the strong tendency for these compounds to partition on soil organic matter (see Section 5.4 below for further discussion). This is supported by the low to undetectable levels of PAHs in subsurface soil and groundwater samples at the HCAFS (see Section 4.5).

Surface transport via surface runoff and snow melt: This is considered a viable pathway for PAHs contained in road dust to migrate towards the unpaved, grass-covered areas adjacent to the roadways. However, given the relatively flat topography at the HCAFS (Section 3.4), overland lateral migration of PAHs is not considered to be a significant migration route.

Particulate re-suspension and atmospheric transport: Because the elevated PAHs in surface soils were measured in grass-covered areas, atmospheric transport is probably likely to occur only when the areas are disturbed and dust is produced. Nonetheless, this migration route is considered when quantifying risks from dermal exposure of site receptors to airborne PAHs from surface soils (see Section 6).

PAHs and arsenic in subsurface soils:

Vertical and horizontal migration through the unsaturated and saturated zones: Similar to PAHs in surface soils, this migration pathway is considered unlikely for PAHs due to their low aqueous solubility and soil partitioning properties (see further discussion in Section 5.4). The significance of this pathway for arsenic depends on the geochemical conditions at the site, as discussed in Section 5.2.3. Note that arsenic was not detected (detection limit of three µg/L) in many of groundwater samples collected to date from the HCAFS; this suggests that mobilization of arsenic in soil is probably not a significant migration pathway.

Surface transport via surface runoff and snow melt: This does not apply to subsurface soils.

Particulate re-suspension and atmospheric transport: This pathway is applicable to scenarios where the subsurface soils are disturbed through tilling and excavations. This migration route is considered when quantifying risks from dermal exposure of site receptors to airborne PAHs and arsenic from subsurface soils (see Section 6).

5.4 CONTAMINANT MIGRATION

This section describes the processes that govern migration of contaminants through soil and groundwater. Fundamental processes that affect the migration of pollutants through soil and groundwater include adsorption, volatilization, dissolution and precipitation, advection and dispersion, and diffusion. As stated above, the COCs are PAHs in surface soil, arsenic in subsurface soil, and inorganic constituents in groundwater. Based on the nature of these contaminants and the characteristics of the HCAFS, environment adsorption is the most significant factor affecting the potential for contaminant migration and is discussed in more detail below. Volatilization is not significant for the PAHs because their vapor pressures are extremely low. Vapor pressures for the PAHs found to exceed standards in the shallow soil at the HCAFS range from 1.1E-7 Torr (a unit of pressure that is equal to approximately 1.316×10^{-3} atmospheres or 133.3 pascals). for benzo(a)anthracene (USEPA, 2004d), to 1.0E-10 Torr for benzo(g,h,i)pyrene (USEPA 2004f), dibenzo(a,h)fluoranthene (USWPA 2004g), and indeno(1,2,3-cd)pyrene (USEPA 2004h). Volatilization is not effective for arsenic at the HCAFS since it is found in subsurface soils. Because it is not exposed at the surface, it is not available for volatilization. In any case, most forms of arsenic are not volatile at standard temperature and pressure. Manganese compounds have a negligible vapor pressure. Therefore, it is also unlikely that volatilization is an effective mechanism for manganese migration (ATSDR 2008). Dissolution is not significant for arsenic or PAHs. Arsenic has limited solubility and PAHs are insoluble in water. Dissolution is a potentially significant factor for manganese and iron and is discussed below in Section 5.4.2. Dissolution is not a likely mechanism for lead and aluminum due to the pH of the groundwater.

Advection and dispersion are applicable only to contaminants that are dissolved in groundwater. Therefore, they are potentially significant for manganese at the HCAFS and are discussed below. Diffusion is not considered to be a factor in manganese migration in groundwater, since it involves movement of a contaminant in groundwater from an area of high concentration to an area of low concentration. There is no indication of a significant manganese concentration gradient in the groundwater of the site. These two processes could become significant for the other inorganic groundwater constituents only if the site conditions change.

5.4.1 Adsorption

The migration of pollutants through the subsurface is greatly affected by the extent to which they are adsorbed to soil. Adsorption is defined as the accumulation of ions or molecules at the interface between a solid phase and an aqueous phase. Adsorption differs from precipitation in that the contaminant does not form a new three-dimensional solid phase, but is instead associated with the surfaces of existing soil particles.

According to Mopoung (2006), arsenic compounds tend to form insoluble complexes with soils, which renders the arsenic immobile in the soils due to adsorption. As described in Section 5.2.3, the pH of the soil at the HCAFS is near neutral and the maximum adsorption of arsenic, in the form of arsenite, is at pH seven. This, combined with the lack of arsenic in groundwater, indicates that arsenic is adsorbed in the soil column. Lead is strongly sorbed to organic matter in soil, which is demonstrated by the detection of lead only in unfiltered groundwater samples. It should be noted that, based on the concentrations of

lead in the unfiltered samples collected for this RI, the lead load in the suspended particles ranges from below the detection limit to 25µg/L.

Manganese can be adsorbed to other oxides, hydroxides, and oxyhydroxides through ligand exchange reactions. In addition, via cation exchange reactions, manganese ions and the charged surface of soil particles form manganese oxides, hydroxides, and oxyhydroxides, which, in turn, form adsorption sites for other metals. The adsorption capacity of manganese is highly variable. In groundwater, in the presence of DO, Mn^{4+}, a relatively insoluble form, can be reduced to the Mn^{2+} form, which is water soluble and easily released to groundwater (ATSDR 2007). As discussed above in Section 5.2.1, the stable form of manganese in the groundwater at the HCAFS in Mn^{2+} .This suggests that absorption is not a controlling factor for manganese.

A determining mechanism for the behavior of PAHs in soil is adsorption. According to Al-Turki (2009), PAHs are significantly hydrophobic. As a result, they tend to be adsorbed on soil particulates, especially on the organic fraction. This binding may make the PAHs unavailable to biologic systems and degradation is inhibited. Distribution coefficient is the ratio of the soil and groundwater concentrations of a compound at equilibrium. The distribution coefficient can be used to estimate the potential for attenuation of a contaminant as a result of adsorption. The distribution coefficients of the PAHs that have been found above criteria in surface soils at the HCAFS range from 6.4E+4ml/g for benzo(a)anthracene (USEPA 2004i), to 5.8E+5ml/g for dibenzo(a,h)anthracene (USEPA 2004j). For comparison, the distribution coefficient for trichloroethylene (TCE), which is known to be a groundwater contaminant, is 3.3E-1ml/g (USEPA 2004k). TCE is not readily adsorbed and therefore, when it is introduced to soil, it does not significantly adsorb which effects groundwater. PAHs, with very high distribution coefficients, are adsorbed by soil and do not readily migrate to groundwater.

5.4.2 Dissolution and Precipitation

The transport and partitioning of manganese in water is controlled by the solubility of the specific chemical form present, which in turn is determined by pH, Eh (oxidation-reduction potential), and the characteristics of the available anions. Manganese occurs in two valance states: divalent and trivalent. Although the chlorides, nitrates, and sulphates are soluble in water, the oxides, carbonates and hydroxides are only sparingly soluble. However, in groundwaters subject to reducing conditions, manganese can be leached from the soil and occur in high concentrations. The divalent form (Mn2+) predominates in most water at pH 4–7, but more highly oxidized forms may occur at higher pH values, or result from microbial oxidation (ATSDR 2000). As shown in Section 5.2.1, based on the Eh and pH conditions in groundwater at the HCAFS, the stable form of manganese, Mn^{2+}, is soluble. This is supported by the fact that the manganese concentrations reported for filtered groundwater samples are the same, or are only slightly lower, than those reported for unfiltered groundwater. This indicates that, although there is some manganese associated with the suspended solids, there is significant dissolved manganese in the groundwater. Therefore, dissolution is a mechanism for manganese migration.

As presented in Section 5.2.1, iron appears to be kept from solution by the DO in the groundwater at the HCAFS. However, DO can vary with recharge, so if the DO decreases, iron could enter solution and then precipitate, if DO rises again.

5.4.3 Advection and Dispersion

Advection describes mass transport due simply to the flow of the water in which the mass is dissolved. The direction and rate of transport coincide with those of groundwater. But dissolved compounds are subject to adsorption and attenuation by the solid surfaces that the water contacts, resulting in a solute velocity that is less than the water velocity. Calculation of groundwater velocity, without retardation, is a conservative approach to estimating transport. Using the equation:

$$v = \frac{Kdh}{n_e dl}$$

Where:

v = groundwater velocity

K = hydraulic conductivity (estimated at .12 to 1.2 meters per day for loess derived soils [USDA Undated])

$\frac{dh}{dl}$ = hydraulic gradient [0.095 meters per meter (TtEC 2008)]

n_e = effective porosity (estimated at 0.15 to .35 [Wiedemeier, 1999])

Based on this calculation, the groundwater velocity at the HCAFS is in the range of .076 to .76 meters, per day. Disregarding any effects of retardation, the manganese, and any other dissolved inorganic constituents in the groundwater at the HCAFS, will move from the site at a rate of 91 to 910 ft, per year. Based on observations during groundwater sampling, during which wells dried up with low flow pumping and were slow to recharge, it is likely that the lower hydraulic conductivity and thus, slower velocity, are more representative of actual site conditions. It should be noted that use of groundwater for water supply is not permitted in the Village of Hanna City due to issues unrelated to the HCAFS. Therefore, there is no downgradient human receptor.

6. BASELINE HUMAN HEALTH RISK ASSESSMENT

6.1 INTRODUCTION

This section documents the baseline HHRA for the HCAFS. The purpose of the baseline HHRA is to evaluate potential human health risks resulting from exposure to soil and groundwater contamination if no remedial action is taken. The assessment was performed in accordance with the RI WP (GEO 2008d), using methods described in USEPA guidance documents (e.g., USEPA 1989, USEPA 2004, USEPA 2009).

Data collected at the HCAFS from the SI, SSI (TtEC 2008), and this RI (presented in Section 4) were aggregated according to the following environmental media: surface soil (defined as soil from 0 to 0.5 ft bgs), subsurface soil (defined as soil from depths greater than 0.5 ft bgs), and groundwater. In evaluating risk from soil contamination, each AOPC (Figure 1-2) was considered as a separate EU. To evaluate risks from exposure to groundwater, the entire site was considered as a single EU.

The rest of this section is organized according to the five major components of the HHRA process:

- Hazard identification (Section 6.2) – A summary of the data used in the HHRA is presented, including an assessment of data quality and usability. This subsection also describes the methods and results for screening site data to identify COPCs that were then carried through the quantitative assessment.
- Exposure assessment (Section 6.3) – This subsection focuses on the identification of potential site receptors based on current and unrestricted land use. It also includes an evaluation of pathways by which receptors may be exposed to site contaminants, as well as quantified exposure estimates through completed pathways for each site receptor.
- Toxicity assessment (Section 6.4) – This subsection lists the carcinogenic and non-carcinogenic toxicity values obtained from the hierarchy of sources recommended by USEPA.
- Risk characterization (Section 6.5) – This subsection presents quantitative estimates of potential cancer risks and non-cancer health effects derived from the integration of contaminant toxicity values (Section 6.3) and exposure assessment (Section 6.4).
- Uncertainty analysis (Section 6.6) – This subsection includes a discussion of the site-specific factors that lead to uncertainties in the risk assessment and the overall impact of these uncertainties on the estimated risks and hazards.

6.2 HAZARD IDENTIFICATION

The hazard identification process involves the following tasks:

- Review of available data (Section 6.2.1)
- Assessment of data quality (Section 6.2.2)
- Screening of the available data to identify COPCs that were carried through the quantitative risk assessment (Section 6.2.3)

6.2.1 Review of Available Data and Assessment of Data Quality and Usability

The data set used in the HHRA consisted of surface and subsurface soil samples collected during the SI in July 1996, the SSI in April 2006 (TtEC 2008), and this RI in August and November 2008 (Section 4 of this report). During the July 1996 sampling event, soil and groundwater samples were collected from areas where DoD operations may have resulted in contaminant releases. These areas or AOPCs included: three former Coal/Coal Ash Storage Areas (A, B, C), the Maintenance Building, the former Paint Shed, Vehicle Wash Rack, the Main Entrance, the abandoned Tile Field and septic tank, and Lagoon area (see Figure 1-2). During the April 2006 SSI, additional soil and groundwater samples were collected from all areas sampled during the July 1996 sampling event, except for the Lagoon Area, which had been since been categorized as having PRP issues (GEO 2008d). The soil and groundwater data from the SI and SSI were then compared against TACO screening criteria, and the screening results were used to focus the sampling conducted for this RI (TtEC 2008; GEO 2008d). Specifically, screening of the SI and SSI data showed the following chemicals were no longer a concern:

- VOCs and PAHs in soil and groundwater from the abandoned Tile Field.
- VOCs in soil and groundwater from all AOPCs.
- PCBs in soil from the Maintenance Building Area (this is the only AOPC were PCB-release during DoD operations was considered possible).
- Metals in surface soil (0 to 0.5 ft) from the Coal Areas and the Vehicle Wash Rack.
- Lead in surface soil (0 to 0.5 ft) from the former Paint Shed. Except for arsenic in the Coal Areas (see below), metals in subsurface soils (greater than 0.5 ft) from these AOPCs were also below TACO screening criteria.

Exceedances of screening levels indicated that the following COPCs needed further investigation:

- PAHs in surface soil (0 to 0.5 ft) at the former Coal/Coal Ash Storage Areas (A, B, C), the Maintenance Building, the former Paint Shed, the Vehicle Wash Rack, and the Main Entrance.
- PAHs in subsurface soil (greater than 0.5 ft) at the Vehicle Wash Rack.
- Arsenic in subsurface soil (greater than 0.5 ft) at Coal Areas A, B, and C.
- Metals in groundwater from several sampling locations within the HCAFS.

The exceedances noted above suggested the need for quantitative assessment of risks and hazards from exposure to these COPCs, and the RI field sampling and analysis was then focused on obtaining additional information to support risk calculations. Specifically, an objective for the RI field sampling was to collect enough samples so that when the SI, SSI, and the RI data were combined, there would be a sufficient number of data points from each EU from which exposure point concentrations (EPCs) can be derived (GEO 2008d). In this HHRA, Coal Area A, Coal Area B, the Main Entrance and the Vehicle Wash Rack AOPCs were each considered as separate EUs. Because of their proximity to each other, Coal Area C, the Maintenance Building, and the Paint Shed were combined into one EU, herein referred to as the Coal Area C EU.

Tables 6-1 through 6-8 show summaries of data for PAHs in surface soil at each of the EUs (Tables 6-1 to 6-5), PAHs in the subsurface soil at the Vehicle Wash Rack EU (Table 6-6), arsenic in subsurface soil at the Coal Area EUs (Table 6-7), and metals in groundwater (Table 6-8). Section 4 of this report includes a presentation and discussion of contaminant spatial distribution. Tables 4-5 to 4-11 have the complete listing of analytical results from the SI, SSI, and RI used in the HHRA. The chemical analyses results were reduced to arrive at the final data set for the HHRA using the following rules:

- Analytical results rejected by data validation (indicated by an "R" qualifier) were removed from the final data set.
- Before calculating the statistical parameters in Tables 6-1 and 6-7 (statistical parameter were not calculated for the groundwater results in Table 6-8), non-detected results (with "U" qualifiers) were substituted with ½ the reporting limit. Note that this substitution of non-detected results was not done when EPCs were estimated (see Section 6.3.3 below).
- For field duplicates, the average of the duplicate concentrations was used as the final value in the HHRA data set.

For PAHs in surface soil (Tables 6-1 to 6-5), there were nine to 28 data points collected from distinct locations at each EU (see Figures 2-1 through 2-5 for sample locations). The subsurface soil samples (Table 6-6 and 6-7) were collected from depths between 0.5 ft and eight ft bgs, with a majority of the samples collected from two to three ft and four to five ft bgs (see Figures 2-6 through 2-9 for soil boring locations). The total number of subsurface soil data points from each EU ranged from 12 to 17.

Unfiltered groundwater samples have been collected from 25 locations and analyzed for lead; of these 25 locations, 18 samples were also analyzed for other metals (Table 6-8; see Figure 2-10 for locations). These samples were collected during the SI in July 1996, during the SSI in April 2006 (TtEC 2008) and in November 2008 (this RI).

6.2.2 Data Quality Assessment

Soil and groundwater samples from the SSI and RI were analyzed using standard methods published by USEPA. Soil samples for PAH analysis from both the SSI and RI were extracted using USEPA Method 3541 (Automated Soxhlet Extraction) and the extracts were analyzed using USEPA Method 8270 (Gas Chromatography/Mass Spectrometry of Semi-Volatile Organic Compounds). Soil samples for metals analysis (except mercury) from the SSI and RI were acid digested using USEPA Method 3050, followed by analysis of the digestates, using USEPA Method 6010 (Inductively Coupled Plasma – Atomic Emission Spectrometry). Mercury was quantified in the SSI and RI samples using USEPA Method 7470 (Cold Vapor Atomic Absorption Spectroscopy). The soil samples from the RI were also digested using USEPA Method 3050 and analyzed using USEPA Method 6010, but only arsenic was quantified in the analyses.

Groundwater samples for metals analysis from the SSI were acid digested using USEPA Method 3010. The digestates were analyzed using USEPA Method 6010. In addition, to achieve lower detection limits for antimony and thallium below screening levels, groundwater samples from the SSI were acid digested using Method 3020 and the digestates were analyzed using element-specific atomic absorption methods (USEPA Methods 7041 for antimony; USEPA Method 7841 for thallium). Mercury was quantified using cold vapor atomic absorption (USEPA Method 7471). The RI groundwater samples were digested using Method 3005A (an acid digestion technique that is equivalent to Method 3010, which was used for the SSI samples). The digestates were then analyzed using USEPA Method 6010, the same method applied to the SSI groundwater sample digestates. Mercury was also quantified using USEPA Method 7471 in the RI groundwater samples. For the RI, there were no additional efforts to quantify antimony and thallium at lower detection limits in groundwater because these metals were not detected above screening levels in the SSI groundwater data.

The quality of the data sets from the SSI and RI were evaluated by a third-party data validator (see data validation reports in Appendix H). Ten percent of the SSI data set was validated using procedures and QC criteria in the Louisville Chemistry Guidelines [LCG (USACE 2002)], while the entire RI data set was validated using procedures and QC criteria in the Louisville Quality System Manual Supplement (USACE 2007) and the DoD QSM for Environmental Laboratories (DoD 2006). Although QC data

associated with the 1996 SI were not available, the data were still used in the HHRA because some of the higher PAH and metals concentrations were detected in these samples. The lack of QC information for the 1996 SI data set does not impact the overall quality of the HHRA because the 1996 data constitutes less than 10% of the combined SI/SSI/RI data set from each EU.

The primary data validation results for PAH analyses in the 2006 SSI are as follows.

- Analysis of check standards. Method reporting limit (MRL) check standards, required by LCG (USACE 2002), consist of a clean matrix spiked to a concentration equal to the reporting limit. Recoveries in MRL check standards were generally within control limits (70-130%). In some MRL standards, recoveries exceeded control limits for fluoranthene, fluorene, phenanthrene, anthracene, and chrysene. Associated field sample results were still deemed useable, but were qualified as estimated values ("J" qualifier) by the data validator.
- MS. MS consist of field samples spiked with known amounts of analytes. Recoveries in some of the MS samples were outside control limits (45 to135%) for fluoranthene (24%, 17%) and pyrene (21%, 22%). A closer inspection of the MS data [Table 6-9(a)] shows that poor recoveries for these compounds may be due to the original concentration in the sample being greater than the spike concentration, such that variability/uncertainty in the original concentration could have introduced uncertainty in calculating spike recoveries.
- Completeness. None of the PAH data were rejected. All data were considered useable.

The primary data validation results for metals analysis in the 2006 SSI are as follows.

- Analysis of check standards. Recoveries for calcium, iron, and manganese in some MRL check standards were outside LCG control limits (70 to 130%). The recoveries were greater than 130%. Associated field sample results were still deemed useable, but were qualified as estimated values ("J" qualifier) by the data validator.
- MS. Recoveries of some analytes in the MS [see Table 6-9(b)] were outside the LCG control limits (75 to 125%). The anomalous recoveries for aluminum, iron, calcium, and manganese may be due to spike recoveries being comparable to measurement errors in the original concentration. For example, the difference between duplicate manganese concentration measurements for MD-179119-30 [Table 6.9(b)] is 201.2 mg/kg, which is greater than the spike concentration of 63.8 mg/kg. This may explain the calculated recovery of -414% for this MS sample. MS for metals in groundwater samples were within control limits, except for antimony [Table 6-9(c)].
- Completeness. None of the metals data were rejected. All data were considered useable.

The following is a list of the primary data validation results for PAH analysis in the 2008 RI (this report; see third-party data validation report in Appendix H).

- Analysis of laboratory control samples. Laboratory control samples (LCS) consist of clean matrices spiked with known amounts of analytes. Recoveries and differences between repeat measurements of the LCS were within QC limits.
- PAHs were detected in one of the method blanks and the EBs collected during the August 2008 sampling event (see Table 2-4). The concentrations in the associated field samples were either below detection limits or more than 10 times the EB concentration. As such, qualification of the field sample results associated with this EB was unnecessary.
- MS. Recoveries for some analytes in the MS were outside control limits. A closer look at the MS results [Table 6.10(a)] indicate that the anomalous recoveries may be due to spike

concentrations being much lower than the original sample concentration. For example, the spike concentration for benzo(a)pyrene is 80 µg/kg, whereas the sample concentration in HCCBSS11010811 is 490 µg/kg. In this sample, the spike concentration is only approximately 16% of the sample concentration and is well within the measurement error range for duplicate PAH measurements. Based on the acceptable recoveries in the LCS and the matrix samples with low PAH concentrations [Table 6-10(a)], the anomalous recoveries in some of the MS samples are probably due to low spike concentrations, rather than being indicative of analytical problems.

- In cases were there was an undiluted and diluted result for a sample, the data validator rejected the measurement that was considered of inferior quality. No other data were rejected.

The following is a list of primary data validation results for metals analysis in the 2008 RI (this report; see third-party data validation report in Appendix H).

- Analysis of laboratory control samples. Recoveries and differences between repeat measurements of the LCS were within QC limits.
- MS. Recoveries of arsenic in all soil MS [Table 6.10(b)] were within QC limits. Recoveries of metals in groundwater MS were within QC limits, except for aluminum [125%, see Table 6.10(c)].
- EBs. Sodium (1260 µg/L) and zinc (5.1 µg/L) were detected in the EBs (see Table 2-5). Qualification of sodium analysis results in groundwater samples was not necessary because sodium concentrations in the groundwater samples were significantly higher (greater than five times) the concentration in the EB. Two of the zinc measurements, which were less than five times the blank contamination were qualified with a "B".
- Completeness. None of the metals data were rejected. All data were considered useable.

Based on the data validation results, the SSI and RI data sets are considered useable for the HHRA.

6.2.3 Risk Screening

To identify COPCs that were to be carried through quantitative HHRA, the data (summarized in Tables 6-1 through 6-8, also discussed in Section 4 of this report) were compared against published human health screening criteria. For soils, the screening criterion for a given chemical was set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives; the RSLs (USEPA 2008); and TACO Tier 1 soil component of the groundwater ingestion pathway remediation objectives for Class 1 groundwater. For groundwater, the screening criterion for a given chemical was set to the lowest of the TACO Class I groundwater objectives (identical to the Illinois Groundwater Quality Standards, 35 IAC 620 for metals), Illinois drinking water standards, and federal Maximum Contaminant Levels (MCLs). For chemicals without TACO or RSL, criteria were obtained from Illinois EPA's list of chemicals not in TACO Tier I Tables (Illinois EPA 2008). For nutrients in groundwater (i.e. calcium, magnesium, potassium, and sodium), the screening level was set to the TACO Class I groundwater standards for total solids (1200 mg/L; GEO 2008d). For data reported as non-detects, 0.5 the reporting limit was compared against the screening criterion. Thus, it was considered an exceedance if 0.5 the reporting limit exceeded the screening criterion. An exception to this rule was made for antimony and thallium. As mentioned previously (Section 6.2.2), during the SI and SSI, antimony and thallium were analyzed using methods specific to these elements with reporting limits that were below the screening levels. Antimony and thallium results from the SI and SSI analyses were below screening criteria, indicating that these elements were not chemicals of potential concern in the HCAFS groundwater. As such, it was not considered necessary to apply separate analytical methods to the RI

groundwater samples to quantify antimony and thallium. Furthermore, there are no indications of antimony and thallium sources in the soil analyses from the SI and SSI. The maximum concentration of antimony in soil in the SI/SSI data is 1.2 mg/kg, which is below the TACO background for this element in non-metro areas (3.3 mg/kg). The maximum detected concentration of thallium in soil in the SI data is 0.16 mg/kg, which is also below the TACO background for this element in non-metro areas (0.42 mg/kg). Thallium releases to the environment include the combustion of fossil fuels and petroleum-based products, ore combustion, cement manufacture, and metal milling (NLM undated). More recently, thallium is used mostly in manufacturing electronic devices, switches, and closures primarily for the semiconductor industry. It also has limited use in the manufacture of special glass and for certain medical procedures. Antimony is released to the environment from metal mining and refining; alloy production and use; production and use of antimony compounds in fire retardants, enamels, glass, ammunition primers, and fireworks; coal combustion; refuse and sludge combustion; and wood processing (NLM undated). Note that other than the combustion of fossil fuels and petroleum-based products, none of these release mechanisms are expected to have occurred at the HCAFS site, given its historical DoD-use as a radar station.

The data summary tables (Tables 6-1 through 6-8) show the chemicals for which the maximum detected concentrations (MDC) exceeded the screening levels and were selected as COPCs for quantitative HHRA. A point-by-point comparison of the soil and groundwater data with human health screening criteria was presented in Section 4 of this report (e.g., Figures 4-4, 4-6, 4-9, 4-11, and 4-13 for maps showing sampling locations with exceedances). As noted in Section 4.0, PAHs with consistent exceedances in surface soil among the EUs were benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. These are the PAHs with the lowest screening levels (15 to 150 µg/kg). At the Coal Area A EU (Table 6-1), one surface soil sample contained naphthalene (4100 µg/kg) at a concentration that exceeded the screening criterion (3900 µg/kg). Because the next highest naphthalene concentration (38 µg/kg) was significantly less than the screening level, naphthalene was not considered a COPC for Coal Area A EU, or any other EU. Chrysene in surface soil exceeded the screening level only at the Coal Area C EU (Table 6.3). For subsurface soils at the Vehicle Wash Rack EU, the PAHs with exceedances that were carried through the quantitative HHRA were benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

The screening value for arsenic in subsurface soils was set to 13 mg/kg, which is the regional background concentration for non-metropolitan areas in Illinois [IAC 742 (TACO), Appendix G, Table A]. Because this screening value was exceeded by the MDC at all three Coal Area EUs (Tables 6-7), arsenic was carried through quantitative HHRA.

For groundwater, the MDC for several metals exceeded screening criteria in unfiltered samples. However, in filtered groundwater samples, only manganese exceeded screening criteria (Table 6-8). As mentioned in Section 4.0, and further discussed in Section 6.6.2, the elevated levels of metals in the unfiltered samples were probably associated with suspended solids that were present in the samples.

Note that element-specific analyses to achieve lower detection limits for antimony and thallium were not included in the scope of the RI because these metals did not exceed screening criteria in the SI and SSI analyses As such, although the .5 x reporting limit for antimony and thallium during the RI were greater than screening criteria, these metals were not considered COPCs, based on the results of the SI and the SSI. The reporting limits for antimony in the 1996 SI and 2006 SSI were equal to or less than the screening level (six µg/L), and there were only two detections (3.9 and two µg/L) of 13 samples (see Table 4-5). The reporting limits for thallium in the 1996 SI and 2006 SSI were equal to the screening level (two µg/L), and there were no detections out of 13 groundwater samples from the SI and SSI (see Table 4-5).

6.3 EXPOSURE ASSESSMENT

The objectives of the exposure assessment are to estimate the magnitude, frequency, and duration of potential human exposure to COPCs. The primary steps of the exposure assessment are to:

- Develop a conceptual site risk model (CSRM) for how site receptors, selected based on current and future land use, can be exposed to potentially contaminated media at the HCAFS;
- Calculate EPCs; and
- Estimate each receptor's exposure to each COPC, from each individual medium.

The output of the exposure assessment was used in conjunction with the output of the toxicity assessment (Section 6.4) to quantify risks and hazards to receptors in the risk characterization (Section 6.5).

6.3.1 Conceptual Site Risk Model

The CSRM in Figure 6-1 illustrates primary transport mechanisms and pathways through which site receptors can be exposed to COPCs in soil, subsurface soil, and groundwater at the HCAFS. The choice of current site receptors in the CSRM assumes that the HCAFS will be used as a correctional facility. At the time the RI WP (GEO 2008d) was prepared, the property was unoccupied, but was in the process of being transferred to Peoria County for possible use to relieve overcrowding in county jails. The property transfer was completed on July 10, 2009, through a bill that mandated the use of the property for public purposes. The site, as of August 2009, is being used by the Peoria County Sheriff's Office for SWAT training. The County anticipates that this use will continue, but that any other future use of the site is not yet known. The County initially considered establishing a nursing home at the property, but recently selected another site for this purpose (McDonald 2009).

The resident adult and resident child receptors were included in the CSRM (Figure 6-1) and in the HHRA to evaluate risks and health effects under an unrestricted land use scenario. The construction worker was not included as a receptor in the HHRA because contaminant concentrations were lower than the TACO Tier I construction worker criteria for all PAHs and all metals, with the exception of mercury (GEO 2008d). Because the exceedance of the construction worker criterion for mercury (0.1 mg/kg) was only observed in one surface soil sample (0.14 mg/kg), mercury was not considered a COPC going into the RI and risks to construction workers from soil contamination at the HCAFS were not a concern.

The CSRM in Figure 6-1 shows the completed pathways from potentially contaminated media to current and unrestricted land use receptors. These pathways were considered in the HHRA and risks were quantified if toxicity values were available (Section 6.4). The following assumptions were made in developing the CSRM and selecting pathway/receptor combinations included in the quantitative HHRA:

- All four site receptors can be exposed to surface soils (0 to 0.5 ft) and subsurface soils (greater than 0.5 ft) at all of the EUs. This exposure can occur through incidental ingestion or inhalation of and dermal contact with contaminated soil. Direct volatilization of PAHs and metals is considered unlikely and not considered in the HHRA.
- The pathway from contaminated groundwater is only considered in the HHRA for residential receptors through direct ingestion and dermal contact with groundwater extracted through an onsite well. Note that very slow recharge rates observed during the RI groundwater sampling indicate that the loess deposits (less than 20 ft) underlying the HCAFS may not be a water-bearing unit capable of supporting a domestic water supply well. The groundwater pathway is considered possible, but unlikely under current land use because drinking water in the area

was being supplied by the Illinois of America Water Company (TtEC 2008). Thus, the groundwater pathway was not analyzed for the correctional facility staff and inmates.

6.3.2 Exposure Equations

Exposure to contaminants by the receptors from contaminated soil and groundwater were quantified using standard equations provided by USEPA (e.g., USEPA 1989, USEPA 2004, USEPA 2009). Exposure through the ingestion pathway is represented by the chemical daily intake [CDI (USEPA 1989)] and is a linear function of the contaminant soil concentration (Cs) for intakes from ingestion of soil and groundwater concentration (Cw) for intakes from ingestion of groundwater (see equations in Appendix I). Exposure through the inhalation pathway is represented by the exposure concentration [EC (USEPA 2009b)], calculated from the contaminant concentration in air adjusted for exposure time. The contaminant air concentration is estimated by dividing the soil concentration Cs by a particulate emission factor of 1.36×10^9 m^3/kg (USEPA 1996). The degree of exposure through dermal contact is represented by the Dermal Absorbed Dose (DAD), which is a linear function of the C_s or C_w for dermal contact with soil and groundwater, respectively.

All exposure equations (CDI, EC, and DAD) to soil and groundwater are linear functions of C_s and C_w, which are referred to as EPCs. Note that the equations used in the HHRA (presented in Appendix I) are the same equations shown in the RI WP (GEO 2008d) with the exception of the inhalation EC. The revised approach for inhalation risk assessment is based on guidance recently published by USEPA (2009).

6.3.3 Exposure Point Concentrations

For each soil COPC in each EU, the EPC was set to the upper limit of the 95th confidence interval around the mean Upper Confidence Limit (UCL), calculated from the data sets using USEPA's statistical program ProUCL 4.00 (Version 4.00.02). Use of the UCL represents a Reasonable Maximum Exposure (RME) approach, in which the highest exposure to a chemical reasonably expected to occur at the site from a given medium (surface soil, subsurface soil, and groundwater) is used in quantifying risks.

The option in ProUCL 4.0 is to calculate UCLs from data sets with non-detects, assuming all available distributions (normal, gamma, lognormal, non-parametric) were selected. The "Potential UCL to use" in the program results (included in Appendix J) was then selected as the EPC, except for when the recommended UCL is greater than the maximum concentration. In the latter case, the EPC is set to the MDC. Note that for PAHs in surface soils (Table 6-1 through 6-5) and arsenic in subsurface soils (Table 6-7), there were no non-detects in the data sets except for dibenzo(a,h)anthracene in the Vehicle Wash Rack EU, for which there was one non-detect out of 11 data points (Table 6-4). For subsurface soils in the Vehicle Wash Rack EU, only the benzo(a)pyrene data set had less than 10% non-detects, while the rest of the PAHs had a higher number of non-detects (Table 6-6). Thus, for subsurface soils in the this EU, the EPC for benzo(a)pyrene was set to the UCL because there were more than 90% detections for this compounds. However, for the rest of the PAHs, the EPCs were set to the median of the concentrations calculated after the non-detects were substituted with 0.5 times the reporting limit. The EPCs are shown in the data summary tables (Table 6-1 through 6-7).

Box and whisker plots of the PAH surface soil data sets (Figure 6-2 through 6-6) show measured concentrations ranging over one to three orders of magnitude. For example, benzo(a)pyrene at the Coal Area C EU had a minimum detected concentration of 80 µg/kg, a median concentration of 390 µg/kg, a mean concentration of 2084 µg/kg and an MDC of 19,000 µg/kg (Table 6-3; see Section 4 for a discussion on contaminant spatial distribution). The EPC for benzo(a)pyrene at the Coal Area C EU, calculated using ProUCL 4.0, is 10,596 µg/kg, which is approximately 0.5 of the maximum, approximately five times the mean concentration and 27 times the median concentration. In general, the

EPCs are closer in value to the higher data points (see Figures 6-2 through 6-6), reflecting the wide range of values. As mentioned previously, the EPC for most of the PAH-COPCs in subsurface soil at the Vehicle Wash Rack EU were set to the median concentration. However, the EPC in subsurface soil for benzo(a)pyrene in this EU is closest in value to the maximum concentration (Figure 6-7), following the same trend observed for PAHs in surface soils (Figure 6-2 through 6-6).

The EPC for groundwater was set to the MDCs in the unfiltered and filtered samples (Table 6-8). This is consistent with the RME approach used for this HHRA. Risks and health effects were calculated for both unfiltered and filtered groundwater samples.

6.3.4 Exposure Parameters and Exposure Calculation Results

In addition to EPCs, other exposure parameters needed to calculate CDIs, inhalation ECs, and DADs are shown in Table 6-11 for soil, and Table 6-12 for groundwater (previously shown in the RI WP, GEO 2008d). The parameters for the residential receptors are set to standard values in published USEPA documents (see Table 6-11 and 6-12 for sources). For the correctional facility receptors, the following assumptions are used in selecting the parameter values:

- The correctional facility inmate is an adult and stays in the facility for 365 days a year for 15 years, corresponding to the mean length of stay for capital offense prisoners published by the IDoC.
- The correctional facility worker is at the facility for 250 days a year for 25 years, corresponding to recommended values for a commercial/industrial worker.
- For estimating the DAD, a soil adherence factor of 0.1 is assumed for both the correctional facility inmate and worker. This value corresponds to the adherence factor for Gardeners, Construction Workers, and Farmers in USEPA (2004).

The other parameters for the correctional facility inmate and worker are set to standard values in published USEPA sources, which are shown in Tables 6-11 and 6-12.

The exposure calculation results, using the equations in Appendix I, the EPCs in Tables 6-1 through 6-8, and the exposure parameters in Tables 6-11 and 6-12, are included in Appendix J. The CDIs, inhalation ECs, and DADs are combined with toxicity values (Section 6.4) to arrive at carcinogenic risks and hazard quotients (HQs) (Section 6.5).

6.4 TOXICITY ASSESSMENT

Toxicity values were obtained from the three-tiered hierarchy of sources, in accordance with USEPA guidance (USEPA 2003e):

1. Tier 1 – USEPA's Integrated Risk Information System (IRIS) (USEPA 2009a);
2. Tier 2 – USEPA Provisional Peer Reviewed Toxicity Values (PPRTVs);
3. Tier 3 – Other toxicity values from additional USEPA and non-USEPA sources, including California Environmental Protection Agency (Cal EPA), ATSDR minimum risk levels, and USEPA's Health Effects Assessment Summary Tables (USEPA 1997b).

Specific information regarding toxicity values for non-carcinogens and carcinogens are provided below.

6.4.1 Carcinogenic Effects

For carcinogens, risk from exposure to contamination is expressed as excess or ILCR, which is cancer-occurrence that is in addition to normally expected rates of cancer development. Excess cancer risks were estimated using published oral cancer slope factor (CSFs) and inhalation unit risks (IUR). Chemical-specific CSFs and IURs used in the evaluation of risk from carcinogenic COPCs are shown in Table 6.13.

As recommended by USEPA guidance (USEPA 1993), toxicity equivalency factors (TEFs) were applied to carcinogenic PAHs. The following TEFs (from USEPA 1993) were used to convert the toxicity values for PAHs from the toxicity value provided in IRIS for benzo(a)pyrene.

PAH	TEF
Benzo(a)pyrene	1
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.01
Chrysene	0.001
Dibenzo(a,h)anthracene	1
Indeno(1,2,3-c,d)pyrene	0.1

In accordance with USEPA guidance for dermal risk assessment (USEPA 2004), dermal slope factors (Table 6.13) were calculated using chemical-specific gastrointestinal absorption factors (ABS_{GI}) using the following equation:

$$CSF_{dermal} = CSF_{oral} / ABS_{GI}$$

Values for ABS_{GI} were obtained from the USEPA guidance document (Exhibit 4-1 of USEPA 2004).

6.4.2 Non-cancer Effects

Non-carcinogenic effects are evaluated by comparing CDIs with an oral reference dose (RfD), and the inhalation ECs, with an inhalation reference concentration (RfC). Oral RfD and inhalation RfCs for COPCs were obtained from the sources listed above and are presented in Table 6-14.

Chronic oral RfDs are developed for protection from long-term exposure to a chemical (from seven years to a lifetime). Subchronic RfDs are used to evaluate short-term exposure [from two weeks to seven years (USEPA 1989)]. Subchronic RfDs are generally the same or an order of magnitude less conservative, as compared to their corresponding chronic RfDs. To be conservative, chronic oral RfDs and RfCs will be used in evaluating risks to all receptors at the HCAFS.

In accordance with USEPA guidance for dermal risk assessment (USEPA 2004), dermal RfDs (Table 6-14) were calculated using chemical-specific gastrointestinal absorption factors (ABS_{GI}), using the following equation:

$$RfD_{dermal} = RfD_{oral} \times ABS_{GI}$$

Values for ABS_{GI} were obtained from the USEPA guidance document (Exhibit 4-1 of USEPA 2004).

There are no available non-carcinogenic toxicity values for any of the PAH-COPCs. A number of PAHs are on the current list of chemicals for which PPRTVs are being developed. However, no values

have been released (as of March 2009). The lack of toxicity values for some COPCs is considered in the uncertainty analysis (Section 6.6)

Toxic effects are diverse and measured in various target body organs (e.g., they range from eye irritation to kidney or liver damage). USEPA is currently reviewing methods for accounting for the difference in severity of effects. However, existing RfDs do not address this issue.

6.5 RISK CHARACTERIZATION

Risk characterization integrates the findings of the exposure and toxicity assessments to estimate the potential for receptors to experience adverse effects as a result of exposure to contaminated media at the HCAFS.

6.5.1 Cancer Risk

Cancer risk from exposure to contamination is expressed as the incremental lifetime cancer risk (ILCR), or the increased chance of cancer above the normal background rate of cancer. The background cancer rate is one in three [Illinois EPA Undated(a), TACO Fact Sheet #2 Risk].

The ILCR for non-mutagenic carcinogens was calculated for each COPC/receptor/exposure pathway combination using one of the equations below (USEPA 1989, USEPA 2004, USEPA 2009):

$$ILCR = CDI \times CSF_{oral} \text{ for oral exposures}$$

$$ILCR = EC \times IUR \text{ for inhalation exposures}$$

$$ILCR = DAD \times CSF_{dermal} \text{ for dermal exposures}$$

where

CDI	=	Chemical Daily Intake (mg/kg-d); Appendix J,
DAD	=	Dermal Absorbed Dose (mg/kg-d); Appendix J,
EC	=	Inhalation Exposure Concentration (mg/m^3); Appendix J,
CSF_{oral}	=	Oral cancer slope factor $(mg/kg\text{-}d)^{-1}$; Table 6-13,
IUR	=	Inhalation Unit Risk $(mg/m^3)^{-1}$; Table 6-13,
CSF_{dermal}	=	Dermal cancer slope factor (mg/kg-d)-1; Table 6-13.

Risks from mutagenic carcinogens were incorporated into the risk calculations by applying age dependent adjustment factors to the slope factors while using age-specific exposure estimates when calculating risks. This procedure follows USEPA guidance (2005a and b) and is described in Appendix I.

The ILCRs calculated for each chemical/receptor/exposure pathway combination are provided in Appendix J. The ILCRs from each pathway for a given chemical and receptor were then summed to arrive at chemical-specific ILCRs for each of the site receptors. The results are presented in the following tables:

- Tables 6-15, 6-16, 6-17, 6-18, and 6-19 contain chemical-specific ILCRs for all site receptors from exposure to PAHs in surface soils at the Coal Area A, Coal Area B, Coal Area C, Vehicle Wash Rack, and Main Entrance EUs, respectively. These tables also include

the summation of chemical-specific ILCRs for a given site receptor, which corresponds to the total ILCR from exposure of the receptor to surface soils.

- Table 6-20 shows chemical-specific ILCRs for all site receptors from exposure to PAHs in subsurface soil at the Vehicle Wash Rack EU. This table also includes the summation of chemical-specific ILCRs for a given site receptor, which corresponds to the total ILCR from exposure of the receptor to subsurface soils at the Vehicle Wash Rack.
- Table 6-21 presents ILCRs for all site receptors from exposure to arsenic in subsurface soils at the Coal Area A, Coal Area B, and Coal Area C EUs.
- Table 6-22 presents the cumulative ILCR for all site receptors from exposure to both surface and subsurface soils at each of the EUs.
- Table 6-23 contains ILCRs for residential site receptors to unfiltered groundwater. Note that there were no carcinogenic COPCs in the filtered groundwater samples (see Table 6-8).

The calculated ILCRs are compared against the magnitude of cancer risk that is relative to setting Superfund site remediation goals in the National Contingency Plan (NCP), which ranges from 10^{-4} (which can be expressed as one-in-ten-thousand) to 10^{-6} (which can be expressed as one-in-one million) depending on the site, proposed usage, and chemicals of concern (USEPA 1990). Within this range, the level of risk that is considered to be acceptable at a specific site is a risk management decision, and is decided on a case-specific basis. Non-science issues such as technical feasibility, economics, social, political, and legal factors, need to be considered to appropriately assign an acceptable risk level. This range of acceptable cleanup levels integrates science and public policy into the decision making process. The NCP risk range of 10^{-4} to 10^{-6} for setting remediation goals is consistent with an acceptable risk range of 10^{-4} and 10^{-6} [Illinois EPA, Undated(b), TACO Fact Sheet #13], if requirements of TACO Section 742.915 are followed. Section 8.2.2 (Recommended Remedial Action Objectives) contains additional discussions regarding compliance with the requirements of Section 742.915(i).

The following key observations can be made regarding the ILCRs from exposure to soil and groundwater at the HCAFS.

<u>Carcinogenic Risks from Soil</u>

- The cumulative ILCR for correctional facility inmates and workers at all the EUs (Table 6-22) are within the risk range of 10^{-4} to 10^{-6} (Illinois EPA, Undated(b), TACO Fact Sheet #13). Between the two correctional facility receptors, the correctional facility worker has a higher ILCR that ranges from 2.5×10^{-5} at the Main Entrance EU, to 7.4×10^{-5} at the Coal Area C EU.
- Under an unrestricted land use scenario, the resident adult has a higher ILCR from exposure to soil when compared to the resident child (Table 6-22). The cumulative ILCR for both the resident adult and child exceed 10^{-4} at all EUs (see Table 6.22).
- Surface soils contribute more than 90% of the total carcinogenic risk from exposure to soil at all EUs (Table 6-22).
- The pathway-specific ILCRs from exposure to PAHs in surface and subsurface soils (Appendix J) show that most of the carcinogenic risks come from the ingestion and dermal contact pathways. Specifically, for the correctional facility receptors, the ingestion of soil pathway contributes 58 to 60% of the cumulative risk, while dermal contact contributes approximately 40 to 42%. The risk contribution from inhalation exposure was negligible (approximately 0.005%) compared to the other exposure routes. For the resident adult, approximately 60 to 70% of the ILCR comes from ingestion of soil, approximately 30 to

40% is contributed by dermal contact, and a negligible amount of incremental risk comes from inhalation exposure. For the resident child, approximately 70 to 75% of the ILCR comes from ingestion of soil, approximately 25 to 30% is contributed by dermal contact, and a negligible risk comes from inhalation exposure.

- The pathway-specific ILCRs from exposure to arsenic in subsurface soils (Appendix J) show that most carcinogenic risk (85 to 90%) comes from ingestion of soils.
- The chemical-specific ILCRs from exposure to surface soils shows that benzo(a)pyrene contributes the most risk at all the EUs (Tables 6-15 to 6-21). For this HHRA, COCs are those chemicals for which the chemical-specific ILCR exceeds 10^{-6} (grey-shaded cells in Tables 6-15 to 6-21). Under land use as a correctional facility, the COCs in surface soil at all EUs are benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Under unrestricted land use, the COCs in surface soil are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. In subsurface soil, arsenic is the only COC at the Coal Area EUs. Benzo(a)pyrene is the only COC in subsurface soil at the Vehicle Wash Rack EU.

Carcinogenic Risks from Groundwater

Carcinogenic risks from groundwater were only evaluated for the residential receptors (see Section 6.3.1 for justification). ILCRs for the residential receptors from exposure to unfiltered groundwater (Table 6-23) are greater than 10^{-4}, with approximately 98% of this risk contributed by arsenic. Note that this risk was calculated from an assumed groundwater concentration of 21 μg/L. As mentioned in Section 4 and further discussed in Section 6.6.2 (Uncertainties in Risk Screening and EPCs), the arsenic and lead detected in the unfiltered groundwater samples were likely associated with suspended solids. Furthermore, the shallow (less than 20 ft) loess deposits underlying the HCAFS are of low conductivity and probably cannot support a domestic water supply.

6.5.2 Non-cancer Health Effects

The risks for non-carcinogenic effects associated with COPCs were evaluated by comparing the estimated exposure (i.e. CDI, Inhalation Exposure Concentration, or DAD) from site media to the non-carcinogenic toxicity values (Section 6.4.2). The HQ (USEPA 1989) was calculated as:

$$HQ = CDI / RfD_{oral} \text{ for oral exposures}$$

$$HQ = EC / RfC \text{ for inhalation exposures}$$

$$HQ = DAD / RfD_{dermal} \text{ for dermal exposures}$$

where

CDI	=	Chemical Daily Intake (mg/kg-d); Appendix J,
DAD	=	Dermal Absorbed Dose (mg/kg-d); Appendix J,
EC	=	Inhalation Exposure Concentration (mg/m^3); Appendix J,
RfD_{oral}	=	Oral Reference Dose (mg/kg-d); Table 6-14,
RfC	=	Inhalation Reference Concentration (mg/m^3); Table 6-14,

RfD_{dermal} = Dermal Reference Dose (mg/kg-d); Table 6-14.

The HQs for each COPC were then summed to obtain a HI, as shown below:

$$HI = \Sigma HQ_i$$

where

HI = hazard index for all toxic effects,

HQ_i = hazard quotient for the ith COPC.

Appendix J includes the calculated HQs for each COPC/exposure pathway/receptor combination.

Hazards from exposure to soil

HIs from exposure of all site receptors to arsenic in subsurface soil are all below one (Table 6-24). Note that since there are no available non-carcinogenic toxicity values for PAHs, the non-carcinogenic health effects from exposure to PAHs in surface and subsurface soils cannot be evaluated.

Hazards from exposure to groundwater

Non-carcinogenic health effects from exposure to groundwater are only evaluated for the residential receptors (see Section 6.3.1 for justification). The HIs from exposure to groundwater is greater than one for both residential receptors (Table 6-25) in unfiltered and filtered groundwater (Table. 6-26). In unfiltered groundwater, HQs for all the metals are greater than one for the resident child (Table 6-25), with the highest quotient associated with iron and arsenic. The hazard for the resident adult from exposure to unfiltered groundwater is also greater than one. In filtered groundwater (Table 6-26), only manganese is a COPC and its associated HI is greater than one.

6.6 UNCERTAINTY ANALYSIS

Site-specific factors that contribute to uncertainty need to be considered when using the risk and hazard calculations for decisions regarding remedial actions at the HCAFS. These factors are discussed below.

6.6.1 Land and Groundwater Use

The current site receptors considered in the HHRA assumed that the HCAFS will be used as a correctional facility. At the time the RI WP was prepared (GEO 2008d), an online article posted by a local newspaper indicated that the property was being transferred to Peoria County for possible use by the county to relieve overcrowding in county jails. The property transfer was completed on July 10, 2009, through a bill that mandated the use of the property for government or public purposes. An online news article published in September 2008 (Wood 2008) indicated that Peoria County was considering other uses, including a site for the county highway department, a nursing home, or converting the land into a recreational park. The site, as of August 2009, is being used by the Peoria County Sheriff's Office for SWAT training .The County anticipates that this use will continue. Any other future use of the site is not yet known (private communication with Scott Sorrel, Peoria County Administrator, August 4, 2009). Thus, there is uncertainty regarding near term land use. An article published in July 2009 (McDonald 2009) stated that the property is unlikely to be used as a nursing home because a more appropriate site closer to the city of Peoria was identified.

Note, however, that the risks and hazards calculated for the correctional facility staff are probably comparable if not higher than risks and hazards for receptors if the site were used for county government offices (e.g., soil adherence factor would be less than 0.1). If the site were used as a correctional facility by Peoria County, 15 years is a conservative estimate for the amount of time a prisoner is kept in a county jail. Although it appears unlikely that the site will be used as a nursing home, the HHRA covers risks under this land use because the duration of exposure for nursing home occupants would probably be similar to, if not less than the duration of exposure assumed for correctional facility inmates (e.g., 365 days a year, 15 years). If the land were used as a recreational area, the exposure of park workers would also be comparable to the exposure assumed for correctional facility workers. Finally, the risks and hazards calculated for the residential receptors provide an upper bound for most other receptors under non-residential land use. Thus, although there is uncertainty in near-term land use for the HCAFS, the risks and hazards for the receptors considered in this HHRA are probably comparable, if not higher, than the risks and hazards for receptors under the other land uses being considered by Peoria County.

The loess deposits from which the groundwater samples were collected are probably not sufficiently conductive to support domestic water supply wells. Furthermore, there is an ordinance from the Village of Hanna City that prohibits the use of groundwater for potable water supply because commercial land use in the Village (not associated with the HCAFS) resulted in groundwater quality not meeting Illinois standards. A water supply well used by the Village of Hanna City was shut down in 1987 by Illinois EPA due to high levels of naturally-occurring radon (TtEC 2008). Drinking water in the area, including the Hanna City Work Camp before it was closed, is provided by the Illinois of America Water Company. Therefore, it is not very likely that residential receptors will use the shallow groundwater underlying the HCAFS.

6.6.2 Uncertainties in Risk Screening and Exposure Point Concentrations

For PAHs in surface soil, the wide range in values that spanned one to two orders of magnitude resulted in Exposure Point Concentrations that were significantly higher than the average values (e.g., five times the mean concentration and 27 times the median concentration in Coal Area C EU; see Section 6.3.3, and Figure 6-2 to 6-6). This suggests that the calculated risks and hazards from exposure to PAHs in surface soils are conservative and may be much higher than risks and hazards had the HHRA been conducted using a central tendency approach.

For subsurface soils at the Vehicle Wash Rack, the primary contributor to risk was benzo(a)pyrene, which was calculated using an EPC of 441 μg/kg. An inspection of the data distribution in Table 4-11 shows that the EPC is closer in magnitude to the maximum values (640 and 480 μg/kg in duplicate samples VWSB01 and VWSB04), which are potential outliers (see Figure 6-7). The next lowest sample (35 μg/kg) is less than a tenth of the maximum values. Thus, there is uncertainty in the calculated risks from PAHs in subsurface soils at the Vehicle Wash Area because the EPC used in the calculation may be an overestimate of true exposure.

For groundwater, the EPCs used in the risk calculations were set to the maximum detected metals concentrations, all of which were measured during the SI and SSI sampling events. For example, the EPC was set to 21 mg/kg for arsenic, which was measured in a sample collected from Coal Area C in April 2006 (during the SI). A comparison of metals concentrations during the SI, SSI and RI shows that lower metals were measured during the RI, as illustrated in Figure 6-9 for aluminum and iron, and 6-10 for arsenic. For arsenic, the measured concentrations identified during the RI were below the screening level of 10 μg/L. Elevated levels of aluminum and iron in the 1996 and 2006 data are indicative of suspended particulates present in the groundwater samples. The correlation between total arsenic and total iron in Figure 6-11 suggests that the arsenic exceedances were due to high solids content in the 1996 and 2006 samples. Similar correlations were observed for other metals (lead, vanadium). As noted by Puls and

Barcelona (1996), the intent of groundwater sampling is to monitor the total mobile contaminant loading, which consists of dissolved and naturally-suspended particles. Sample turbidity can result in an overestimate of the mobile contaminant because of the inclusion of otherwise immobile, but artificially-suspended particles. The lower levels of aluminum and iron during the RI sampling (Figure 6-9) indicate lower suspended particle content when compared to the samples from 1996 and 2006, and are, therefore, more representative of site groundwater. Thus, the risks calculated using the EPCs based on the elevated concentrations during the SI and SSI sampling likely overestimate true risks from exposure to the HCAFS groundwater.

Although arsenic in subsurface soils contributed less than 10% of the total risk at the Coal Areas, the chemical-specific risk from this metal alone exceeded 10^{-6} for all the site receptors. The EPCs used to calculate the risks ranged from 10.5 to 12.6 mg/kg (Table 6-21), all of which are already below the TACO background level for arsenic metropolitan areas. This suggests that the risks from arsenic in soil at the HCAFS are comparable to background conditions, and that this must be considered when deciding on the need to address the arsenic in subsurface soil at the HCAFS.

6.6.3 Uncertainties from Unavailable Non-carcinogenic Toxicity Values

Non-carcinogenic toxicity values (reference doses and concentrations) were not available for the PAHs, which were the only COPCs in surface soil in all EUs and in subsurface soil at the Vehicle Wash Rack EU. As such, an HI cannot be calculated for exposure to soils at the HCAFS.

6.6.4 Uncertainties from Unavailable Carcinogenic Toxicity Values

IRIS had an oral slope factors for benzo(a)pyrene; the oral CSF was extrapolated to the other PAHs through USEPA-recommended toxicity equivalence factors (USEPA 1993). Since there were no IURs for PAHs in IRIS, the inhalation slope factor for benzo(a)pyrene from Cal EPA was used, and extrapolated to the other PAHs using the same set of TEFs used for extrapolating the oral slope factor.

6.6.5 Impacts of Road Runoff and Vehicular Traffic on Surface Soils

As noted in Section 4.3.6.3, soil samples with the highest concentrations of PAHs were generally collected within 10 ft of roadways. This suggests that road run-off or vehicular emissions are major sources of PAH contamination at the HCAFS. Although the HCAFS is located in a generally rural area, facility-use as a radar tracking station by DoD from 1952 to 1968, and as a minimum security prison by IDoC through 2002, has been similar to an urban or an industrial/commercial site where activities required regular access by motor vehicles with accompanying vehicle emissions and road runoff. As noted in Section 4.3.6.3, EPRI (2002) measured the highest benzo(a)pyrene levels (11.2 mg/kg) in surface soils near municipal facilities such as fire stations and town buildings, even greater than the maximum concentration measured in samples collected near road easements (3.6 mg/kg). Vehicular activity at the HCAFS, when it was used by DoD and IDoC, is likely comparable to vehicular activity in municipal areas. As a matter of definition of release under CERCLA 101(22), to which CERCLA 104 gives authority to respond, as well as a common sense issue that an exemption to PAHs adjacent to roads exists in the CERCLA program. The applicable CERCLA exclusion for the HCAFS is stated in 42 USC Section 9601, 22(B), which defines one form of exclusion as “emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station.”

6.7 HUMAN HEALTH RISK ASSESSMENT SUMMARY AND CONCLUSIONS

A baseline HHRA was conducted to evaluate potential human health risks resulting from exposure to soil and groundwater contamination under existing conditions at the HCAFS. Data collected during previous investigations and this RI were aggregated according to the following environmental media:

surface soil (defined as soil from 0 to 0.5 ft bgs), subsurface soil (defined as soil from depths greater than 0.5 ft bgs), and groundwater. In evaluating risk from soil contamination, Coal Area A, Coal Area B, the Vehicle Wash Rack and Main Entrance were each considered as separate EUs. Because of their proximity to each other, Coal Area C, the Maintenance Building, and the Paint Shed were combined into one EU. To evaluate risks from groundwater, the entire site was considered as a single EU.

The risk assessment was focused on COPCs in areas where chemical analyses from the SI and SSI exceeded human health screening criteria. Specifically, the HHRA evaluated carcinogenic risks and non-carcinogenic hazards from PAHs in surface soils at all EUs, PAHs in subsurface soil at the Vehicle Wash Rack EU, arsenic in subsurface soil at the three Coal Area EUs, and metals in groundwater. Additional data were collected as part of the RI, so that when combined with data from previous investigations, a data set with a sufficient number of samples was available for reliably quantifying exposures. To identify COPCs that were to be carried through the quantitative HHRA, data were compared against human health screening criteria that consisted of the TACO background concentrations for metals or the lowest of the TACO and USEPA RSL criteria for soil, and the lowest of the TACO groundwater criteria, Illinois and federal drinking water standards for groundwater. Before the data were screened, non-detects were replaced with 0.5 the reporting limit, such that if 0.5 the reporting limit was greater than the screening criterion, it was considered an exceedance (Note that this substitution was not used in calculating UCLs. Instead, methods in ProUCL for data sets with non-detects were used). PAHs with consistent exceedances in surface soil among the EUs were benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. A similar set of PAHs were observed to have exceedances in subsurface soil at the Vehicle Wash Rack EU. Although concentrations were much lower than in the surface soil and there were many non-detects. Arsenic concentrations in a number of subsurface soil samples exceeded the TACO background concentration for arsenic in non-metropolitan areas, which was used as the screening criterion. For unfiltered groundwater, there were exceedances for aluminum, arsenic, iron, lead, magnesium, manganese, and vanadium. The elevated metals in the unfiltered groundwater samples were likely associated with suspended solids, based on analyses of filtered groundwater samples, for which exceedances were only observed for manganese.

Based on the most recent land use as a correctional facility, the site receptors considered in the HHRA were a correctional facility inmate and a correctional facility worker. An unrestricted land use scenario was incorporated in the risk assessment by including residential receptors (adult and child). In the CSRM, it was assumed that there were completed pathways from surface and subsurface soil to all four site receptors, and from groundwater to residential receptors. These completed pathways were then included in the HHRA.

Using the combined data set from previous investigations and the RI field sampling event, EPCs for COPCs were calculated using ProUCL 4.0 (Version 4.00.02). The EPCs were then converted to CDIs, inhalation ECs, and DADs using standard equations and parameters provided by USEPA for modeling exposure through ingestion, inhalation, and dermal contact. Incremental carcinogenic risks and HIs were then calculated using carcinogenic and non-carcinogenic toxicity values published by USEPA and other sources accepted by USEPA (e.g., PPRTV, CalEPA).

The following conclusions were made from the HHRA results:

- For all EUs considered in the HHRA, incremental carcinogenic risks from surface and subsurface soil for correctional facility inmates and workers were below 10^{-4}. Between the two correctional facility receptors, the ILCR was higher for the correctional facility worker, ranging from 2.5×10^{-5} at the Main Entrance EU to 7.4×10^{-5} at the Coal Area C EU.

- Under unrestricted land use, incremental carcinogenic risks from exposure to soil at the all the EUs were above 10^{-4} for the residential adult and child receptors. More than approximately 90% of these risks are from exposure to PAHs in surface soil.
- For this HHRA, COCs are those chemicals for which the chemical-specific ILCR exceeds 10^{-6}. Under land use as a correctional facility, the COCs in surface soil at all EUs are benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Under unrestricted land use, the COCs in surface soil are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. In subsurface soil, arsenic is the only a COC at the Coal Area EUs. Benzo(a)pyrene is the only COC in subsurface soil at the Vehicle Wash Rack EU.
- The HIs from surface soil cannot be calculated because there are no non-carcinogenic toxicity values available for PAHs. The HIs from arsenic in subsurface soil are below one for all site receptors.
- Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10^{-4}, primarily from arsenic. Note that the arsenic is probably associated with suspended solids and that there are no carcinogenic COPCs in the filtered groundwater samples.
- The HIs from unfiltered groundwater for the residential receptors are greater than one, with HQs for every metal exceeding one. The only COPC in filtered groundwater is manganese, with a HI greater than one. However, it should be noted that the surficial materials in the HCAFS area are generally of low-to-very low permeability. Therefore, it is unlikely that groundwater from the surficial materials, above bedrock, would be used for water supply. In addition, the EPC used to calculate risks for groundwater is based on concentrations measured in earlier investigations and is thought to be biased high, due to the high-suspended solids.

The following uncertainty factors need to be considered when using the calculated risks and hazards for decision making at the HCAFS:

- The property was transferred to Peoria County on July 10, 2009, through a bill that mandated the use of the property for government or public purposes. The site, as of August 2009, is being used by the Peoria County Sheriff's Office for SWAT training. The County anticipates that this use will continue. Any other future use of the site is not yet known. The County initially considered establishing a nursing home at the property, but recently selected another site for this purpose (McDonald 2009). One of the options being considered is to use the property to help relieve overcrowding in county jails, for which the analyses of risks to correctional facility receptors would be applicable. Furthermore, the exposure parameters used for the correctional facility inmate and worker may be sufficiently conservative for possible receptors under the other land uses (e.g., county government worker, recreational user, nursing home resident).
- For PAHs in surface soil, the wide range in values that spanned one to two orders of magnitude resulted in EPCs that were significantly higher than the average values (e.g., five times the mean concentration and twenty-seven times the median concentration in Coal Area C EU). This suggests that the calculated risks and hazards from exposure to PAHs in surface soils are conservative and may be much higher than risks and hazards had the HHRA been conducted using a central tendency approach.
- Arsenic is the primary contributor to risk from exposure to site groundwater. However, concentrations of arsenic, iron and manganese above the Illinois Groundwater Standards

have been documented as characteristic of the natural groundwater quality in the Glasford Formation, which is at or near the surface at the HCAFS. More recent groundwater samples collected in November 2008, as part of the RI, contained lower levels of metals; arsenic levels were less than 10 μg/L, the MCL. The lower metals concentrations in the RI samples is likely from lower suspended solids in the RI samples, when compared to the SI and SSI samples and are, therefore, more representative of site groundwater. Thus, the low levels of arsenic in the RI samples indicate that naturally mobile fraction of arsenic in site groundwater (including dissolved plus adsorbed on colloidal material) is unlikely to be present at levels above the MCL.

- There is an ordinance from the Village of Hanna City that prohibits the use of groundwater for potable water supply because commercial land use in the Village (not associated with the HCAFS) resulted in groundwater quality not meeting Illinois standards. Although it could not be confirmed that this ordinance applies to the HCAFS site, it does indicate that the Village, which is the local population center, does not use groundwater for water supply. Drinking water in the area, including the Hanna City Work Camp before it was closed, is provided by the Illinois of America Water Company. In addition, slow recharge observed during RI field sampling suggests that the loess deposits from which the groundwater samples were collected are not sufficiently conductive to support domestic water supply wells. It is therefore unlikely that residential receptors will use the shallow groundwater underlying the HCAFS.

7. SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT

7.1 INTRODUCTION

This section documents a screening level ecological risk assessment (SLERA) for the HCAFS. The purpose of the SLERA is to evaluate ecological risks from current and potential future exposure to soil contamination if no remedial action is taken, and to determine if a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. In contrast to the HHRA (Section 6), where risks were evaluated for each AOPC, the EU for this SLERA is defined as the entire 42.89 acres formerly occupied by the HCAFS (see Figure 1-2).

The rest of this section is organized as follows:

- Section 7.2: Screening Level Problem Formulation/Data Evaluation. The findings of an ecological site reconnaissance conducted at the HCAFS on November 18, 2008 are summarized. Aggregation of SI, SSI, and RI data for subsequent analysis to reflect where organisms could be exposed are described.
- Section 7.3: Ecological Conceptual Site Risk Model (ECSRM) and Exposure Assessment. The ECSRM is presented, followed by a summary of the soil data to be used for quantifying exposures to ecological receptors.
- Section 7.4: Screening Level Ecological effects and Risk characterization. This section presents the selection of ecological screening values (ESVs) used to quantify ecological effects from the hierarchy of sources specified by Illinois EPA. The results of the screening-level risk characterization, which involved a comparison of soil ECs to the ESVs, are described to arrive at a tentative list of Chemicals of Potential Ecological Concern (COPECs). Following a discussion of the tentative COPECs from a more regional perspective, as well as a comparison with USEPA's Ecological Soil Screening Levels (Eco-SSL), this section concludes with the list of site COPECs.
- Section 7.5: Uncertainty assessment. This section lists the site-specific factors that contribute uncertainty to the SLERA results.
- Section 7.6: This section summarizes the SLERA methods and results.

7.2 PROBLEM FORMULATION/DATA EVALUATION

Problem formulation involves documenting the habitats and wildlife that were observed at the HCAFS during the ecological site reconnaissance, conducted on November 18, 2008, and determining if important ecological resources at the site may be at risk. Data evaluation involves assessing the suitability of the chemical data and organizing that chemical data to reflect where organisms could be exposed.

7.2.1 Results of the Ecological Site Reconnaissance

A field ecological reconnaissance was conducted by EnviroScience, Inc. on November 18, 2008 to document habitats and any observed wildlife within and around the HCAFS. The purpose of the reconnaissance was also to identify any designated wetlands that are a critical or sensitive habitat for threatened and endangered species. The USACE ecological scoping checklist was completed and photographs were taken during the site visit (Appendix G). The findings are summarized below.

The area surrounding the HCAFS is designated as an agricultural zone (Peoria County 2009) with no ecologically sensitive areas within a 0.5 mile radius. As mentioned in Section 3.9, the Illinois Natural

Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Inventory sites, dedicated Illinois Nature Preserves, or registered land and water reserves in the vicinity of the site (see Appendix G for correspondence with Illinois Department of Natural Resources). The site itself consists primarily of buildings, paved roads and parking lots (Photographs 1, 2, 5, and 8 in Figure 7-1) and formerly mowed lawns that are now fallow fields (Photographs 3, 4, 6, 7, and 9 in Figure 7-1).

Terrestrial habitats at the HCAFS site consist of open fallow fields with landscape trees and shrubs. Dominant plants include Kentucky bluegrass, goldenrod, dandelion, and aster. There are no wooded or scrub-shrub areas on the site. Animals observed during the site visit include several common bird species (dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows) and eastern cottontail rabbits. The Indiana bat (*Myotis sodalist*) is included in the federally endangered list for Peoria County (Table 3-1 in Section 3). However, trees located onsite do not contain suitable habitat for this species.

There were three wetland areas observed at the site (Wetlands A, B and C in Figure 7-2). Wetlands A and B (Photographs 1, 2, 3, Figure 7-2) are the wastewater treatment ponds (not part of the original HCAFS facility) that have not been in use since the Hanna City Work Camp was shut down in 2002. Both had standing water in November 2008, probably from accumulating precipitation. The 0.29-acre northern pond (Wetland A) and the 0.15 acre southern pond (Wetland B) have palustrine emergent vegetation consisting of cattails and floating vegetation consisting of duckweed. There were no visible outlets for the pond water. Filter beds located south of Wetlands A and B were dry during the site visit (Photograph 4, Figure 7-2). The third wetland area (Wetland C, Photo 5, Figure 7-2) is the water treatment lagoon south of the former water treatment facility, which has been overgrown with palustrine emergent vegetation. As noted previously (Section 1.2.3.3), this lagoon was not considered in this RI because of PRP issues.

Drainage features observed onsite include roadside ditches running parallel to the main road at the HCAFS (Photographs 6 and 7; Figure 7-2). These ditches were dry during the site visit and probably only carry intermittent flow during precipitation events. No other flowing systems were observed at the site.

In summary, there are no important ecological resources at and within 0.5 miles of the HCAFS. Terrestrial habitats at the HCAFS consist of formerly mowed lawns that are now fallow open fields. Aquatic habitats consist of former wastewater treatment ponds that have standing water with floating and palustrine emergent vegetation, and a lagoon overgrown with palustrine emergent vegetation.

7.2.2 Data Evaluation

The data used in the SLERA consists of surface and subsurface soil samples collected during the SI in July 1996, the SSI in April 2006 (TtEC 2008), and this RI in August and November 2008 (Section 4 of this report). Groundwater is not considered an ecological medium of concern at the site because there are no groundwater seeps or discharge areas where terrestrial organisms can be exposed. The HHRA presented in Section 6 focused on PAHs in soil and arsenic in subsurface soil because concern regarding other chemicals had been eliminated, based on a comparison of SI and SSI data with human health screening criteria (TtEC 2008). Because an ecological screening was not part of the SSI (TtEC 2008), this SLERA includes an evaluation of VOCs and PCBs, in addition to PAHs and metals (other than arsenic) in soil at the HCAFS. Specifically, the data sets used for this SLERA include:

VOCs in surface soil (0 to 0.5 ft) and subsurface soil (four to five ft) collected during the SI and SSI (TtEC 2008) from the Coal Areas, the Maintenance Building, Vehicle Wash Rack, Main Entrance, and Tile Field AOPC (see Table 7-1(a), Figure 1-2 and 7-1 for AOPC locations).

PCBs in surface soil (0 to 0.5 ft) and subsurface soil (four to five ft) collected during the SI and SSI (TtEC 2008) from the Maintenance Building [Table 7-1(b)].

PAHs in surface soil (0 to 0.5 ft) and subsurface soil (two to three ft, four to five ft) collected during the SI, SSI (TtEC 2008), and RI (this report) from the Coal Areas, the Maintenance Building, Vehicle Wash Rack, Main Entrance, and Tile Field (summary in Table 7-1(c); see Tables 4-7 to 4-11(a) and (b), and Table 7-1(d) for complete data set).

Metals in surface soil (0 to 0.5 ft) and subsurface soil (two to three ft, four to five ft) collected during the SI, SSI (TtEC 2008), and RI (this report) from the Coal Areas, the Maintenance Building, Vehicle Wash Rack, Main Entrance, and Tile Field (summary in Table 7-1(e) see Table 7-1(f) and (g), and Table 4-6 for complete data set).

As mentioned in Section 6.2.2 under the HHRA, 10% of the SSI data and 100% of the RI data were evaluated by a third-party data validator using procedures and QC criteria published by DoD (LCG, USACE 2002; QSM; DoD 2006). The data validation for the SSI indicated that 100% of the PAH and metals data were useable. For the RI PAH data, where there were duplicate analyses for the same soil sample under different dilutions, the data validators rejected the result that was deemed to be of inferior quality between the pair of measurements such that there was a valid PAH analysis for each soil sample collected during the RI. All the metals data from the RI were considered valid by the data validators. Section 6.2.2 has more details regarding the PAH and metals data validation, while Appendix H has the full data validation reports.

Ten percent of the VOC and PCB data from the SSI considered in the SLERA were also evaluated by a third party validator. Acetone analysis results were rejected for two surface soil samples because of problems with recoveries in the MRL check standard, continuing calibration, and variability in duplicate measurements (i.e., RPD exceeded criteria). Several VOC results in three soil samples were qualified as "estimated" ("J" qualifier) because of problems with internal standard recoveries and calibration checks; note that none of these VOCs were detected in the site samples. The rejected acetone and butanone results were removed from the data set before it was used for this SLERA. There were no validation issues with the PCB analyses.

7.3 ECOLOGICAL CONCEPTUAL SITE RISK MODEL AND EXPOSURE ASSESSMENT

7.3.1 Ecological conceptual site model

Figure 7-3 shows an ECSRM for the HCAFS based on the ecological reconnaissance findings (Section 7.2). Only terrestrial receptors are included in the ECSRM because the aquatic habitats onsite consist of wastewater treatment ponds and a lagoon that have become overgrown with vegetation due to years of disuse. The primary exposure media for the terrestrial receptors are surface and subsurface soil, and the primary exposure routes are through ingestion and direct contact, as well as consumption of contaminated food. Exposure by organisms to groundwater is considered unlikely because the depth to the water table during previous (TtEC 2008) and more recent (this report) investigations was observed to be generally greater than 4.5 ft bgs, as observed during the RI groundwater sampling (see Section 3).

7.3.2 Exposure data

Tables 7-1(a), (b), (c), and (e) show data summaries for VOCs (only detected analytes shown), PCBs, PAHs, and metals in surface (0 to 0.5 ft) and subsurface soil (0.5 to five ft) from the HCAFS. Note that in contrast to the HHRA (Section 6), where data were aggregated according to AOPCs, the data from all the AOPCs were evaluated as a group for this SLERA because the entire 42.96 acre site is considered as the EU for assessing ecological risks. Furthermore, data collected from the Tile Field AOPC (see Figure 7-1 for location) during the SI and SSI were included in the SLERA data set. Data collected from the Lagoon AOPC during the 1996 SI were excluded due to PRP issues (see Section 1.2.3.3).

The VOC and PCB data sets summarized in Tables 7-1(a) and (b) were collected during the 1996 SI and 2006 SSI (TtEC, 2008). As noted previously, the RI did not include sampling for VOCs and PCBs because these chemical classes were ruled out as COPCs based on human health screening of data from previous investigations. PAH data summarized in Tables 7-1(c) were collected during field sampling in 1996 (SI), 2006 (SSI; TtEC 2008), and 2008 (RI; this report). With the exception of arsenic, the metals data set summarized in Tables 7-1(e) were collected in 1996 (SI) and 2006 (SSI; TtEC, 2008). The data for arsenic includes soil sample analyses from the 1996 SI, 2006 SSI, and the RI (this report). The arsenic data from the RI sampling consist of analyses of subsurface soil samples (two to three ft and four to five ft depth) from the Coal Areas and Paint Shed. The RI focused on arsenic in these AOPCs based on human health screening results from the SI and SSI (TtEC 2008, GEO 2008d).

To identify candidate COPECs (Section 7.4), it was assumed that the exposure of organisms at the 42.96 acre HCAFS site is quantitatively represented by the MDCs shown in Tables 7-1(a) through (d). This approach is conservative considering that the combined area of the AOPCs is a small fraction (less than 25%) of the total acreage of the site (see Figure 1-2).

7.4 ECOLOGICAL EFFECTS ASSESSMENT AND RISK CHARACTERIZATION

Potential harm to the environment was qualitatively evaluated by comparing MDCs with ESVs and TACO metropolitan background values (IAC Title 35, Section 742, Appendix G, Table G). Chemicals that exceeded ESVs and TACO background values were tentatively identified as COPECs. A screening level risk characterization for the candidate COPECs is presented in Section 7.4.2.

7.4.1 Ecological Screening Values (ESVs) and Illinois/TACO Background Concentrations

To identify COPECs, the data [summarized in Tables 7-1(a)-(c) and 7-1(e)] were compared against the lowest of ESVs from the following sources:

- Oak Ridge National Laboratory (ORNL) soil benchmarks (e.g., Efroymson et al. 1997a, Efroymson et al. 1997b, Efroymson et al. 1997c)
- USEPA Region 5 Ecological Screening Levels (ESLs) (USEPA 2003a)
- USEPA Eco-SSL (USEPA 2003b)

The lowest ESVs were consistently either from the ORNL soil benchmarks or the USEPA Region 5 [see column labeled "Source" in Tables 7-1(a)-(c) and 7-1(e)]. For metals, the site data were also compared against the TACO metropolitan background values [IAC Title 35, Section 742, Appendix A, Table G]. If the MDC for a chemical exceeded the ESV and TACO background (for metals) for metropolitan areas, the chemical was considered a candidate COPEC for further evaluation. The results of this screening process are as follows:

- The MDC for all detected VOCs were below ESVs [see Table 7-1(a)]. As such, there are no ecological risks from VOCs in surface and subsurface soil at the HCAFS.
- None of the PCBs were detected in the surface and subsurface soil samples collected from the Maintenance Building [this is the only AOPC where PCBs could have been released based on the preliminary evaluation of the site (Vickers 1996)]. Because 0.5 of the reporting limit for PCBs is below the ESVs, and none were detected, it is reasonable to exclude PCBs from the COPEC list for the HCAFS.
- There were a number of PAHs that exceeded the ESVs in surface soil samples [Table 7-1(c)]. These include: naphthalene, benzo(a)anthracene, chrysene, and benzo(a)pyrene. Thus, PAHs in surface soils are candidate COPECs for further consideration (Section 7.4.2). The

MDC for all PAHs in subsurface soil were below corresponding ESVs [Table 7-1(c)]. As such, it is reasonable to assume that PAHs in subsurface soil do not pose ecological risks at the HCAFS.

- The MDCs for most of the metals exceeded both the ESV and TACO background values [Table 7-1(e)]. Thus, all metals, excluding silver, antimony, calcium, magnesium, potassium, and sodium, are considered further in Section 7.4.2. Silver can be eliminated from further consideration as a COPEC because the MDC in both surface and subsurface soil below the ESV and TACO background values [Table 7-1(e)]. Antimony can also be eliminated as a COPEC because the MDC (1.5 mg/kg) is lower than the TACO background value for metropolitan statistical areas (four mg/kg). Calcium, magnesium, potassium, and sodium do not have screening values and were excluded from the COPEC list. Table 7-1(e) also includes the arithmetic mean and standard deviation of metals in soil samples collected from Illinois by Shacklette and Boergen (1984). Note that only the TACO background values were used in the screening process for selecting COPECs for further evaluation. The data set from Shacklette and Boergen (1984) is primarily used as supplemental information for discussing the screening-level ecological risk characterization results (Section 7.4.2).

The following subsection presents a more detailed evaluation of PAHs in surface soil and candidate COPEC metals in surface and subsurface soils.

7.4.2 Assessment of Candidate Chemicals of Potential Ecological Concern (COPEC)

PAHs in surface soil

A comparison of PAH concentrations in surface soil samples against ESVs [Table 7-1(c)] showed that the maximum concentrations of naphthalene, benzo(a)anthracene, chrysene, and benzo(a)pyrene were greater than the screening values. The ESVs for all four chemicals are from the USEPA Region 5 RCRA ESLs table (USEPA 2003a) and are based on exposure to a masked shrew [*Sorex cinerus*, see Footnote v in USEPA (2003a); exposure equations and sources for toxicity reference values used in deriving the screening values are not available]. More recently, USEPA published an Eco-SSL document (USEPA 2007a) that includes Eco-SSLs for low molecular weight (LMW) PAHs (chemical with fewer than four rings) and high molecular weight (HMW) PAHs (chemicals with 4 or more rings). Table 7-1(c) includes a column that shows the number of rings for each PAH compound. The Eco-SSLs were derived using a methodology that was peer-reviewed by experts who were experienced with either the toxicity and/or risk assessment of PAHs (USEPA 2007a), and literature sources that met specific standards in order to be considered for the screening value calculations (USEPA 2003b). USEPA publishes Eco-SSLs to be used during Step 2 of the Superfund Ecological Risk Assessment process (USEPA 2003b), and are, therefore, suitable for use in this SLERA.

The Eco-SSLs for LMW-PAHs and HMW-PAHs are shown in Table 7-2(a). Note that USEPA attempted to derive Eco-SSLs for plants and avian wildlife, but were unable to find sufficient toxicity data for these receptor classes (USEPA 2007a). Ecological risks were quantified by comparing ECs for LMW-PAHs and HMW-PAHs to the Eco-SSLs. Following the HHRA approach, the EC was set to the 95% UCL, which was calculated using ProUCL 4.0 from the data set consisting of PAH measurements in soil samples from all the AOPCs. Use of the 95% UCL, instead of the MDC, is reasonable given the relatively large number of data points (68) in the data set. To calculate the LMW-PAH and HMW-PAH levels for a given sample, the non-detects in the individual PAH results were first replaced by 0.5 the reporting limit, then the concentrations of the chemicals with less than four rings were summed to determine the sample LMW-PAH concentration, and the concentrations of chemicals with four rings or more were added to calculate the HMW-PAH concentration. Table 7-1(c) shows the number of rings for each PAH compound.

Figure 7-4 shows box and whisker plots for LMW-PAH and HMW-PAHs in surface soil samples from the HCAFS, as well as the 95% UCL values calculated using ProUCL 4.0. As in the HHRA (Section 6), the 95% UCL is significantly higher than the data set median because data points span several orders of magnitude (Figure 7-4). Table 7-2(a) shows surface soil ECs (set to the 95%UCL) for LMW-PAHs and HMW-PAHs, Eco-SSLs for soil invertebrates and mammalian wildlife receptor group, and the ratio between these values (i.e., a HQ) for each receptor group. The HQs for both receptor groups from exposure to LMW-PAHs are below one, which indicates that the ecological risks from this class of chemicals in surface soils are not a concern at the HCAFS. The HQs from exposure to HMW-PAHs are greater than one for soil invertebrates and significantly greater than one for mammalian receptors [Table 7-2(a)].

The Eco-SSL for mammalian receptors is based on HMW-PAH exposure of a mammalian insectivore (shrew), which had the lowest soil screening level of three mammalian receptor types considered by USEPA [Table 7-2(b)]. Using the soil screening levels for these other mammalian receptor types published in the Eco-SSL document (USEPA 2007a) and ECs from the site data, the calculated HQs for HMW-PAHs is less than one for mammalian herbivores and carnivores [see Table 7-2(b)].

In summary, ecological risks from LMW-PAHs in surface soils at the HCAFS are not a concern. Ecological risks from HWM-PAHs in surface soils may be a concern for soil invertebrates and mammalian insectivores (represented by the shrew), but may not be a concern for mammalian carnivores or herbivores.

Metals in surface soil and subsurface soil

The metals concentrations in surface soil and subsurface soil at the HCAFS were compared against USEPA Eco-SSLs and USEPA ESLs (Table 7-3). A metal was retained as a COPEC for further analysis and screening level risk characterization if MDCs exceeded USEPA Eco-SSLs, or regional USEPA SSLs, if USEPA Eco-SSLs were not available (i.e., for mercury and thallium). The following summarizes the results of the comparison for each tentative COPEC:

Mercury: There are no USEPA Eco-SSLs for mercury, but regional USEPA levels range from 0.1 to 0.3 mg/kg. Because only one data point in surface soil (0.14 mg/kg) and none of the subsurface soil concentrations exceeded 0.1 mg/kg (see box plots of data in Figure 7-5), mercury was not retained as a COPEC for further analysis. Note that Figure 7-5 also includes box plots of regional mercury values for Eastern United States from the USEPA database (USEPA 2007c). The latter are included to provide a regional perspective on the mercury levels measured at the HCAFS.

Aluminum: The USEPA Eco-SSL document for aluminum (USEPA 2003f) states that this metal is only toxic at pH levels below 5.5. Since soil pH data collected from the HCAFS are greater than six, aluminum is not considered a COPEC for the site. Note that the maximum aluminum soil concentration (17,000 mg/kg) is below the mean value for aluminum (48714 mg/kg) in background soil samples collected from Illinois by Shacklette and Boerngen (1984).

Arsenic: Arsenic is not a COPEC for surface soil because the MDC in surface soil (11 mg/kg) is below the TACO metropolitan background (13 mg/kg). The MDC in subsurface soil (18 mg/kg) is above the plant Eco-SSLs. Arsenic was retained as a COPEC for further analysis.

Barium: Barium was not retained as a COPEC for further analysis because the MDCs in both surface and subsurface soils are below the USEPA Eco-SSLs. Note that the maximum barium soil concentration (182 mg/kg) is below the mean value measured by Shacklette and Boerngen [1984 (551 mg/kg)] in background soil samples collected from Illinois.

Beryllium: Beryllium was not retained as a COPEC for further analysis because the MDCs in both surface and subsurface soils are below the USEPA Eco-SSLs.

Cadmium: Cadmium was retained as a COPEC for further analysis in surface soil because the MDC (1.7 mg/kg) was above the avian and mammalian USEPA Eco-SSLs (0.77 and 0.36 mg/kg, respectively). Cadmium was eliminated as a COPEC in subsurface soil because the MDC in subsurface soil (0.245 mg/kg) is below the USEPA Eco-SSLs.

Chromium: Chromium was eliminated as a COPEC for further analysis because the MDCs for both surface and subsurface soil are below the USEPA Eco-SSLs. Note that the maximum chromium soil concentration (20 mg/kg) is below the mean value measured by Shacklette and Boerngen [1984 (48.4 mg/kg)] in background soil samples collected from Illinois.

Cobalt: Cobalt was retained as a COPEC for further analysis in subsurface soil because the MDC (16 mg/kg) exceeded the USEPA Eco-SSL for plants.

Copper: Copper was retained as a COPEC for both surface and subsurface soil because the MDCs were above the avian USEPA Eco-SSL.

Iron: The USEPA Eco-SSL document for iron (USEPA 2003f) indicates that iron is not toxic to plants and that this metal is naturally occurring and widely distributed at concentrations ranging from 20,000 to 550,000 mg/kg. As such, iron was eliminated as a COPEC for further analysis.

Lead: Lead was retained as a COPEC for both surface and subsurface soil because the MDCs were above the avian and mammalian USEPA Eco-SSLs.

Manganese: Manganese was retained as a COPEC for both surface and subsurface soil because the MDCs were above the plant and soil invertebrate Eco-SSL.

Nickel: Nickel was eliminated as a COPEC for further analysis for both surface and subsurface soil because the MDCs were less than the soil invertebrate, avian and mammalian Eco-SSLs, and only slightly higher than the plant Eco-SSL.

Selenium: Selenium was retained as a COPEC for further analysis because the MDCs for both surface and subsurface soil exceeded the plant and mammalian Eco-SSLs.

Thallium: Thallium was detected with a maximum concentration of 0.14 mg/kg in surface soil, which is below the USEPA Region 4 and six SSLs. It was not detected in any of the subsurface soil samples (reporting limit of three mg/kg). There was only one detection at 0.14 mg/kg, three non-detects at a reporting limit of 0.2 mg/kg (SI), and nine non-detects with a reporting limit of three mg/kg (SSI). Note that Shacklette and Boerngen (1984) obtained a mean value of 10.3 mg/kg in background soil samples collected from Illinois. The detection at 0.14 mg/kg and non-detects at a reporting limit of 0.2 mg/kg suggest that thallium concentrations are within, or below, background conditions at the HCAFS. Thus, thallium was eliminated as a COPEC.

Vanadium: Vanadium was retained as a COPEC for further analysis because the MDCs for both surface and subsurface soil exceeded the avian Eco-SSLs.

Zinc: Zinc was retained as a COPEC for both surface and subsurface soil because MDCs exceeded the USEPA Eco-SSLs.

ECs for metals COPECs in surface soil, set to the MDCs, coupled with available Eco-SSLs for plant, soil invertebrate, avian wildlife and mammalian wildlife receptor groups as toxicity reference values were used to calculate ecological HQs [Table 7-4(a)]. A similar screening level risk characterization was performed for metal COPECs in subsurface soil [Table 7-5(a)]. In addition, HQs in surface and subsurface soil were also calculated for more specific avian and mammalian receptors [Table 7-4(b) and (c); Table 7-5(b) and (c)] using soil screening levels published in the Eco-SSL documents as toxicity reference values for specific receptor species. The following observations can be made regarding the calculated screening-level ecological risks of these metals:

- Cadmium: The ecological HQs for avian and mammalian receptors from exposure to surface soil are greater than one [Table 7-4(a)]. Note that the HQs were calculated using the MDC of 1.7 mg/kg, which appears to be an outlier (see boxplot of data in Figure 7-6). The remaining data points are comparable to the TACO background and regional data collected by USEPA (also shown in Figure 7-6). Thus, any ecological risks to cadmium at the HCAFS appear to be also comparable to ecological risks under background conditions.
- Cobalt: The ecological HQ for plant receptors from exposure to subsurface soil is greater than one. However, HQs for invertebrate, avian, mammalian and other terrestrial receptors are below one [Table 7-5(a)]. Thus, cobalt in soil at the HCAFS does not pose ecological risks to wildlife. Note that the measured cobalt values are comparable to regional background data compiled by USEPA (Figure 7-7).
- Copper: The HQ from exposure to copper in surface and subsurface soil is greater than one for avian receptors [Table 7-4(a) and 7-5(a)], primarily for avian ground insectivores [woodcock; see Table 7-4(b) and 7-5(b)]. The HQ of 1.14 for avian ground insectivores from exposure to copper in surface soil is only slightly greater than one. The HQ for avian ground insectivores from exposure subsurface soil is higher (1.29), though this is probably conservative since avian receptors are not likely to be frequently directly exposed to soil below a depth of 0.5 ft. Thus, the analysis suggests that copper is not of ecological concern at the HCAFS.
- Selenium: The HQs from exposure to selenium in surface and subsurface soil is greater than one for plant receptors [Table 7-4(a) and 7-5(a)] and mammalian receptors, specifically ground insectivores [shrew; Table 7-4(c) and 7-5(c)]. HQs are below one for other terrestrial receptors. Note that the maximum selenium site concentration (one mg/kg) is within two standard deviations of the mean value in the Shacklette and Boergen [1984 (see Table 7-1e)] data set, which suggests selenium at the HCAFS may be comparable to background.
- Vanadium: The HQs from exposure to vanadium in surface and subsurface soil is greater than one for avian receptors [Table 7-4(a) and 7-5(a)], specifically from avian herbivore [dove; Table 7-4(b) and 7-5(b)] and ground insectivores [woodcock; Table 7-4(c) and 7-5(c)]. Note that the MDC (45 mg/kg) is below the mean of background values (61.82 mg/kg) measured by Shacklette and Boerngen (1984) in soil samples from Illinois. Thus, ecological risks from vanadium appear to be comparable to regional background conditions.
- Manganese: The HQ for plants and soil invertebrates from exposure to manganese in surface and subsurface soil is greater than one [Table 7-4(a) and 7-5(a)]. However, HQs for avian and mammalian receptors are less than one [Table 7-4(a) and 7-5(a)], indicating that manganese does not pose risks to wildlife at the HCAFS.
- Arsenic: The HQs for all ecological receptors from exposure to arsenic in subsurface soil are less than or equal to one (Table 7-5). As such, it is reasonable to conclude that arsenic can be eliminated as a COPEC at the HCAFS.

- Lead: The HQ for plant and soil invertebrates from exposure to lead in surface and subsurface soil are less than one, but are greater than one for avian and mammalian receptor groups [Table 7-4(a) and Table 7-5(a)]. More specific avian receptors were considered in Table 7-4(b) and 7-5(b) (avian herbivores, avian insectivores, and avian carnivores), and Table 7-4(c) and Table 7-5(c) (mammalian herbivores, mammalian insectivores, and mammalian carnivores). The resulting HQs vary with the avian and mammal receptor types, and range from 0.08 for mammalian herbivores (vole) to 8.45 for an avian ground insectivore. Note that the median value for lead in surface and subsurface soil is below the TACO background value for metro areas, and the MDC used to calculate HQs for surface and subsurface soil are both outlier values (see boxplot in Figure 7-7).
- Zinc: The HQs for zinc for all ecological receptor groups were greater than one [Table 7-4(a)] in surface soil, and were greater than one for wildlife receptors in subsurface soil [Table 7-5(a)]. However, if more specific avian and mammalian species are considered [Table 7-4(b) and 7-4(c); Table 7-5(b) and 7-5(c)], one finds that the HQ for zinc is only greater than one for avian and mammalian ground insectivores, but are less than one for avian and mammalian herbivores, as well as avian and mammalian carnivores. Note that the median value for zinc in surface and subsurface soil is below the TACO background value for metro areas, and the MDC used to calculate HQs for surface and subsurface soil are both outlier values (see boxplot in Figure 7-8).

In summary, risk characterization conducted as part of the SLERA indicates that a number of metals are COPECs at the HCAFS because hazards for some terrestrial receptors are greater than one. The need to address these ecological hazards through remedial actions will have to be evaluated in the context of the land use and ecological reconnaissance findings (Section 7.2). The MDCs for lead and zinc were both outliers in the data sets (Figure 7-7 and 7-8). This suggests these elevated values are localized at the HCAFS. Elevated lead in surface soils at the HCAFS is possibly from coal combustion as well as combustion of leaded fuel in vehicles, while elevated zinc can be from road run-off. None of these sources are specific to DoD use of the HCAFS as a radar station. Birds observed during the ecological reconnaissance (dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows) consist of herbivores and ground insectivores. Only the eastern cotton tail rabbit was observed during the ecological site visit, although it is possible that shrews (a common mammalian ground insectivore) were also present, but not observed due their nocturnal habits. Thus, the avian and mammalian species at the HCAFS consist of herbivores and/or ground insectivores that may be exposed to lead, zinc, and other metals in soil at the HCAFS. It should be noted that the HQs were calculated using MDCs. This results in conservative risk estimates, especially for birds that are exposed to soils while foraging and would likely forage in areas larger than the localized areas of elevated zinc and lead. All of the species observed during the ecological reconnaissance are very common and widely distributed. Furthermore, there are no records of State-listed threatened or endangered species within 0.5 miles of the HCAFS. Because there are no important ecological resources in, nor within 0.5 miles of the site, it is not recommended that a baseline ecological risk assessment be conducted for the site.

7.5 UNCERTAINTY ASSESSMENT

Site-specific factors that contribute to uncertainties in the SLERA are discussed below in accordance with the four steps followed to complete the assessment: problem formulation, exposure assessment, effects assessment and risk screening.

7.5.1 Uncertainties in Problem Formulation

Uncertainties associated with problem formulation for this SLERA are related to the following issues: (1) description of the environmental setting, (2) completeness of the ECSM, and (3) definition of the EU.

Environmental setting. The environmental setting for the HCAFS has undergone changes over the past few years since the Hanna City Work Camp was closed in 2002. The fallow fields that make up the primary terrestrial habitat at the site came to exist only after the site was no longer being actively used. As noted in Section 6, there are uncertainties in near-term land use because Peoria County recently took over ownership of the site from the State of Illinois and is still evaluating options for how the land will be used. For all the uses being considered (county jail, county government offices, recreational park), it is likely that the fallow fields will be mowed and landscaped once again. Similarly, aquatic vegetation currently present in the wastewater treatment ponds and lagoon will probably be removed if the site becomes active and the treatment facility becomes operational again. Although there are uncertainties in onsite land use, the agriculture land use in the surrounding area appears to be stable and is likely to remain unchanged in the future. Thus, it is highly unlikely that the area surrounding the HCAFS will be transformed into areas with habitat suitable for sensitive species.

ECSM. There is a low degree of uncertainty associated with the ECSM. The source media (i.e. soil) are well-defined. Given the simplicity of the site layout, which consists of open fields and paved surfaces, transport mechanisms are not expected to be complex and have been adequately incorporated in the ECSM.

EU. The EU for this SLERA was assumed to consist of the 42.96-acre site formerly occupied by the HCAFS. The boundaries of this property, as well as the location of site operations, are well-defined. However, the SLERA did not consider the risks associated with the lagoon due to PRP issues (Section 1.2.3.3). Thus, there is some uncertainty associated with the definition of the EU for the HCAFS because ecological risks from the lagoon have not been considered.

7.5.2 Uncertainties in Exposure Assessment

Uncertainties associated with exposure assessment are related to representativeness of the soil data, analytical data quality and sensitivity. There is always uncertainty in using the analyses of discrete soil samples to characterize a volume of soil that is several orders of magnitude larger than the total volume of the soil samples. The soil data were collected from sub-areas within the HCAFS, where chemical releases were most probable based onsite operations and the site layout. Thus, the soil samples were collected using a spatial scheme that would bias the overall result towards the potentially more contaminated areas, which could possibly result in an overestimation of ECs. The uncertainties associated with analytical data quality were minimized through the use of QC checks (e.g., analysis of laboratory control standards).

7.5.3 Uncertainties in Effects Assessment

Ecological effects were evaluated by selecting ESVs from the lowest of screening values from ORNL soil benchmarks (e.g., Efroymson et al. 1997a-d), USEPA Eco-SSL, USEPA Region 5 ESLs (USEPA 2003c). The lowest values from these sources mostly came from the Region 5 ESLs or the ORNL benchmarks. Although there is uncertainty in the use of these screening values that are based on a limited number of toxicity studies, these values are considered conservative and, therefore, their use is considered appropriate for this SLERA.

If the maximum concentration for a chemical exceeds ESVs and regional background values, ecological effects were evaluated using Eco-SSLs published by USEPA. Use of the Eco-SSLs, instead of

conducting an independent literature search for toxicity reference values, minimizes the uncertainty in the ecological effects evaluation because the Eco-SSLs were derived using a standardized process which was peer-reviewed by national experts on toxicity and risk assessment (USEPA 2003b) and were based on an extensive literature search for toxicity studies that could not have been performed using the funding resources available for the HCAFS RI.

7.5.4 Uncertainties in Risk Screening and COPEC Identification

In general, the risk screening and hazard calculations were conservative because the EC was either set to the MDC for metals, or the 95% UCL for PAHs.

7.6 SUMMARY

A SLERA was performed to evaluate ecological risks from current and potential future exposure to contamination at the HCAFS if no remedial action is taken, and to determine whether a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. In contrast to the HHRA (Section 6), where risks were evaluated for each AOPC, the EU for this SLERA is defined as the entire 42.89 acres formerly occupied by the HCAFS.

As part of a screening level problem formulation, a field ecological reconnaissance was conducted by EnviroScience, Inc. on November 18, 2008, to document habitats and any observed wildlife within and around the HCAFS, as well as to identify any designated wetlands, critical or sensitive habitat for threatened and endangered species. The area surrounding the HCAFS is designated as an agricultural zone with no sensitive areas within a 0.5 mile radius. The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Inventory sites, dedicated Illinois Nature Preserves, or registered land and water Reserves in the vicinity of the site. The site itself consists primarily of buildings, paved roads and parking lots and formerly mowed lawns that are now fallow fields. Dominant plants include Kentucky bluegrass, goldenrod, dandelion, and aster. Animals observed during the site visit include several common bird species (dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows) and eastern cottontail rabbits. Trees located onsite do not contain suitable habitat for the federally endangered Indiana bat (*Myotis sodalist*), which is listed for Peoria County. Three wetland areas observed at the site consist of two wastewater treatment ponds and the lagoon south of the former Village of Hanna City water treatment facility. The ponds and lagoon have not been in use for several years and parts have been overgrown with palustrine emergent vegetation.

The ECSRM developed for the site assumes that the primary contaminant sources are surface (0 to 0.5 ft) and subsurface (0.5 to 5 ft) soil, and there are completed pathways from these sources to plants, soil invertebrates, and avian and mammalian wildlife. Groundwater is not considered a medium of concern for environmental risk because the depth to the water table over most of the site is below 4.5 ft. The data set used in the SLERA consists of surface and subsurface soil samples collected during the SI in July 1996, the SSI in April 2006 (TtEC 2008), and this RI in August and November 2008 (Section 4 of this report). Although the HHRA (Section 6) was focused on PAHs and arsenic in soil, this SLERA considered all chemical analyses from the SI and SSI, as well as this RI. Thus, in addition to PAHs and arsenic, the SLERA included an evaluation of ecological risks from VOCs, PCBs, and all metals in soil at the HCAFS.

To identify COPECs, the surface and subsurface soil data were compared against the lowest of the following ESVs: ORNL soil benchmarks, USEPA Region 5 ESLs, and USEPA Eco-SSLs. For metals, the site data were also compared against the TACO metropolitan background values. If the maximum concentration for a chemical exceeded the ESV and TACO background (for metals) for non-metropolitan areas, the chemical was considered a candidate COPEC for further evaluation. Using this screening

process, VOCs, PCBs, silver, and antimony were eliminated as COPECs. A number of PAHs and metals exceeded their respective ESV and TACO background values (for metals). These chemicals were then evaluated further through a comparison with Eco-SSLs and regional USEPA ecological screening levels (for metals).

Further evaluation for PAHs consisted of a comparison of site concentrations with Eco-SSLs for low-molecular weight (less than four rings) and high-molecular weight (four or more rings) PAHs. Individual PAH concentrations were summed according to the number of rings for a given PAH compound to determine LMW-PAH and HMW-PAH sample concentrations to be compared to the Eco-SSLs. HQs calculated using the 95% UCL for the LMW-PAH and HMW-PAH data sets and the Eco-SSLs show that hazards from the LWM-PAH are below one. Therefore, it is reasonable to conclude that there are no ecological risks from this class of compounds. Hazard calculations for three types of mammals (herbivore, ground insectivore, carnivore) show hazards from exposure to HMW-PAHs to be greater than one for the mammalian ground insectivore (shrew) and less than one for mammalian herbivores (vole) and carnivores (weasel).

The metals concentrations in surface soil and subsurface soil at the HCAFS were compared against USEPA Eco-SSLs and USEPA regional SSLs (Table 7-3). A metal was eliminated as a COPEC if the MDCs were below USEPA Eco-SSLs, or regional USEPA SSLs, if USEPA Eco-SSLs were not available (i.e., for mercury and thallium). Using this screening process (Table 7-3), arsenic, cadmium, cobalt, copper, lead, manganese, selenium, vanadium, and zinc were retained for further analysis as COPECs in surface and/or subsurface soil.

- Using the MDC as the EC and the Eco-SSL as toxicity values, HQs were calculated for plant, soil invertebrate, avian wildlife, and mammalian wildlife receptor groups. The primary results are summarized below.
- Cadmium: The HQs for avian and mammalian receptors from exposure to surface soil are greater than one, but these were calculated using the MDC, which appears to be an outlier. The rest of the data points are comparable to the TACO background and suggest that any ecological risks to cadmium at the HCAFS are also comparable to ecological risks under background conditions.
- Cobalt: The HQ for plant receptors from exposure to subsurface soil is greater than one, however HQs for other terrestrial receptors are below one. Thus, cobalt in soil at the HCAFS does not pose any ecological risks to wildlife.
- Copper: The HQs from exposure to copper in surface and subsurface soil are greater than one only for avian ground insectivores (woodcock). The HQ of 1.14 for avian ground insectivores from exposure to cobalt in surface soil is only slightly greater than one. The HQ for avian ground insectivores from exposure subsurface soil is higher (1.29), although this is probably conservative since avian receptors are not likely to be frequently directly exposed to soil below a depth of 0.5 ft.
- Selenium: The HQs from exposure to selenium in surface and subsurface soil is greater than one for plant receptors and mammalian ground insectivores (shrew). HQs are below one for other terrestrial receptors.
- Vanadium: The HQs from exposure to vanadium in surface and subsurface soil is greater than one for avian herbivores (dove) and ground insectivores (woodcock). Note that the MDC (45 mg/kg) is below the mean of background values (61.82 mg/kg) measured by Shacklette and Boerngen (1984) in soil samples from Illinois. Thus any ecological risks from vanadium appear to be comparable to regional background conditions.

- Manganese: The HQs for plants and soil invertebrates from exposure to manganese in surface and subsurface soil are greater than one, but HQs for avian and mammalian receptors are less than one, indicating that manganese does not pose risks to wildlife at the HCAFS.
- Arsenic: The HQs for all ecological receptors from exposure to arsenic in subsurface soil are less than or equal to one. As such, it is reasonable to conclude that arsenic in soil is not of ecological concern at the HCAFS.
- Lead: The HQ for plant and soil invertebrates from exposure to lead in surface soil are less than one, but are greater than one for avian and mammalian receptor groups. Note that the median value for lead in surface and subsurface soil is below the TACO background value for metro areas, and the MDC used to calculate HQs for surface and subsurface soil are both outlier values. Thus, the elevated lead concentrations appear to be localized rather than being broadly characteristic of the site.
- Zinc: The HQs for zinc for all ecological receptor groups were greater than one. Note that the median value for zinc in surface and subsurface soil is below the TACO background value for metro areas, and the MDC used to calculate HQs for surface and subsurface soil are both outlier values. Similar to lead, the elevated zinc concentrations appear to be localized, rather than being broadly characteristic of the site.

Hazards are greatest for the avian and mammalian ground insectivores. The birds observed during the ecological reconnaissance and mammals likely to be present (e.g., shrews) at the HCAFS consist of herbivores and/or ground insectivores that may be exposed to metals in site soil. However, use of MDCs in HQ calculations results in very conservative risk estimates, especially for birds that are exposed to soils while foraging for food and are more likely to forage in large areas. This is relevant to risks from lead and zinc, which appear to be elevated in localized areas, but on average, are comparable or below the TACO regional background values.

In conclusion, there are a number of metals COPECs in the HCAFS soil based on calculated HQs that were greater than one. However, the HQs are likely to be conservative or comparable to background ecological risks because these were calculated using MDCs that were either outliers or comparable to background values in Illinois soil, as reported in TACO (Appendix A, Table G, metropolitan areas) and by Shacklette and Boerngen (1984). The latter study is very frequently cited as a reference for background data, including USEPA's compilation of background values to support the development of Eco-SSLs (2007c). The ecological reconnaissance indicated that organisms from these receptor groups are present at the HCAFS, but all consist of common, widely distributed species. Because there are no important ecological resources in and within 0.5 miles of the site, it is not recommended that a baseline ecological risk assessment be conducted for the site. The scope and results of the SLERA are sufficient to serve as a basis for decisions regarding future remedial actions at the HCAFS.

8. SUMMARY AND CONCLUSIONS

This section summarizes the various aspects of the RI activities and findings and presents significant conclusions. Recommendations are offered based on the conclusions.

8.1 SUMMARY

A summary of the events undertaken in the field and the results of the analyses with respect to the presence, location, and migration of contaminants in the affected media are presented below. This RI was designed to characterize the nature, extent of, and associated risks from exposure to the groundwater and soil contamination at the HCAFS, Hanna City, Peoria County, Illinois, as part of a continuing effort to assess contaminated media at the HCAFS site. Previous studies have indicated that the soil has elevated levels of PAHs and arsenic while unfiltered groundwater has elevated metals.

8.1.1 Field Activities

The HCAFS has been investigated to determine the nature and extent of contamination in the surface soil, subsurface soil, and groundwater, as well as to compile a database for quantitative risk assessment. Previous studies identified the following areas of concern: metals in groundwater, arsenic in subsurface soil at the Coal/Coal Ash Storage Areas, PAHs in the surface soil at all of the EUs, and PAHs in the subsurface soil at the Vehicle Wash Rack EU.

The field program was designed based on the results of field sampling in 1996, as part of an SI and in 2006 as part of an SSI (TtEC 2008). The RI WP (GEO 2008d) identified six AOPCs for investigation: Coal Area A, Coal Area B, Coal Area C, the Maintenance Building, the Paint Shed, the Vehicle Wash Rack, and the Main Entrance. For calculating risks, Coal Area A, Coal Area B, the Vehicle Wash Rack and the Main Entrance were each considered as separate EUs, which are defined as the likely area in which a receptor will be affected by a potential contaminant in a given medium. Coal Area C, the Maintenance Building, and the Paint Shed (referred to collectively as the Coal Area C EU) were considered as one EU because of their proximity to each other. Groundwater is considered as one EU for the entire site.

The analysis results from the previous SI and SSI showed that PCBs in soil and groundwater and pesticides in groundwater were not found above the reported detection limit. The analytes that were reported above the detection limits were compared to the Illinois EPA's TACO (IAC Section 742) criteria. That comparison showed that neither the results for pesticides in soil, VOCs in groundwater or soil, nor PAHs in groundwater exceeded the applicable standard. Of the metals measured in the surface and subsurface soil samples, only arsenic exceeded the TACO Tier 1 residential soil criteria and only in subsurface soil. Metals were found above TACO Tier 1 Class I groundwater remediation objective in unfiltered groundwater samples. Metals in unfiltered groundwater samples that exceeded TACO groundwater criteria include iron, lead, manganese, and vanadium (arsenic was below the TACO standard but was above the MCL). Filtered groundwater samples analyzed during the SI show significantly reduced aluminum concentrations when compared with the associated unfiltered groundwater samples. Iron, lead, manganese and vanadium in these filtered groundwater samples were below the TACO Class I groundwater criteria (with the exception of manganese in the filtered sample from Coal Area C).

Prior to the fieldwork at the HCAFS, GEO prepared project plans to guide all aspects of the investigation. These included a WP (2008d) and SAP (GEO 2008b), QAPP (GEO 2008a), and Health and Safety Plan (GEO 2008c). The fieldwork took place in August and November 2008.

The RI field and related activities included the following:

- Surface soil samples were collected on August 25, 2008 and November 18, 2008. The August sampling event was performed in accordance with the WP and SAP. The November sampling event was performed after receipt of the August analytical data and was designed to provide additional characterization beyond that proposed in the WP and SAP and to further delineate and confirm the August data points, which were above screening levels. Total, 54 soil samples were collected.
- All subsurface soil samples were collected on November 19, 2008, in accordance with the WP and SAP. Fifty four subsurface samples were collected.
- Ten temporary monitoring wells were installed in accordance with the WP and SAP. Wells were installed at each of the Coal Storage Areas, the Vehicle Wash Rack and the Paint Shed. These wells were sampled on November 20, 2008.

All environmental samples were analyzed, in accordance with the WP, SAP, and QAPP, by Empirical Laboratories, LLC, under contract to GEO. For QA purposes, 11 split samples were analyzed by CT Laboratories. All analyses were performed according to USEPA protocols and methods. The data was verified according to USEPA protocol and LCG requirements. The data validation was performed under full validation guidelines, according to the following documents, as applicable to each method:

- USACE LQSMS, March 2007,
- DoD QSM for Environmental Laboratories, Final Version, January 2006, and,
- USEPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update II, December 1996; update IIIA, April 1998; update IIIB, November 2004; update IV, February 2007.

Screening of COPCs during the RI was performed using the following criteria, based on guidance from Illinois EPA staff. For soils, the screening criterion for a given chemical was set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the RSL (USEPA 2008), and TACO Tier 1 soil component of the groundwater ingestion pathway remediation objectives for Class 1 groundwater. For groundwater, the screening criterion for a given chemical was set to the lowest of the TACO Class I groundwater objectives, Illinois drinking water standards, and federal MCLs. The chemicals without TACO or RSL, criteria were obtained from Illinois EPA's list of Chemicals not in TACO Tier 1 Tables (Illinois EPA 2008). For nutrients in groundwater (i.e., calcium, magnesium, potassium, and sodium), the screening level was set to the TACO Class I groundwater standards for total solids [1200 mg/L (GEO 2008)].

8.1.2 Contamination Assessment

Groundwater

One of the objectives of groundwater sampling for this RI was to test the hypothesis that metals in groundwater are associated with suspended particulates. To that end, both filtered and unfiltered samples were collected. For a given chemical, the groundwater screening criterion used for this RI was the lower value between the Illinois Class I Groundwater Remediation Objective and MCLs. Results of analysis of these samples showed that manganese was the only metal to exceed the screening criteria in both filtered and unfiltered samples. The concentrations in filtered samples were slightly lower than in unfiltered samples. During the soil sampling for this RI, the presence of manganese concretions was noted in the soil. There is no known specific source of manganese based on the likely activities conducted at a radar tracking facility such as the HCAFS. Analysis for manganese in soil, performed in 1996, at the HCAFS show that the concentration in soil, ranging from 170 mg/kg to 1110 mg/kg and averaging 536 mg/kg, is

close to or below the background soil concentration of 630 mg/kg. The concentration of manganese in the site soils is consistent with the manganese concretions observed in the soil and the soil types that have been mapped at the site. The occurrence of manganese in the soil is also consistent with the presence of the Glasford formation above bedrock and coal layers in the sedimentary rocks that occur below the HCAFS. Therefore, natural conditions are the likely reason for the presence of elevated manganese in groundwater. This is also supported by the field Eh and pH measurements, which indicate that soluble manganese is the favored phase under equilibrium conditions. Based on the presence of manganese concretions in the onsite soils, it is probable that manganese in groundwater above the standard is representative of natural conditions.

Additional groundwater constituents that have been identified in samples collected for this RI over the criteria are iron, aluminum, and lead. Iron, like manganese is also common to the onsite soils and, therefore, the presence of iron, present in one unfiltered groundwater sample, is also likely to be naturally occurring. Aluminum was reported above the criteria in two unfiltered samples. All filtered sample results for these constituents were below the criteria. Both aluminum and iron had been reported above the criteria in previous investigations (TtEC 2008). Lead was also reported above the criteria in previous investigations but was not reported above the detection limit in the samples collected for this RI.

The activities associated for radar tracking at the HCAFS do not indicate a source for these metals. Leaching of metals from past coal and coal ash storage can be a source of metals. However, there were no areas of elevated metals concentrations in the surface soil identified that point to a source. Based on the available data, it is not possible to rule out whether the metals are naturally occurring or, if there have been a contribution as a result of site activities.

Surface Soils

Based on previous investigations, the COC in surface soil at the HCAFS are PAHs. Sampling and analysis of surface soil conducted during the SI and SSI showed the presence of PAHs exceeding the TACO Tier 1 residential soil criteria for all sites being considered in this current RI. The PAHs with the lowest criteria (15 µg/kg) are benzo(a)pyrene and dibenzo(a,h)anthracene, which was exceeded in all samples. The PAHs that exceeded criteria in some samples are benzo(a)anthracene (150 µg/kg), benzo(b)fluoranthene (150 µg/kg), and indeno(1,2,3-cd)pyrene (150 µg/kg). Some of the elevated PAHs were found in the vicinity of the former location of a 2000 gal gasohol UST, which was removed in 1993. In addition, a contaminated soil storage pile was also reported to be in the vicinity. The type of soil stored is unknown, but it may have been a staging area for soil removed when the tank was removed. In order to determine the extent of surface soil contamination and to support the baseline risk assessment, GEO collected surface soil samples at Coal Area A (eight samples), Coal Area B (11 samples), the Coal Area C EA (21 samples), the Vehicle Wash Rack (eight samples), and the Main Entrance (seven samples).

The PAHs that have reported concentrations above the RSLs are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, chrysene and dibenzo(a,h)anthracene. Sources of PAHs in soil include road runoff, accumulation of snow along road sides after plowing, pavement sealants, as well as incomplete burning of coal, vehicular emissions, and petroleum spills (Al-Turki 2009; Lopes 1998; Van Metre et al. 2009). There are possible sources of PAHs specific to individual EUs (i.e., vehicle maintenance; coal and coal ash storage); however, road runoff, melting of plowed snow, and vehicular emissions appears to be a site-wide source. PAHs in vehicular emissions are typically adsorbed on air-borne particulate matter, which can be transported at greater distances from roads when compared to road runoff.

In the Coal Area A EU, the total concentration of total PAHs range from 191.4 to 34,994 µg/kg [concentrations for benzo(a)pyrene, the most toxic PAH, ranges from 19 to 3000 µg/kg]. One sample had

no reported results above the criteria. The highest concentrations of total PAHs were reported from two samples that were collected within 20 ft of each other in the area that is thought to be the location of the Coal Storage Pile, although these samples were also located within five ft of a paved surface. This suggests that a possible source of the higher levels of PAH at these locations is residual contamination from coal storage; however, road runoff and plowed snow cannot be ruled out. The presence of PAHs in every sample from the Coal Area EU, even at more than 100 ft from the suspected storage location, suggests a diffuse source such as vehicle emissions.

The reported results from samples collected in the Coal Area B EU for total PAHs range from 191.4 to 33,550 µg/kg. Benzo(a)pyrene concentrations exceed the screening criteria in all samples (94 to 11,000 parts per billion). The sample with the highest PAH concentrations is located in the vicinity of the suspected coal area, although it is also within a few feet of a paved surface. The other samples with high PAHs were collected 50 ft from a suspected coal storage area along the berm, around wastewater treatment ponds. Detailed ground elevation measurements are not available for the site; however, given that the wastewater treatment facility was built in this location, this is probably the lowest spot in the area (to allow gravity feed of sewage). Thus, although there are no roads next to some of the samples with elevated PAHs that would directly indicate road runoff; it is possible that surface water runoff (carrying road-related PAHs) drains towards this area. The areal distribution of reported PAH concentrations in the surface soil suggest that, similar to Coal Area A, the primary source of PAHs at Coal Area B may be residual material from the coal storage pile. However, road and surface water runoff and snow melt cannot be ruled out as sources of PAHs in this area.

The Coal Area C EU includes Coal Area C, the Maintenance Building and the Paint Shed. These sites were combined into one EU due to their proximity to each other. This is also the area where a 2000 gal gasohol UST (owned and installed by IDoC) was removed (also by IDoC) in 1993 and a stock pile of contaminated soil was located based on documents obtained from Illinois EPA's LUST division. The source of the contaminated soil is unknown, but it was likely soil excavated during one of the tank removals. The total reported PAH concentrations range from 1071.9 to 243,550 µg/kg [benzo(a)pyrene range from 80 to 19000 µg/kg]. All of the surface soil samples collected in the HCCC EU exceed the screening criteria. The reported concentrations for benzo(a)pyrene and dibenzo(a,h)anthracene exceed the respective screening criteria for all samples collected. This is the only EU where chrysene was found to exceed the criteria (more than 15,000 µg/kg in two samples). Analysis results for benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene exceed the screening criteria at 28 and 22 locations, out of 29, respectively. Criteria exceedances for other PAHs occur in more limited numbers of locations. Residual contamination from the former coal storage area is a possible source of PAHs in the surface soil. There seems to be a general trend across this EU of higher concentrations of PAHs near parking areas and roads. This indicates the possibility that a source of PAHs to the surface soil is runoff or snow plowed to the edge of these areas. Other potential sources are a drain that emerges from the Maintenance Building, the residual contamination from the former soil pile location, and residual contamination from a former tank location. The diffuse detection of PAHs, even at locations away from the suspected coal area, the Maintenance Building and the Paint Shed building also suggests vehicular emissions as a source.

The reported results from all samples from the Main Entrance EU, where a possible former underground fuel tank or septic tank was suspected exceed screening criteria for benzo(a)pyrene. Samples from all but two locations exceed the criteria for dibenzo(a,h)anthracene. The total concentration of PAHs at the sampled locations range from 275 µg/kg to 79,881 µg/kg [benzo(a)pyrene ranges from 43 to 5900 µg/kg]. Criteria exceedances for other PAHs occur in more limited numbers of locations. The distribution of elevated PAH concentrations does not suggest a particular pattern of occurrence, although all sampling locations, because of the layout of the site, are near parking areas or roads. The highest PAHs were measured in a sample collected from the vicinity of the suspected underground tank or septic tank, although this location is also within five to 10 ft of a road. Furthermore, the next highest PAHs were

measured in a sample that was collected more than 100 ft from the suspected tank location, but within five to 10 ft of a paved surface. Thus, although leaks from a suspected tank fueling station cannot be ruled out, the PAH concentrations at this EU likely reflect transport of PAHs onto the site from runoff and piling of plowed snow at the edges of the vehicle areas, and vehicular emissions.

The reported results from all samples from the Vehicle Wash Rack EU exceed the TACO screening criteria for benzo(a)pyrene and samples from all but two locations exceed the criteria for benzo(b)fluoranthene and dibenzo(a,h)anthracene. Criteria exceedances for other PAHs occur in more limited numbers of locations. The total PAH concentrations range from 217.3 to 55,095 µg/kg [benzo(a)pyrene from 17 to 7900 µg/kg]. Concentrations of PAHs at this EU appear to be highest adjacent to the road to Coal Area A. The lowest concentrations occur at the greatest distance from this road. This suggests the possibility of PAHs either resulting from loss of material as it was being transported to or from the Coal Area, or from runoff or snow piles associated with the road rather than, or in addition to, the Vehicle Wash Rack operations.

Subsurface Soil

Two subsurface samples were collected for PAH analysis at each of seven locations in the Vehicle Wash Rack EU. These samples were collected because the reported results for one sample, and its duplicate, collected at this site during the SI and SSI were above the TACO Tier 1 residential soil criteria for four PAHs. The reported results of the RI sampling and analysis are below the detection limit for most samples. The only exceedances of the TACO Tier 1 criteria identified are for benzo(a)pyrene in only the four to five ft sample interval at two locations. The criterion for benzo(a)pyrene is 15 µg/kg; which is also the reported concentration in the sample at HCVWSB04. The reported concentration in the sample at HCVWSB05 is 35 µg/kg. Based on the low levels of PAHs found in the remaining subsurface samples, it is reasonable to conclude that the exceedances identified previously are isolated occurrences.

In order to determine the vertical extent of elevated arsenic concentrations found in the subsurface soil in previous investigations, GEO collected soil samples at depths of two to three ft and four to five ft bgs. Samples from each depth were collected from seven locations at Coal Storage Area A, seven locations at Coal Storage Area B; four locations at Coal Storage Area C, and three locations at the Paint Shed. Including duplicate samples, a total of 46 samples were collected from 20 locations and analyzed for arsenic. Four samples, including one duplicate, were also analyzed for soil pH.

The background arsenic concentration for counties within metropolitan areas (13 mg/kg) was reached or exceeded in 12 of the 58 samples. Arsenic concentrations in the samples collected for this RI ranged from seven mg/kg to 16.2 mg/kg. At none of the four locations where duplicate samples were collected and analyzed for arsenic, were both the primary and duplicate sample analysis results above the background concentration. The distribution of arsenic in the subsurface soil at each of the EUs sampled does not suggest either pattern within each EU or for the site as a whole. There are no known site activities associated with radar tracking that would be potential sources of arsenic. Possible sources of arsenic include pesticides and coal. There has been no documentation of use of pesticides containing arsenic at the HCAFS. The coal storage areas possibly contributed to the arsenic concentrations in the subsoil, but it must also be pointed out that coal seams have been reported in the shallow bedrock in the vicinity of the HCAFS. These coal seams may also be contributors of arsenic in the soil for all EUs at the HCAFS. It should also be noted that groundwater in the Glasford formation has been documented to have high arsenic concentrations. Although no analysis of the aquifer material could be located, the presence of arsenic in the groundwater in this formation strongly suggests that arsenic is naturally present in the formation. The presence of natural sources and the lack of a pattern of distribution of elevated arsenic that points to specific source(s) suggest that either the arsenic is naturally occurring, or the sources resulted in broad low level distribution.

8.1.3 Fate and Transport of Contaminants

The fate and transport of contaminants is generally due to persistence of the contaminants in the media, migration pathways available to each contaminant, and the characteristics of the migration pathways. The COPCs that were identified in the RI WP were: metals in groundwater, arsenic in subsurface soil at the Coal/Coal Ash Storage Areas, PAHs in the surface soil at all of the EUs, and PAHs in the subsurface soil at the Vehicle Wash Rack EU. Based on the results of sampling conducted for this RI, the most significant of these are PAHs in surface soils. In addition, metals in groundwater and arsenic in subsurface soil are also of concern.

PAHs are persistent in the soil because of their hydrophobic nature/low solubility and strong tendency to adsorb to soil. Except for manganese, the metals in groundwater are associated with the suspended particulates based on the difference between concentrations reported for filtered and unfiltered samples. This is also confirmed by the limited solubility of the forms of aluminum and lead that are stable in the Eh/pH conditions of the site. Therefore, the metals in groundwater are considered to be persistent in the solid phase and unlikely to become solubilized. The solubility of the stable form of iron is also limited under site conditions. Iron, however, is also dependent on the DO content of the water, which is a factor that can change seasonally with changes in recharge. Iron could become soluble with a decrease in DO. Based on these conditions, iron is considered to be stable in the solid phase under the current conditions, but with the potential to become soluble and available for transport with change in groundwater conditions.

Manganese behaves similarly to iron, although at different rates. The stable form of manganese in the Eh/pH conditions of the site is a soluble form. As a result, manganese is dissolving into groundwater. This is demonstrated by the small difference in concentrations reported in filtered and unfiltered samples. There also appears to be an on-going source for manganese in that manganese concretions were observed in the soil during soil sampling. Manganese is, therefore, expected to be persistent in the dissolved phase in groundwater.

As a result of the nature and extent of contamination and the site-specific conditions, the potential migration pathways of contaminants at the site fall into the following categories: vertical and horizontal migration through the unsaturated and saturated zones; surface transport of shallow soil contaminants via surface runoff and snow melt; and particulate re-suspension, and atmospheric transport in a prevailing downwind direction or during activities that result in soil disturbance. The PAHs at the HCAFS facility have impacted surface soils and all of the migration routes are possible. It is impossible to determine if the inorganic constituents in groundwater are naturally occurring or the result of site activities. A potential migration route for arsenic found in the subsurface soil is to groundwater, via dissolution. This is unlikely since arsenic occurs in a form that is of limited solubility under site conditions.

The available pathways for PAHs in surface soils are surface transport via surface runoff and snow melt. Particulate re-suspension and atmospheric transport are possible pathways for PAHs in both surface and subsurface soils from coal storage areas or if the soil is disturbed by excavation or tilling. Surface soils containing PAHs are subject to atmospheric transport when the soils are disturbed and dust is produced. Arsenic in subsurface soils would also be subject to atmospheric transport if the soil is disturbed.

Migration in groundwater is a pathway for manganese, since manganese occurs in the dissolved phase; it is also a potential pathway for iron should iron become soluble. Manganese in groundwater is subject to diffusion and advection. However, diffusion is the movement of dissolved contaminants from areas of high concentration to areas of low concentration. Concentrations of manganese are generally even and distributed in the groundwater of the site. If the manganese concentrations are significantly lower in groundwater downgradient of the site, then diffusion will occur. The same would be true for iron

if site conditions change and iron becomes soluble. The use of groundwater as a water supply is not permitted in the Village of Hanna City due to issues unrelated to the HCAFS. Therefore, there is no downgradient human receptor.

8.1.4 Risk Assessment

8.1.4.1 Human Health Risk Assessment

A baseline HHRA was conducted to evaluate potential human health risks resulting from exposure to soil and groundwater contamination if no remedial action is taken at the HCAFS. Data collected from the SI, SSI, and RI were aggregated according to the following environmental media: surface soil (defined as soil from 0 to 0.5 ft bgs), subsurface soil (defined as soil from depths greater than 0.5 ft bgs), and groundwater. In evaluating risk from soil contamination, Coal Area A, Coal Area B, the Vehicle Wash Rack, and the Main Entrance were each considered as separate EUs. Because of their proximity to each other, Coal Area C, the Maintenance Building, and the Paint Shed were combined into one EU. To evaluate risks from groundwater, the entire site was considered as a single EU.

The risk assessment was focused on COPCs in areas where chemical analyses from the SI and SSI exceeded human health screening criteria. Specifically, the HHRA evaluated carcinogenic risks and non-carcinogenic hazards from PAHs in surface soils at all EUs, PAHs in subsurface soil at the Vehicle Wash Rack EU, arsenic in subsurface soil at the three Coal Area EUs, and metals in groundwater. Additional data were collected as part of the RI such that when combined with data from previous investigations, a data set with a sufficient number of samples was available for reliably quantifying exposures. To identify COPCs that were to be carried through the quantitative HHRA, data were compared against human health screening criteria that consisted of the TACO background concentrations for metals (or the lowest of the TACO and USEPA RSL criteria for soil) and the lowest of the TACO groundwater criteria (Illinois and federal drinking water standards for groundwater). Before the data were screened, non-detects were replaced with 0.5 the reporting limit such that if 0.5 the reporting limit was greater than the screening criterion, it was considered an exceedance. PAHs with consistent exceedances in surface soil among the EUs were benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. A similar set of PAHs were observed to have exceedances in subsurface soil at the Vehicle Wash Rack EU, though concentrations were much lower than in the surface soil and there were many non-detects. Arsenic concentrations in a number of subsurface soil samples exceeded the TACO background concentration for arsenic in non-metropolitan areas, which was used as the screening criterion. For unfiltered groundwater from the SI, SSI, and RI, there were exceedances for aluminum, arsenic, iron, lead, magnesium, manganese, and vanadium. The elevated metals in the unfiltered groundwater samples were likely associated with suspended solids, based on analyses of filtered groundwater samples, for which exceedances were only observed for manganese.

Based on the most recent land use as a correctional facility, the site receptors considered in the HHRA were a correctional facility inmate and a correctional facility worker. An unrestricted land use scenario was incorporated in the risk assessment by including residential receptors (adult and child). In the CSRM, it was assumed that there were completed pathways from surface and subsurface soil to all four site receptors and from groundwater to residential receptors. These completed pathways were then included in the HHRA.

Using the combined data set from and the SI, SSI, and the RI field sampling events, EPCs for COPCs were calculated using ProUCL 4.0 (Version 4.00.02). The EPCs were then converted to CDIs, inhalation ECs, and DADs using standard equations and parameters provided by USEPA for modeling exposure through ingestion, inhalation, and dermal contact. Incremental carcinogenic risks and HIs were then calculated using carcinogenic and non-carcinogenic toxicity values published by USEPA and other sources accepted by USEPA (e.g., PPRTV, CalEPA).

The calculated ILCRs are compared against the NCP risk range (10^{-4} to 10^{-6}) for setting remediation goals (USEPA 1990), which is consistent with the TACO acceptable risk range of 10^{-4} and 10^{-6}, if requirements of TACO Section 742.915 are followed. For all EUs considered in the HHRA, incremental carcinogenic risks from surface and subsurface soil for correctional facility inmate and workers were below 10^{-4}, the risk level considered unacceptable by TACO regulations. Between the two correctional facility receptors, the ILCR was higher for the correctional facility worker, ranging from 2.5×10^{-5} at the Main Entrance EU to 7.4×10^{-5} at the Coal Area C EU. Under unrestricted land use, incremental carcinogenic risks from exposure to soil for both the resident adult and child receptors were greater than 10^{-4}. More than 90% of these risks are from exposure to PAHs in surface soil.

COCs are those chemicals for which the chemical-specific ILCR exceeds 10^{-6}. Under land use as a correctional facility, the COC in surface soil at all EUs are benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Under unrestricted land use, the COCs in surface soil are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. In subsurface soil, arsenic is only a COC at the Coal Area EUs. Benzo(a)pyrene is the only COC in subsurface soil at the Vehicle Wash Rack EU.

The HIs from surface soil cannot be calculated because there are no non-carcinogenic toxicity values available for PAHs. The HIs from arsenic in subsurface soil are below 1 for all site receptors.

Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10^{-4}, which is primarily from arsenic. Note that the arsenic is probably associated with suspended solids, and that there are no carcinogenic COPCs in the filtered groundwater samples. Groundwater samples collected in November 2008, as part of the RI, had lower levels of metals, including arsenic, which did not exceed the MCL (10 μg/L) in the unfiltered samples. Elevated metals measured during the SI and SSI (and which were used in the risk calculations) are likely biased high from suspended solids. Thus, the RI samples are more representative of groundwater quality at the HCAFS.

The HIs from unfiltered groundwater for the residential receptors are greater than one, with HQs for every metal exceeding one. The HIs from filtered groundwater are also greater than one, with dissolved manganese being the only contributor to this hazard.

8.1.4.2 Screening Level Ecological Risk Assessment

A SLERA was performed to evaluate ecological risks from current and potential future exposure to contamination at the HCAFS, if no remedial action is taken, and to determine if a baseline ecological risk assessment is required to protect important ecological resources within and in the vicinity of the HCAFS. In contrast to the HHRA, where risks were evaluated for each AOPC, the EU for this SLERA is defined as the entire 42.89 acres formerly occupied by the HCAFS.

As part of a screening level problem formulation, a field ecological reconnaissance was conducted by EnviroScience, Inc. on November 18, 2008, to document habitats and observed wildlife within and around the HCAFS, as well as to identify designated wetlands, critical or sensitive habitat for threatened and endangered species. The area surrounding the HCAFS is designated as an agricultural zone with no sensitive areas within a 0.5 mile radius. The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Inventory sites, dedicated Illinois Nature Preserves, or registered land and water Reserves in the vicinity of the site. The site itself consists primarily of buildings, paved roads and parking lots, and formerly mowed lawns that are now fallow fields. Dominant plants include Kentucky bluegrass, goldenrod, dandelion, and aster. Animals observed during the site visit include several common bird species (dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows) and eastern cottontail rabbits. Trees located onsite do not contain suitable habitat for the federally endangered Indiana bat (*Myotis sodalist*),

which is listed for Peoria County. Three wetland areas observed at the site consist of two wastewater treatment ponds and the lagoon south of the former Village of Hanna City water treatment facility. The ponds and lagoon have not been in use for several years, and parts have been overgrown with palustrine emergent vegetation.

The ECSRM developed for the site assumes that the primary contaminant sources are surface (0 to 0.5 ft) and subsurface (0.5 to five ft) soil, and there are completed pathways from these sources to plants, soil invertebrates, and avian and mammalian wildlife. Groundwater is not considered a medium of concern for environmental risk because the depth to the water table over most of the site is below four ft. The data set used in the SLERA consists of surface and subsurface soil samples collected during the SI in July 1996, the SSI in April 2006 (TtEC 2008), and this RI in August and November 2008. Although the HHRA focuses on PAHs and arsenic in soil, this SLERA considers all chemical analyses from the SI and SSI, as well as this RI. Thus, in addition to PAHs and arsenic, the SLERA includes an evaluation of ecological risks from VOCs, PCBs, and all metals in soil at the HCAFS.

To identify COPECs, the surface and subsurface soil data were compared against the lowest of the following ESVs: ORNL soil benchmarks, USEPA Region 5 ESLs, and USEPA Eco-SSLs. For metals, the site data were also compared against the TACO non-metropolitan background values. If the maximum concentration for a chemical exceeded the ESV and TACO background (for metals) for non-metropolitan areas, the chemical was considered a candidate COPEC for further evaluation. Using this screening process, VOCs, PCBs, silver and antimony were eliminated as COPECs. A number of PAHs and metals exceeded their respective ESV and TACO background values (for metals); these chemicals were then evaluated further through a comparison with Eco-SSLs and regional USEPA ecological screening levels (for metals).

Further evaluation for PAHs consisted of a comparison of site concentrations with Eco-SSLs for LMW- (less than four rings) and HMW- (four or more rings) PAHs. Individual PAH concentrations were summed according to the number of rings for a given PAH compound to determine LMW-PAH and HMW-PAH sample concentrations to be compared to the Eco-SSLs. HQs calculated using the 95% UCL for the LMW-PAH and HMW-PAH data sets and the Eco-SSLs show that hazards from the LWM-PAH are below one. Therefore, it is reasonable to conclude that there are no ecological risks from this class of compounds. Hazard calculations for three types of mammals (herbivore, ground insectivore, carnivore) show hazards from exposure to HMW-PAHs to be greater than one for the mammalian ground insectivore (shrew) and less than one for mammalian herbivores (vole) and carnivores (weasel).

There are a number of metal COPECs in the HCAFS soil, based on calculated HQs that were greater than one. However, the HQs are likely to be conservative or comparable to background ecological risks because these were calculated using MDCs that were either outliers or comparable to regional soil background values for Illinois. Hazards are greatest for the avian and mammalian ground insectivores. The birds observed during the ecological reconnaissance and mammals likely to be present (e.g., shrews) at the HCAFS consist of herbivores and/or ground insectivores that may be exposed to metals in site soil. However, use of MDCs in HQ calculations results in very conservative risk estimates, especially for birds, which are exposed to soils while foraging for food and which are more likely to forage in large areas. This is relevant to risks from lead and zinc, which appear to be elevated in localized areas, but on average are comparable to or below the TACO regional background values. Organisms observed during the ecological reconnaissance consist of common bird species and the eastern cottontail rabbit. There are no records of State-listed threatened or endangered species within 0.5 miles of the HCAFS. Because there are no important ecological resources in and within 0.5 miles of the site, it is not recommended that a baseline ecological risk assessment be conducted for the site. The scope and results of the SLERA are sufficient to serve as a basis for decisions regarding future remedial actions at the HCAFS.

8.2 CONCLUSIONS

The work completed for this RI Report was designed to:

- Identify possible sources of potential environmental contamination,
- Characterize the nature and extent of potential environmental contamination, and
- Quantify associated risks to human health and the environment at the HCAFS.

The potential contaminants have been identified as PAHs in surface and subsurface soil, arsenic in subsurface soil, and metals (manganese, iron, aluminum, and lead) in groundwater. There are several possible sources of PAHs in the surface soil, which include: former coal storage areas, residual contamination from leaking underground fuel storage tanks, a former contaminated soil storage pile and road runoff and snow melt. Conclusions regarding sources for PAHs are:

- Given the ubiquitous occurrence of low level PAH concentrations and the location of elevated concentrations near roads and parking areas, road runoff, snowmelt, and vehicle emissions can be identified as a source of surface soil PAHs across the entire HCAFS,
- The distribution of elevated PAHs in the surface soil at Coal Area A and Coal Area B can lead one to conclude that the former coal storage piles were contributing sources, though the highest PAH concentrations were consistently found next to roads or areas where surface water runoff can accumulate (i.e., Coal Area B being at a lower elevation that most of the site),
- Residual contamination from the fuel storage tanks (installed and removed by IDoC) are likely, but not confirmed, as localized sources of elevated PAH concentrations in Coal Area C EU,
- Road runoff and/or snowmelt, and vehicle emissions are the primary sources of PAHs in the surface soil at the Main Entrance and the Vehicle Wash Rack, and
- A source for elevated PAH concentrations at the Vehicle Wash Rack in the subsurface soil cannot be identified and the elevated PAHs are thought to be isolated occurrences.

Arsenic was found above background concentrations in the subsurface soil in Coal Areas A, B and C. A single source could not be found and it is concluded that the concentrations are likely representative of background conditions, based on the association of arsenic with the Glasford formation and with coal, both of which occur in the subsurface at the HCAFS.

Metals have been detected in groundwater samples. Total metals or unfiltered sample results show concentrations of iron, aluminum, vanadium and lead over the Illinois criteria. Based on the absence of elevated levels of these metals in filtered samples, it is concluded they are associated with suspended particulates. Both filtered and unfiltered samples were reported to contain manganese over the standard across the site. Based on the presence of manganese concretions in the soil, their documented presence in the unconsolidated material above bedrock, and the solubility of manganese, it is concluded that manganese is being solubilized from the surface and subsurface soil. Based on the lack of solubility of the other metals and the presence of a natural source of manganese in the soil, it is concluded that the metals in groundwater represent natural conditions.

Based on the data collected for this RI and previous studies, the following conclusions are made regarding the nature and extent of contamination:

- Sample results from surface and subsurface soils and groundwater exceed the applicable screening criteria provided by Illinois EPA staff;
- Localized occurrences of significantly elevated PAHs occur in Coal Area B and C, in the vicinity of suspected coal/coal ash storage areas, but also next to paved surfaces;
- Concentrations of arsenic in the subsurface soil that exceed screening criteria are distributed generally evenly both laterally and vertically;
- Metals in groundwater that exceed the screening criteria are, except for manganese, associated with suspended particulates. It has been documented that elevated levels of manganese, arsenic, iron and vanadium, which are found above criteria in unfiltered samples, are natural constituents of the groundwater in the formations found at the HCAFS. Further, iron was found in only one of the unfiltered samples collected for this RI. There is no known source of aluminum at the site and aluminum was found above the criteria in only two of the unfiltered samples collected for this RI. The difference between the concentrations of these constituents reported from analysis of samples prior to the RI and the unfiltered samples collected during the RI, suggests that the higher concentrations reported in earlier investigations are the result of high sample turbidity; and
- Except for PAHs in soil, the potential contaminants are representative of natural conditions.

The following conclusions were made from the HHRA results:

- For all EUs considered in the HHRA, incremental carcinogenic risks from surface and subsurface soil for correctional facility inmate and workers were below 10-4 (the risk level considered unacceptable by TACO regulations).
- Under unrestricted land use, incremental carcinogenic risks from exposure to soil at all EUs were above 10-4 for both the resident adult and resident child receptors.
- For this HHRA, COCs are those chemicals for which the chemical-specific ILCR exceeds 10-6. Under land use as a correctional facility, the COCs in surface soil at all EUs are benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Under unrestricted land use, the COCs in surface soil are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene. In subsurface soil, arsenic is the only a COC at the Coal Area EUs. Benzo(a)pyrene is the only COC in subsurface soil at the Vehicle Wash Rack EU.
- The HIs from surface soil cannot be calculated because there are no non-carcinogenic toxicity values available for PAHs. The HIs from arsenic in subsurface soil are below one for all site receptors.
- Incremental carcinogenic risks from unfiltered groundwater for the residential receptors exceed 10-4, primarily from arsenic. Note that the arsenic is probably associated with suspended solids, and that there are no carcinogenic COPCs in the filtered groundwater samples.

The HIs from unfiltered groundwater for the residential receptors are greater than one, with HQs for every metal exceeding one. The HIs from filtered groundwater are less than one with manganese being the only contribution to this risk.

The conclusion of the SLERA is that there are a number of metals COPECs in the HCAFS soil, based on calculated HQs that were greater than one. However, the HQs are likely to be conservative or comparable to background ecological risks because these were calculated using MDCs that were either outliers or comparable to background values in Illinois soil, as reported in TACO (Appendix A, Table G,

metropolitan areas) and by Shacklette and Boerngen (1984). The latter study is very frequently cited as a reference for background data, including USEPA's compilation of background values to support the development of Eco-SSLs (2007c). Hazards are greatest for the avian and mammalian ground insectivores. The birds observed during the ecological reconnaissance and mammals likely to be present (e.g., shrews) at the HCAFS consist of herbivores and/or ground insectivores that may be exposed to metals in site soil. However, use of MDCs in HQ calculations results in very conservative risk estimates, especially for birds that are exposed to soils while foraging for food and are more likely to forage in large areas. This is relevant to risks from lead and zinc, which appear to be elevated in localized areas, but on average, are comparable to or below the TACO regional background values. Organisms observed during the ecological reconnaissance consist of common bird species and the eastern cottontail rabbit. There are no records of State-listed threatened or endangered species within 0.5 miles of the HCAFS. Because there are no important ecological resources in and within 0.5 miles of the site, it is not recommended that a baseline ecological risk assessment be conducted for the site. The scope and results of the SLERA are sufficient to serve as a basis for decisions regarding future remedial actions at the HCAFS.

8.2.1 Data Limitations and Recommendations for Future Work

The identification of uncertainties is important to the interpretation of study findings in order to evaluate the magnitude of conservatism and identify significant data gaps. The uncertainties associated with the procedures leading to the summary and conclusions presented are discussed below:

- Lacking inorganic water quality data from shallow groundwater upgradient of the HCAFS, it is not possible to definitively state that the metals, particularly manganese, are representative of natural conditions. Since there is no human receptor for groundwater downgradient of the HCAFS, and no known onsite source for the metals, this uncertainty is not significant, and
- The exact sources of elevated PAHs in the surface soil cannot be identified. However, all of the possible original site sources have been removed and are, therefore, no longer active contributors. Although normal road use appears to be a significant source of PAHs, the extent of the contribution of roads cannot be quantified based on the available data.

The following uncertainty factors need to be considered when using the calculated risks and hazards for decision making at the HCAFS:

- There is uncertainty regarding land use because Peoria County recently (in July 2009) took ownership of the property from the State of Illinois, and the county government is still considering what to do with the land. One of the options being considered is to use the property to help relieve overcrowding in county jails, for which the analyses of risks to correctional facility receptors would be applicable. The exposure parameters used for the correctional facility inmate and worker may be sufficiently conservative for possible receptors under other land uses (e.g., county government worker, recreational user).
- For PAHs in surface soil, the wide range in values that spanned one to two orders of magnitude resulted in EPCs that were significantly higher than the average values (e.g., five times the mean concentration and 27 times the median concentration in Coal Area C EU). This suggests that the calculated risks and hazards from exposure to PAHs in surface soils are conservative and may be much higher than risks and hazards that would have been determined had the HHRA been conducted using a central tendency approach.

Very slow recharge observed during RI field sampling suggests that the deposits from which the groundwater samples were collected are not sufficiently conductive to support domestic water supply wells. Furthermore, there is an ordinance from the Village of Hanna City that prohibits the use of groundwater for potable water supply because industrial/commercial land use in the Village resulted in

groundwater quality not meeting Illinois standards. Drinking water in the area, including the Hanna City Work Camp before it was closed, is provided by the Illinois of America Water Company. It is therefore not likely that residential receptors will use the shallow groundwater underlying the HCAFS.

8.2.2 Recommended Remedial Action Objectives

The recommended remedial objectives for the HCAFS have been developed based on the following:

- The HI for filtered groundwater is less than one for manganese, which is the only detected metal in filtered groundwater samples that exceeded screening criteria. The Total HI for unfiltered groundwater is greater than one, with manganese, arsenic, and iron being the major contributors. It has been documented that elevated levels of these constituents and vanadium, which is also a contributor, are typical of the groundwater in the formations found at the HCAFS. Further, iron was found in only one of the unfiltered samples collected for this RI. There is no known source of aluminum at the site and aluminum was found above the criteria in only two of the unfiltered samples collected for this RI. The difference between the measured concentrations in samples collected during the SI and SSI, and the unfiltered samples collected during the RI, suggests that the higher concentrations reported in earlier investigations are the result of high sample turbidity. Therefore, since the calculation of the EPCs includes the results from earlier investigations, the HI for groundwater is considered to be biased high.
- Arsenic, the only metal in the subsurface soil for which concentrations exceeded the screening criteria, was carried through the quantitative risk assessment. The result was the HIs for all receptors are less than one, and incremental carcinogenic risks are less than 10-5 for all receptors.
- Based on the variety of potential sources that are not specifically associated with the use of the HCAFS by the Air Force and that are subject to exemption or exclusion from CERCLA, including road runoff/snow melt, delineation of PAHs attributable to site activities may not be feasible.
- The incremental carcinogenic risks from exposure to soil for residential receptors exceeds 10^{-4} at all EUs, and 90% of these risks are from exposure to PAHs in surface soil. At all EUs, the risk to correctional facility workers and inmates is below 10^{-4}.
- Based on a review of the available literature and the distribution of concentrations of PAHs at the HCAFS, it appears that vehicular emissions and normal road use is, at least, a significant source of PAHs in the surface soil. As a matter of definition of release under CERCLA, an exemption to PAHs adjacent to roads exists in the CERCLA program. The applicable CERCLA exclusion for the HCAFS is stated in 42 USC Section 9601, 22(B), which defines one form of exclusion as “emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station.”
- The future use of the HCAFS is uncertain at this time. The site must be used for public purpose(s). However, the specific future use is uncertain at this time. The target receptor populations that were used for evaluation of human health risk are comparable to the range of possible uses. We have included both adult and child residents in the determination of human health risk with the understanding that this is a very conservative approach. Given the mandate that the site must be used for a public purpose, the probability that there will be housing on the site is very low. In the past, the site had been considered for use by elderly residents, but the site was rejected for this use due to its distance from population centers and from public transportation.

Based on the above considerations, the recommended remedial action objective is to reduce the human health risk posed by surface soils to acceptable levels for residential or industrial/commercial use. The actual extent of remediation will then be determined as part of remedial design after collection and analysis of additional samples to determine the lateral extent of surface soil contamination. Because there is evidence that vehicle emissions and road runoff may be sources of PAHs at the HCAFS, a site-specific background study will be conducted before remediation to determine concentrations of PAHs in surface soils that can be attributed to vehicular traffic and road effects. The background concentrations will be used in delineating areas requiring remediation at each EU. Groundwater sampling will also be conducted to determine background concentrations of manganese in groundwater at the HCAFS. The groundwater background study will be used to confirm that the elevated manganese groundwater concentrations measured during the investigations are due to natural conditions.

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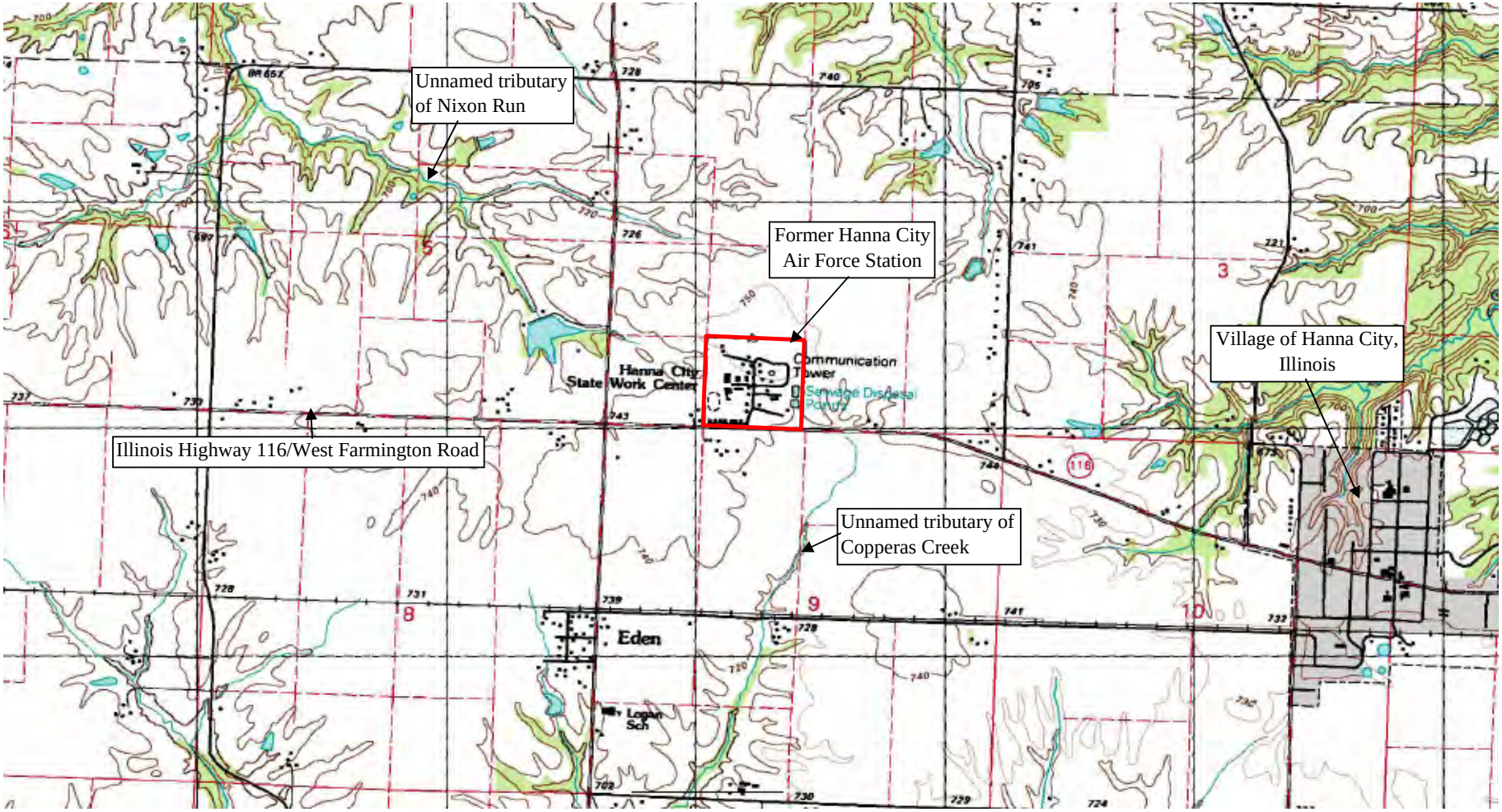
APPENDICES

APPENDIX A

FIGURES

Figure 1-1. Site vicinity map for the HCAFS site
Figure 1-2. Historical and Current Site Layout for the HCAFS
Figure 1-3. Former locations of underground storage tanks (USTs)
Figure 1-4. Aerial photograph of the HCAFS site, April 22, 1969
Figure 2-1. Surface soil sampling locations at Coal Area A
Figure 2-2. Surface soil sampling locations at Coal Area B
Figure 2-3. Surface soil sampling locations at Coal Area C, Maintenance Building and Paint Shed
Figure 2-4. Surface soil sampling locations at the Main Entrance
Figure 2-5. Surface soil sampling locations at the Vehicle Wash Rack
Figure 2-6. Subsurface soil sampling locations at Coal Area A
Figure 2-7. Subsurface soil sampling locations at Coal Area B
Figure 2-8. Subsurface soil sampling locations at Coal Area C and Paint Shed
Figure 2-9. Subsurface soil sampling locations at the Vehicle Wash Rack
Figure 2-10. Groundwater sampling locations at Coal Area A, Coal Area C, Paint Shed and Vehicle Wash Rack
Figure 3-1. Water supply wells in the vicinity of the HCAFS
Figure 3-2. Conceptual Lithology at and in the vicinity of the HCAFS
Figure 4-1. Arsenic concentrations in subsurface soils at Coal Area A
Figure 4-2. Arsenic concentrations in subsurface soils at Coal Area B
Figure 4-3. Arsenic concentrations in subsurface soils at Coal Area C and Paint Shed
Figure 4-4. PAH exceedances of human health screening criteria in surface soils at Coal Area A
Figure 4-5. Total PAH concentrations in surface soils at Coal Area A
Figure 4-6. PAH exceedances of human health screening criteria in surface soils at Coal Area B
Figure 4-7. Total PAH concentration in surface soils at Coal Area B
Figure 4-8. Former UST locations near Control Building/Bldg 202 and Maintenance Building/Bldg 206
Figure 4-9. PAH exceedances of human health screening criteria in surface soils at Coal Area C
Figure 4-10. Total PAH concentration in surface soils at Coal Area C
Figure 4-11. PAH exceedances of human health screening criteria in surface soils at the Main Entrance
Figure 4-12. Total PAH concentration in surface soils at the Main Entrance
Figure 4-13. PAH exceedances of human health screening criteria in surface soils at the Vehicle Wash Rack
Figure 4-14. Total PAH concentration in surface soils at the Vehicle Wash Rack
Figure 4-15. Benzo(a)pyrene residential TACO exceedances in surface soil at HCAFS
Figure 4-16. Benzo(a)pyrene industrial/commercial TACO exceedances in surface soil at HCAFS
Figure 6-1. Conceptual Site Risk Model for the HCAFS
Figure 6-2. Box and whisker plots of select PAHs in surface soils (0 to 0.5ft) at the Coal Area A Exposure Unit
Figure 6-3. Box and whisker plots of select PAHs in surface soils (0 to 0.5ft) at the Coal Area B Exposure Unit
Figure 6-4. Box and whisker plots of PAHs in surface soils (0 to 0.5ft) that exceeded human health screening criteria at the Coal Area C Exposure Unit
Figure 6-5. Box and whisker plots of PAHs in surface soils (0 to 0.5ft) at the Vehicle Wash Rack Exposure Unit
Figure 6-6. Box and whisker plots of PAHs in surface soils (0 to 0.5ft) at the Main Entrance Exposure Unit
Figure 6-7. Box and whisker plots of PAHs in subsurface soils (0 to 0.5ft) at the Vehicle Wash Rack Exposure Unit
Figure 6-8. Box and whisker plots of arsenic in subsurface soils (>0.5ft) at the Coal Areas

Figure 6-9. Total aluminum and iron concentrations in groundwater samples collected from the HCAFS
Figure 6-10. Total arsenic in groundwater samples collected from the HCAFS
Figure 6-11. Positive correlation between total arsenic and total iron in groundwater samples from the HCAFS
Figure 7-1. Paved areas and fallow fields at the HCAFS
Figure 7-2. Wetland areas and drainage features at the HCAFS
Figure 7-3. Ecological Conceptual Site Risk Model for the HCAFS
Figure 7-4. Box and whisker plots for low-molecular weight and high molecular weight PAHs in surface soils at the HCAFS
Figure 7-5. Box and whisker plots of mercury in surface and subsurface soil at the HCAFS, compared with TACO and background mercury levels in the eastern United States
Figure 7-6. Box and whisker plots of cadmium in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States
Figure 7-7. Box and whisker plots of lead in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States
Figure 7-8. Box and whisker plots of zinc in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States



Topographic map courtesy of U.S. Geological Survey, Hanna City quadrangle 1996.

Figure 1-1. Site vicinity map for the HCAFS site

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Aerial photo from Peoria County GIS, 2003.

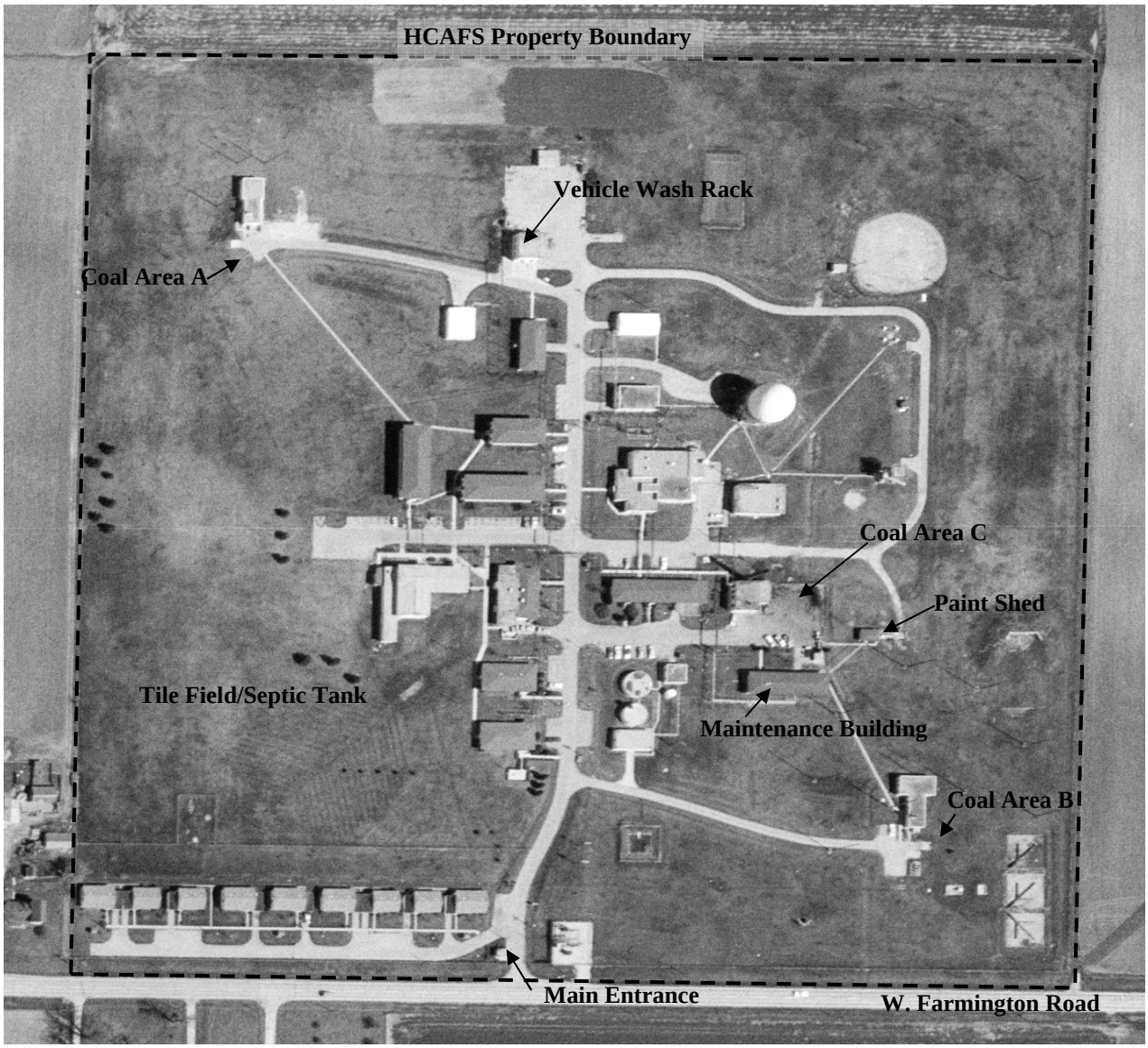
Areas (white text), building numbers (black text) are based on the Hanna City Air Force Station (HCAFS) site layout drawing from TtEC (2008).
Areas of Potential Concern are the Coal Ash Storage Areas A,B,C; Main Entrance; Vehicle Wash Rack; Maintenance Building and Paint Shed. These areas are marked by bright green circles.

Former Hanna City Air Force Station Hanna City, Illinois	**Figure 1-2. Historical and Current Site Layout for the HCAFS**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky

Aerial photo from Peoria County GIS, 2003.

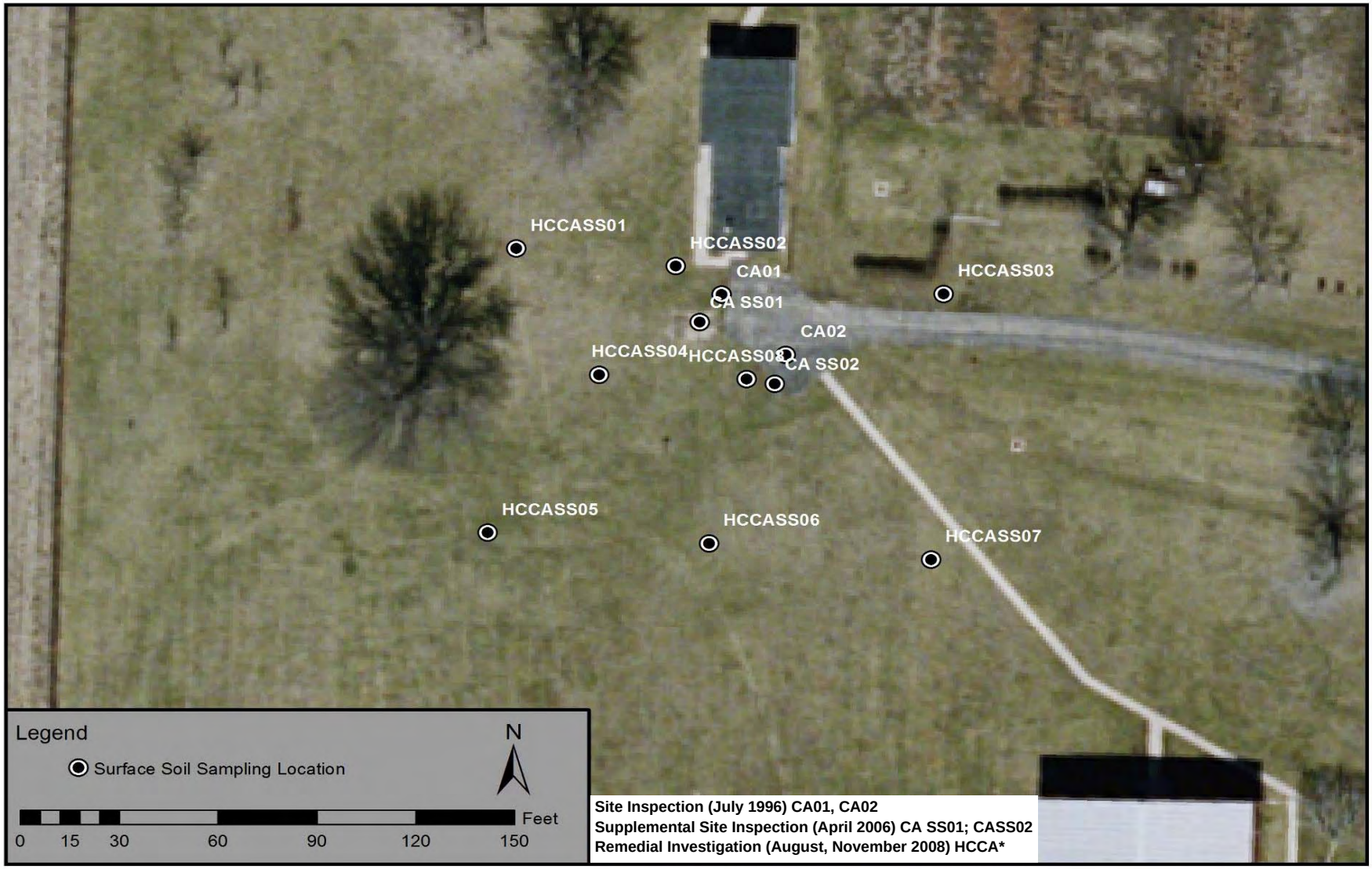
Former UST locations based on documents from IEPA L.U.S.T. program for LPC#1430405005.

Former Hanna City Air Force Station **Hanna City, Illinois**	**Figure 1-3. Former locations of underground storage tanks (USTs)**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky



Source: United States Geological Survey Earth Explorer, AR1VCAE00010025
Note: HCAFS was deactivated in 1968. Property was transferred to State of Illinois in November 1969.

Former Hanna City Air Force Station **Hanna City, Illinois**	**Figure 1-4. Aerial photograph of the HCAFS site, April 22, 1969**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky



Source for base photo map: Peoria County GIS, 2003

Figure 2-1. Surface soil sampling locations at Coal Area A

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

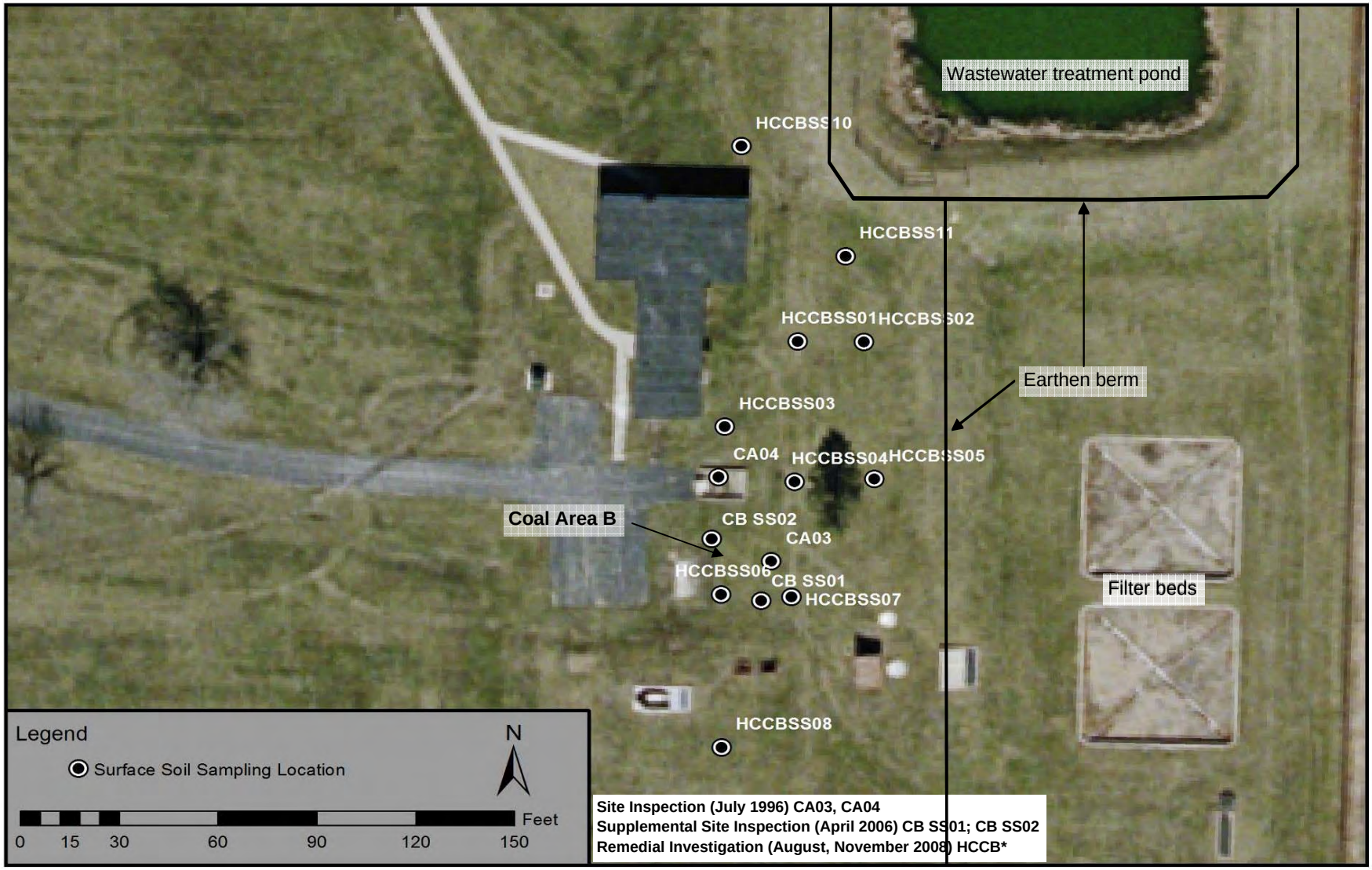


Figure 2-2. Surface soil sampling locations at Coal Area B

U.S. Army Corps of Engineers
Louisville District

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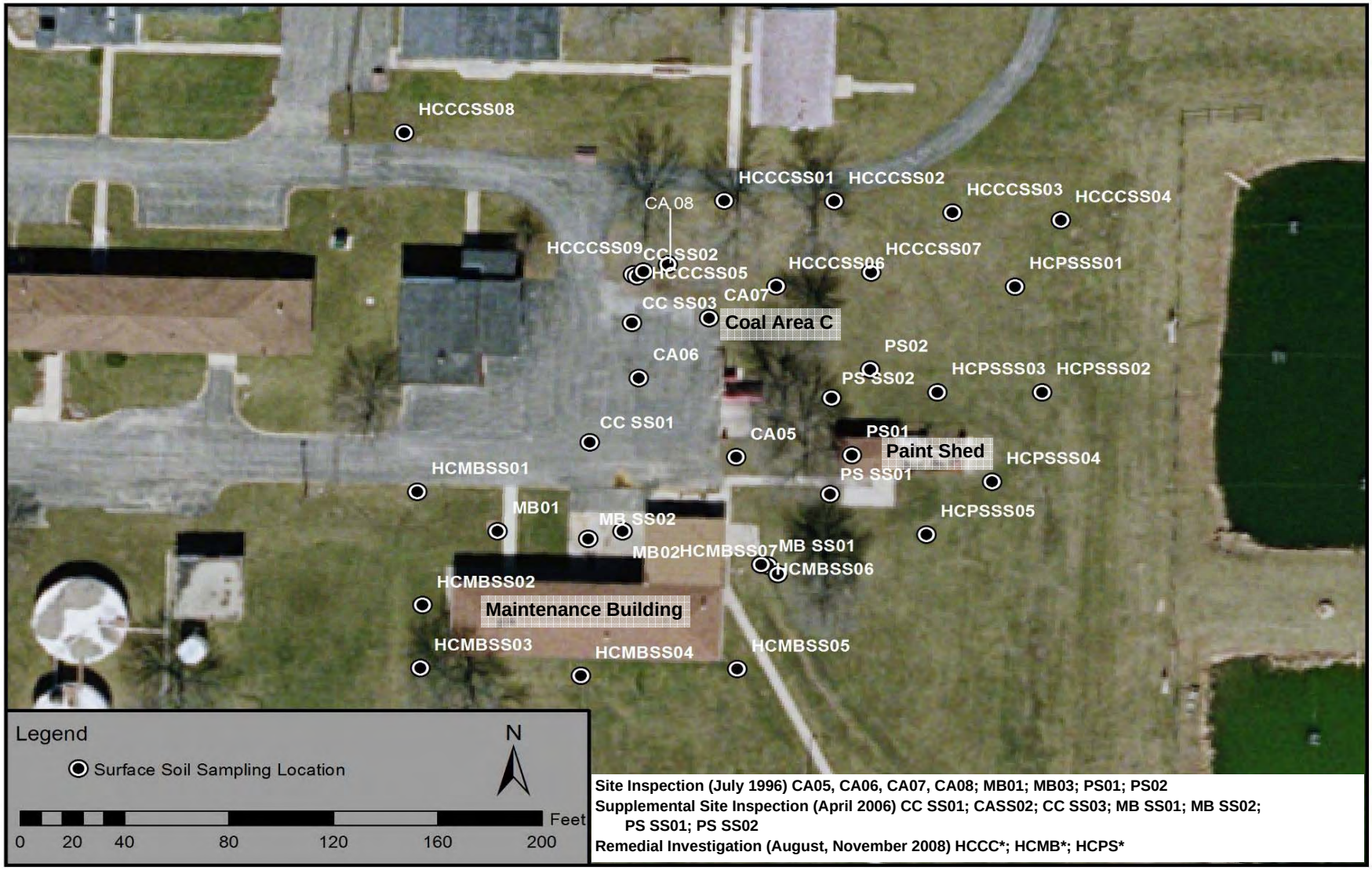
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003



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Supplemental Site Inspection (April 2006) CC SS01; CASS02; CC SS03; MB SS01; MB SS02; PS SS01; PS SS02
Remedial Investigation (August, November 2008) HCCC*; HCMB*; HCPS*

Figure 2-3. Surface soil sampling locations at Coal Area C, Maintenance Building and Paint Shed

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

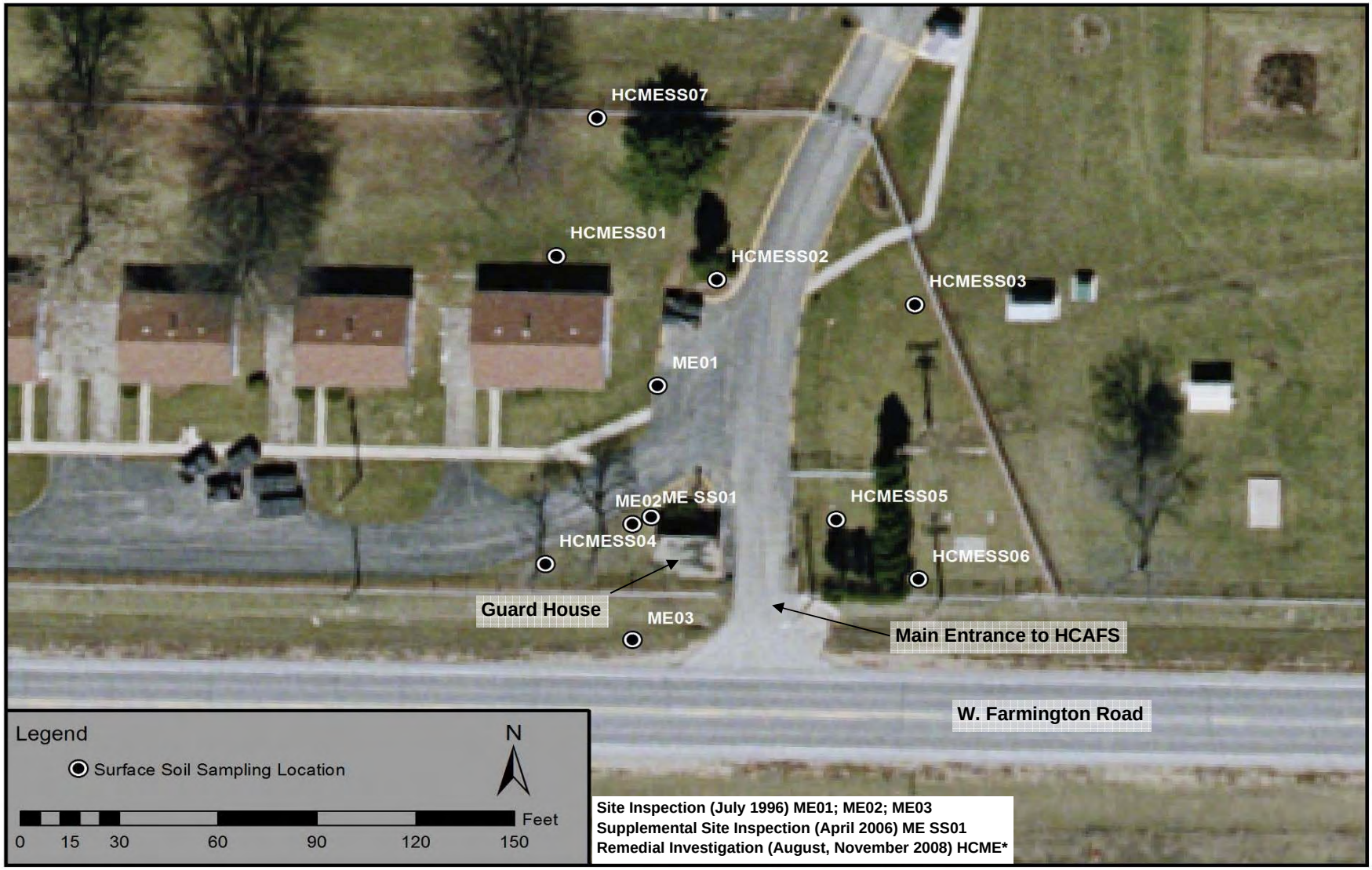

Figure 2-4. Surface soil sampling locations at the Main Entrance

U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky	**Former Hanna City Air Force Station** **Hanna City, Illinois**

Source for base photo map: Peoria County GIS, 2003

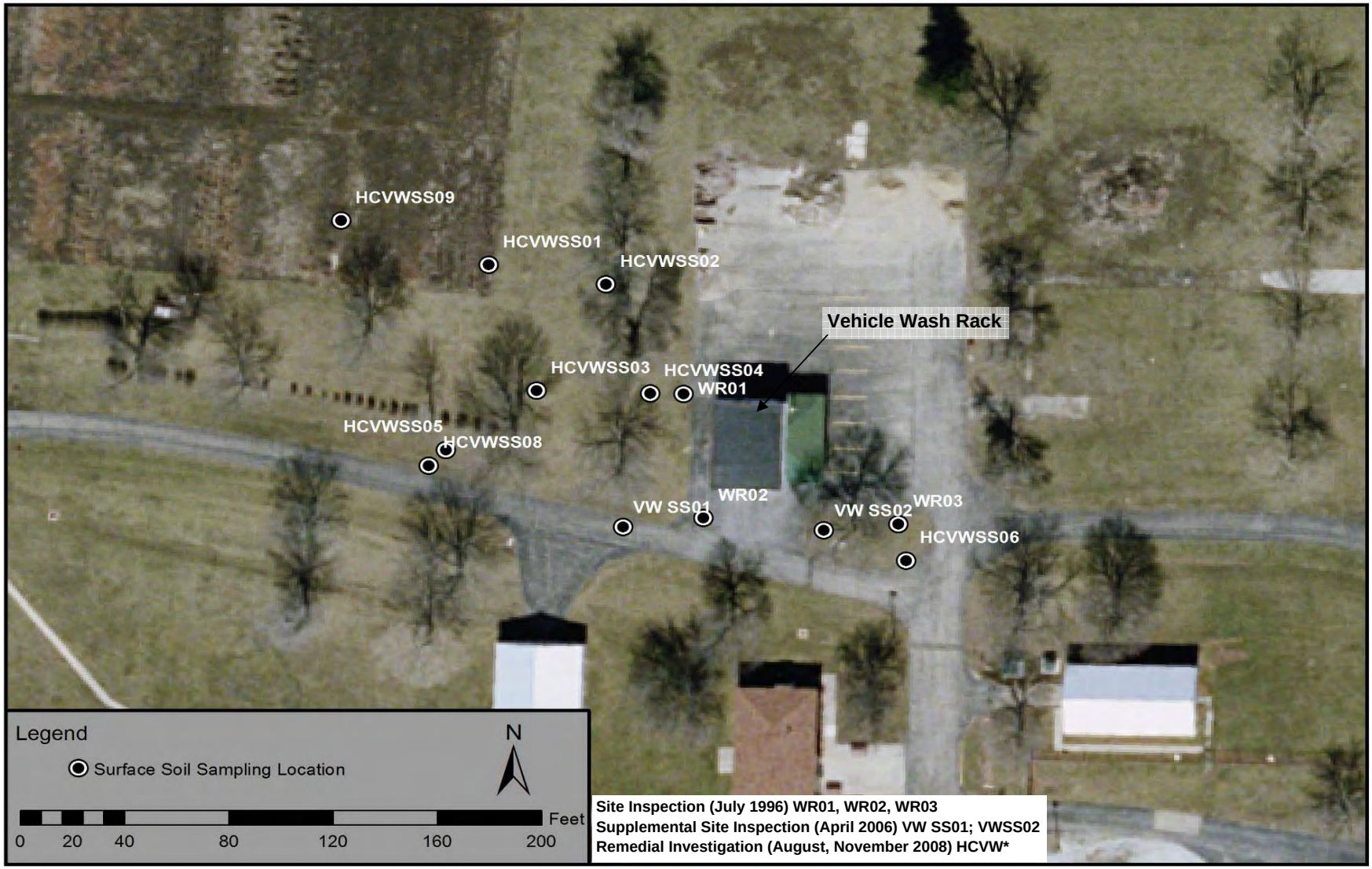

Figure 2-5. Surface soil sampling locations at the Vehicle Wash Rack

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Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

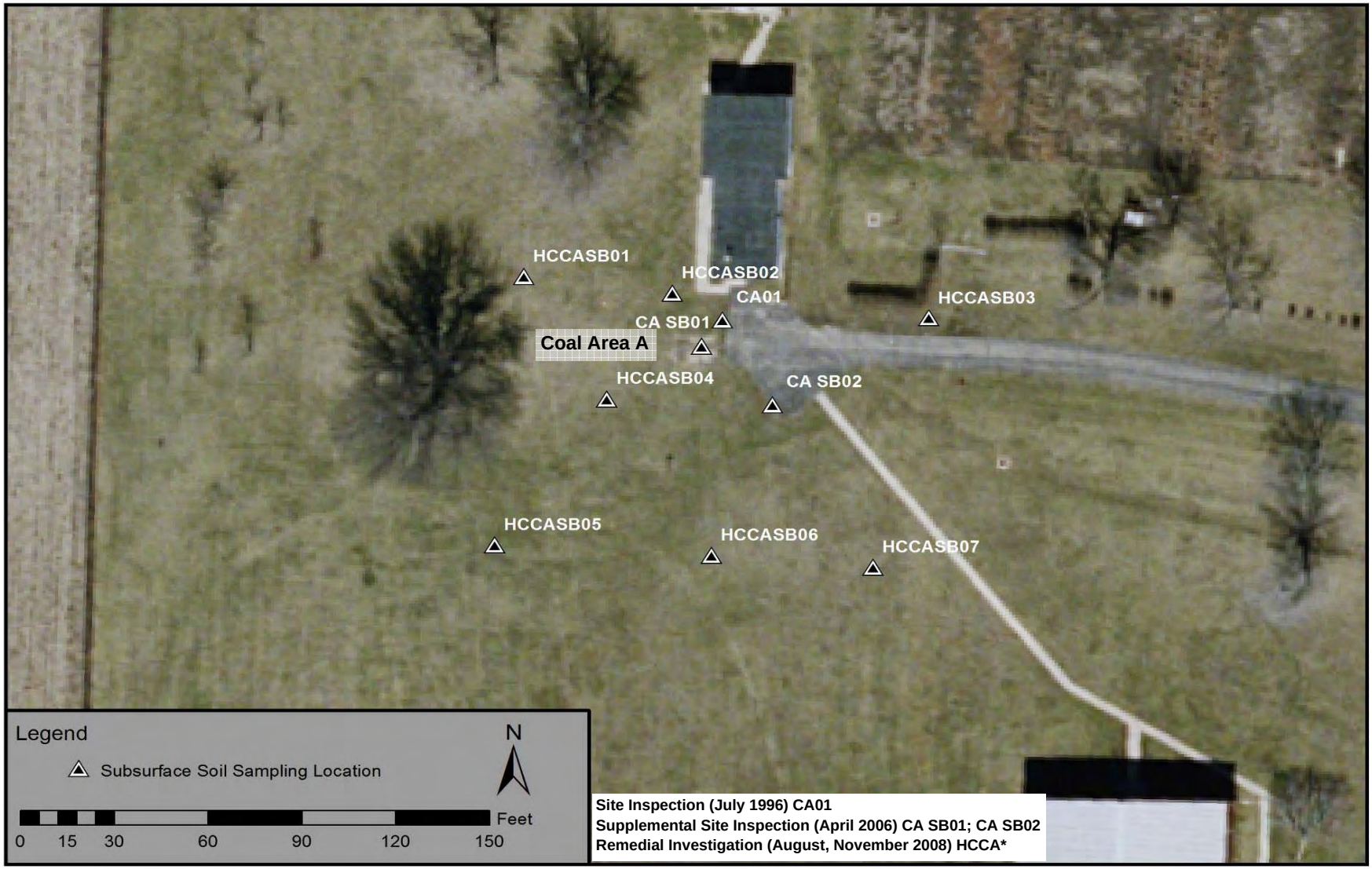

Figure 2-6. Subsurface soil sampling locations at Coal Area A

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Louisville District

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Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

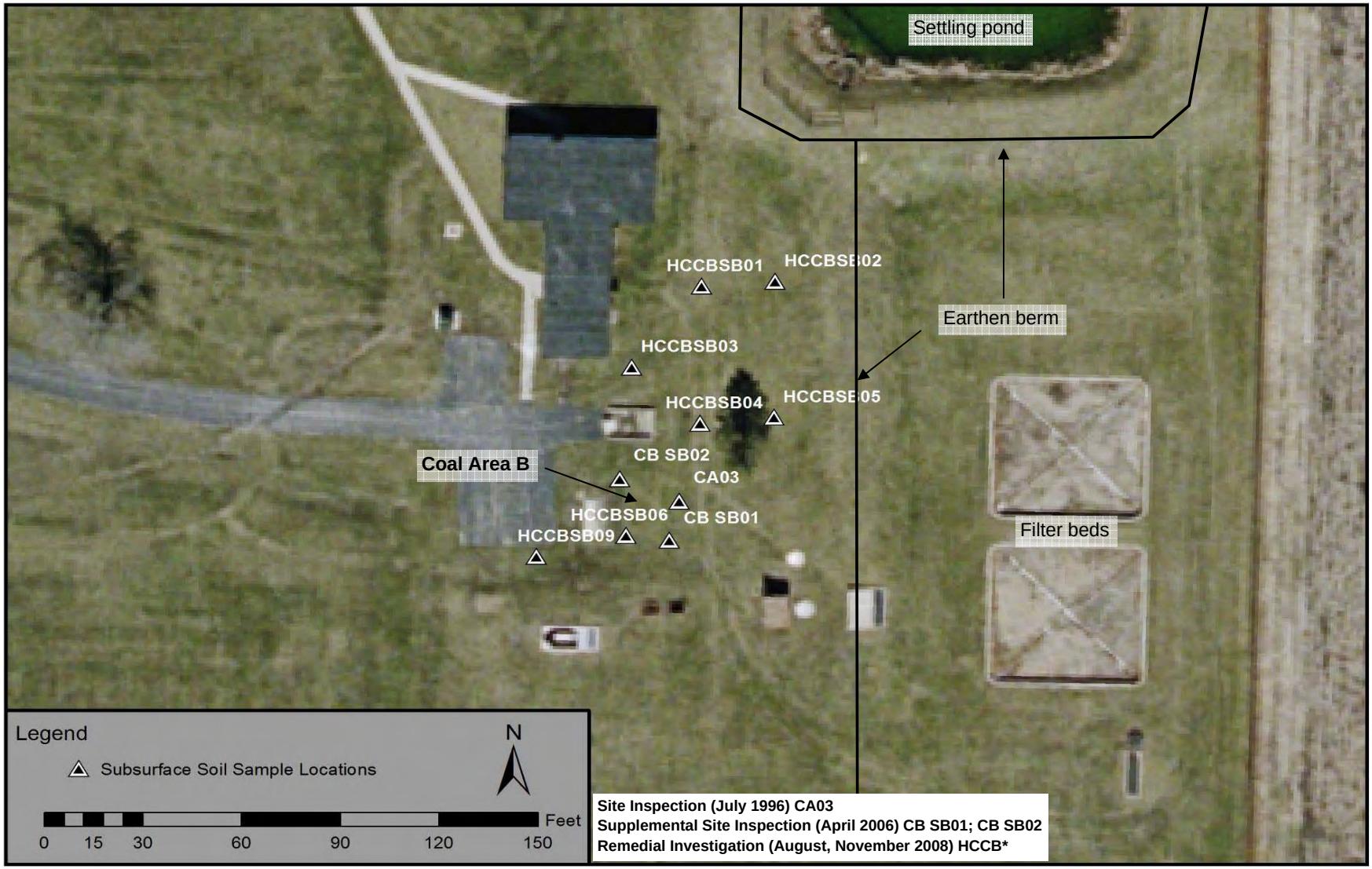

Figure 2-7. Subsurface soil sampling locations at Coal Area B

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Louisville District

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Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

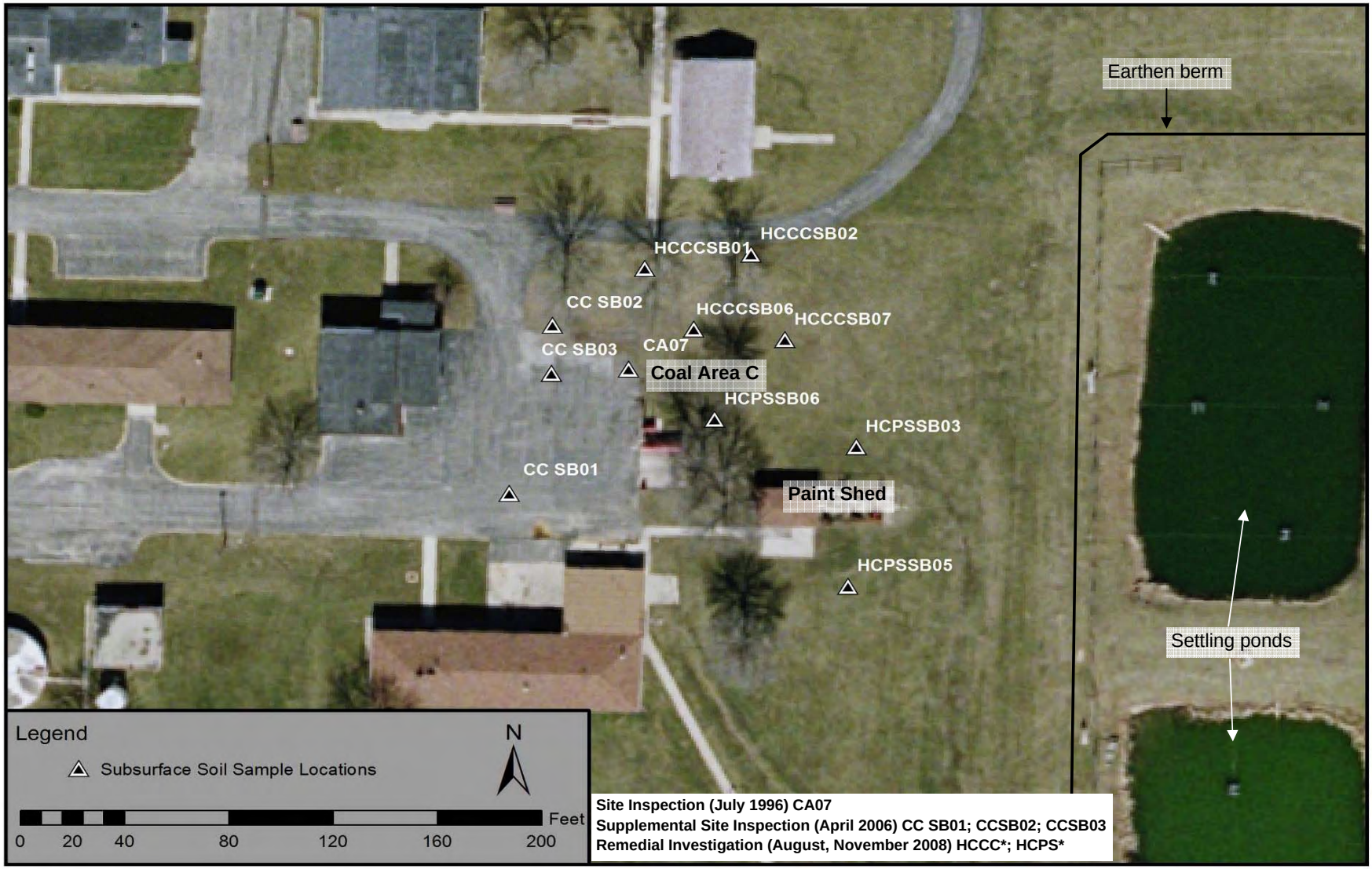

Figure 2-8. Subsurface soil sampling locations at Coal Area C and Paint Shed

U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky	**Former Hanna City Air Force Station** **Hanna City, Illinois**

Source for base photo map: Peoria County GIS, 2003

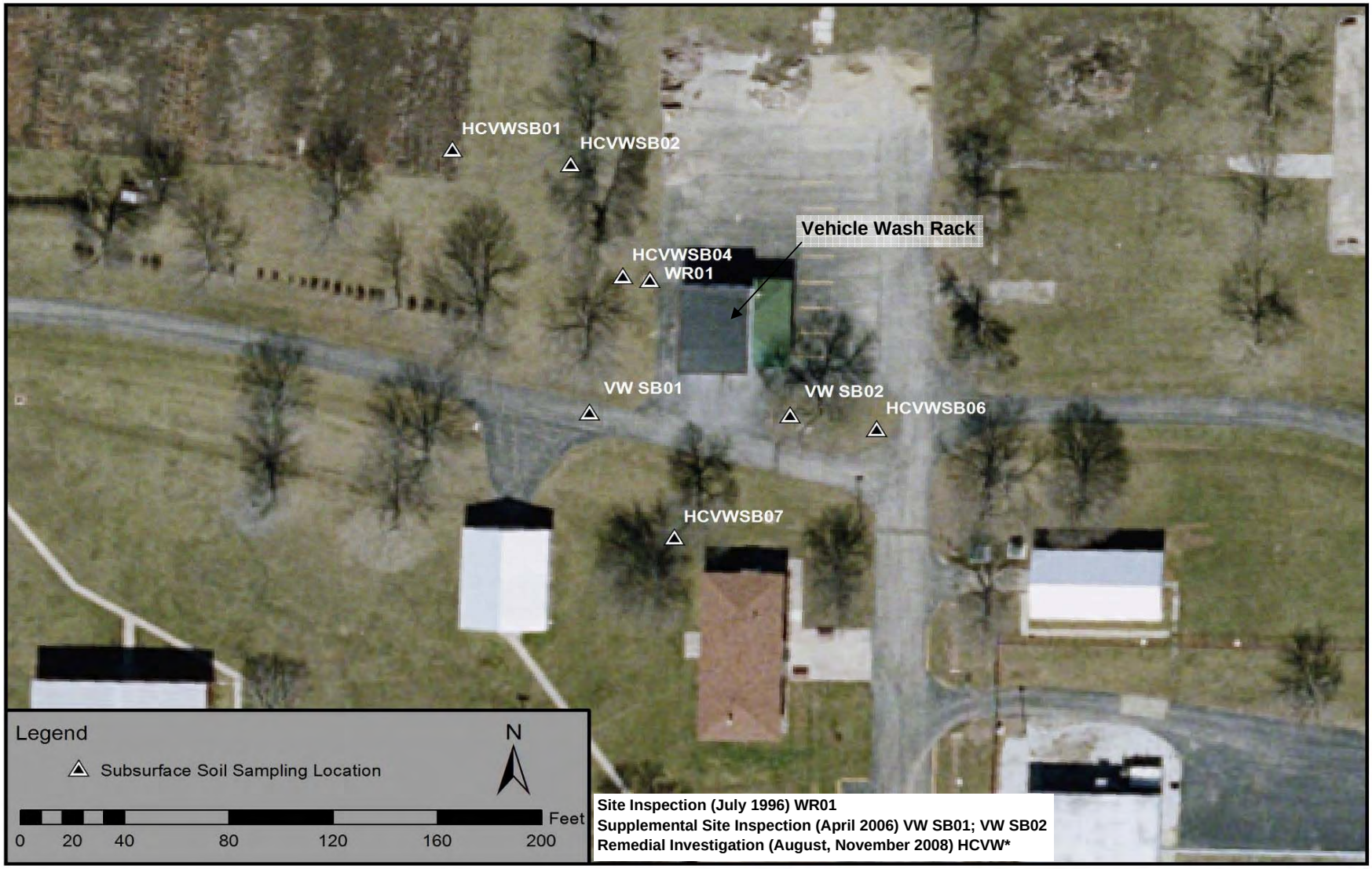

Figure 2-9. Subsurface soil sampling locations at the Vehicle Wash Rack

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

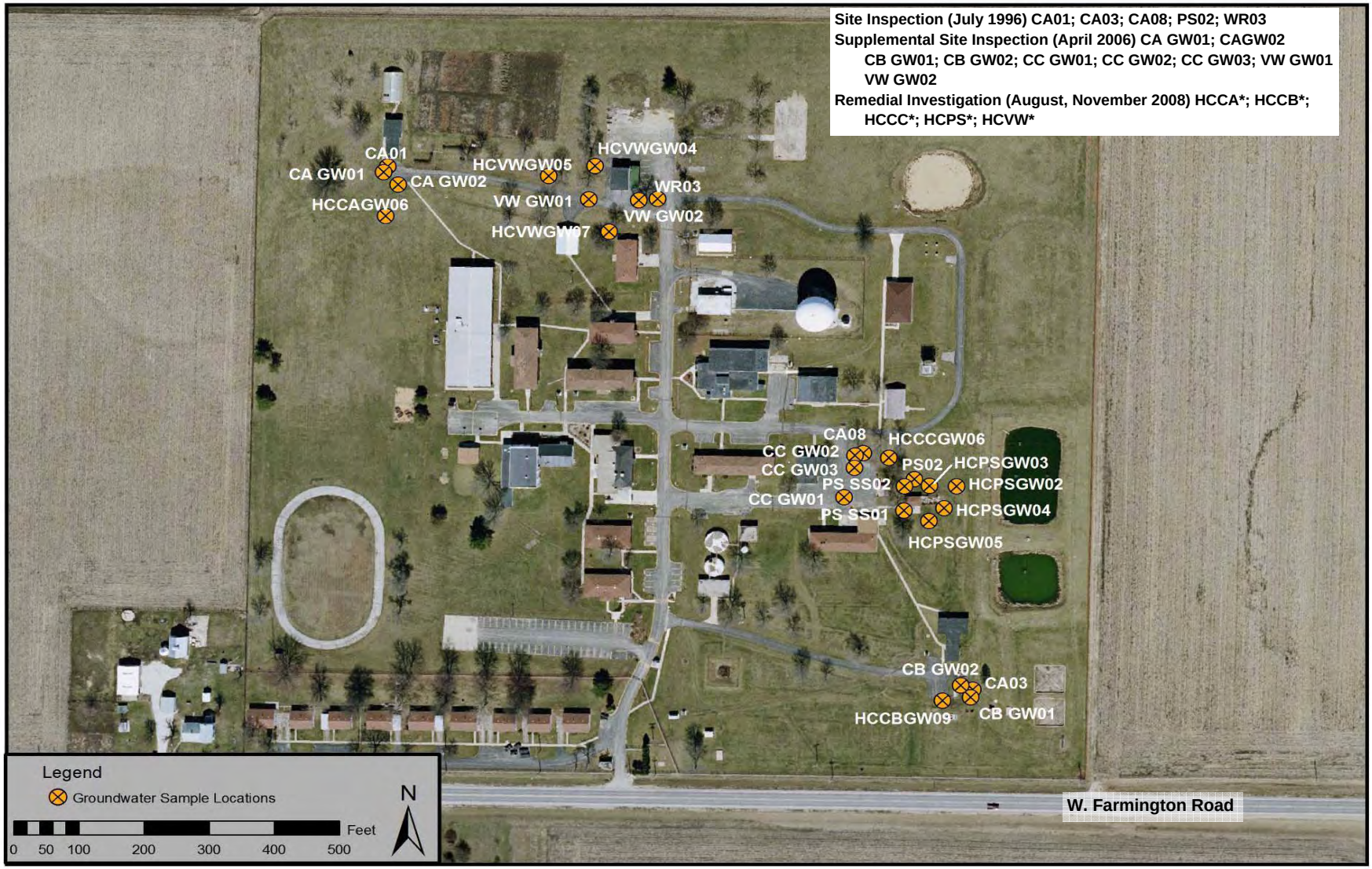

Figure 2-10. Groundwater sampling locations at Coal Area A, Coal Area B, Coal Area C, Paint Shed and Vehicle Wash Rack

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

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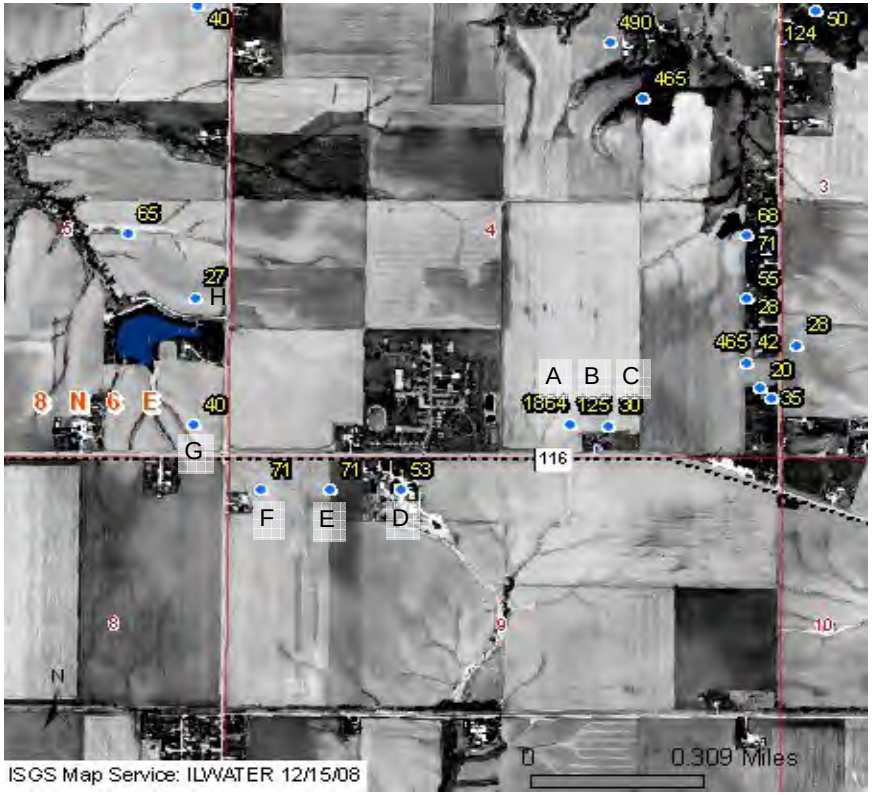
Hanna City, Illinois



Legend

Water and Related Wells

Well Status

- Outcrop
- Dry
- Engineering
- MONIT; MONITP
- Stratigraphic
- WATER; WATERP; WATOT; WATRS; WATRSP; WTST; WTSTP
- US Highways
- State Routes
- Sections
- Townships
- Counties
- Lakes
- Municipalities

CUA 2005 UTM 16 (east)

RGB

- Red: Band_1
- Green: Band_2
- Blue: Band_3

DOO 2005 UTM 16 (east)

Value

High : 255

Low : 0

DOO 2005 UTM 15 (west)

Value

High : 254

Low : 0

Source: http://ablation.isgs.uiuc.edu/website/ilwater/viewer.htm

Source:

Figure 3-1. Water supply wells in the vicinity of the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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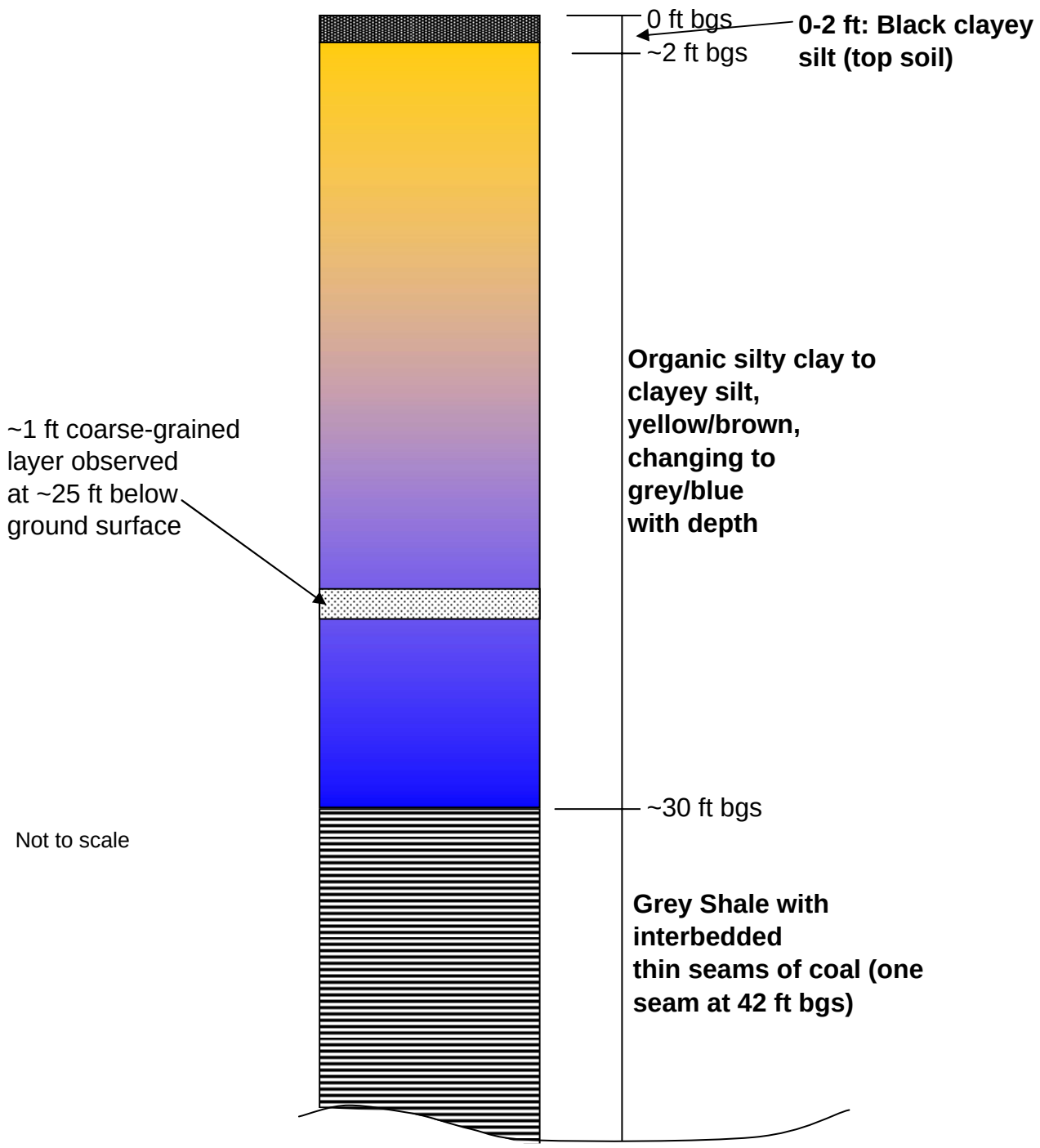
Kevil, Kentucky

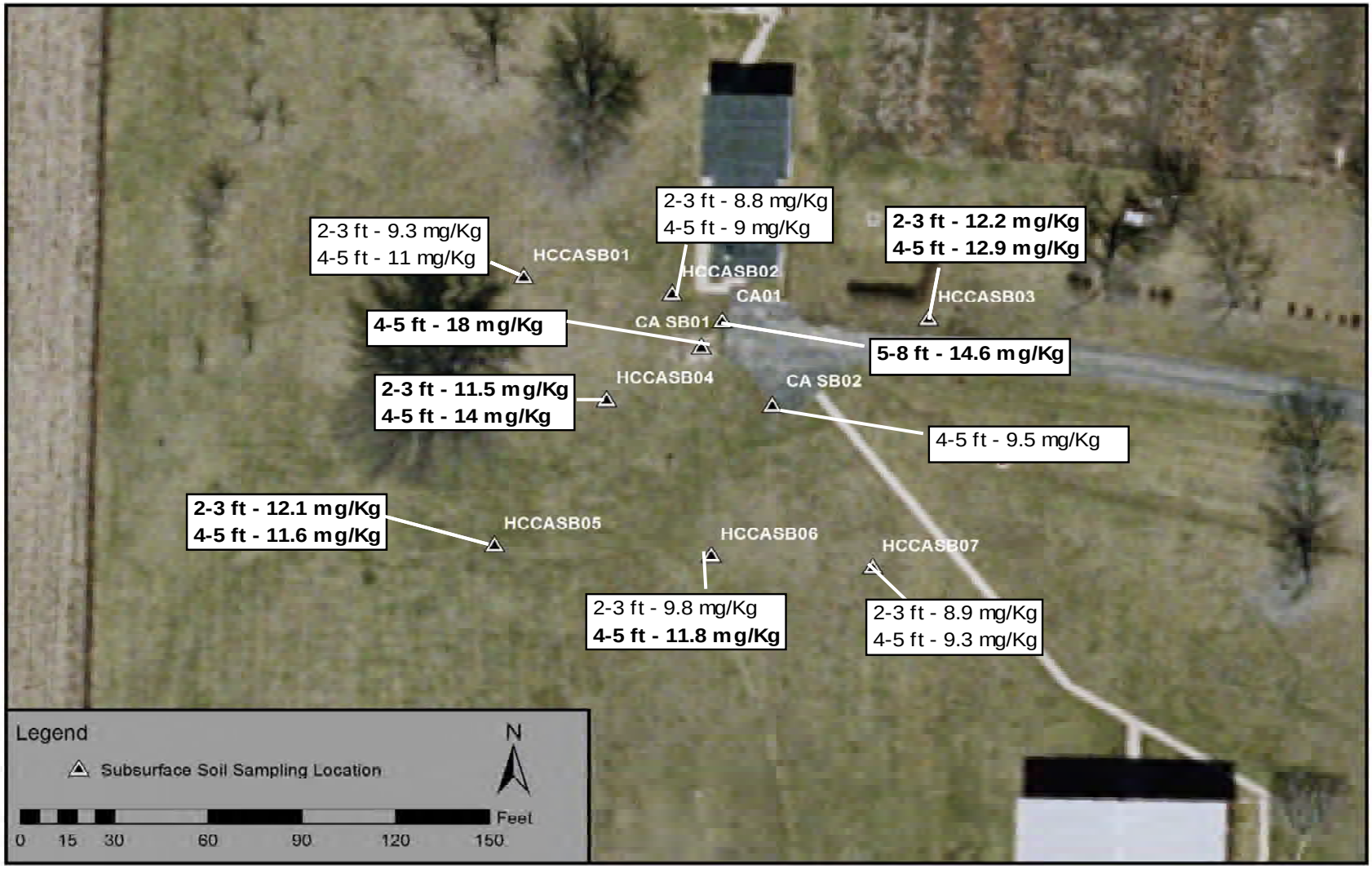
Former Hanna City Air Force Station Hanna City, Illinois



Based on RI and SSI boring logs (to 20 ft bgs) and well drilling logs (Figure 3-1) from ISGS.

Former Hanna City Air Force Station **Hanna City, Illinois**	**Figure 3-2. Conceptual Lithology at and in the vicinity of the HCAFS**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky

Source for base photo map: Peoria County GIS, 2003



NOTE: Concentrations shown in bold exceed the TACO Tier 1 Residential Soil Criteria

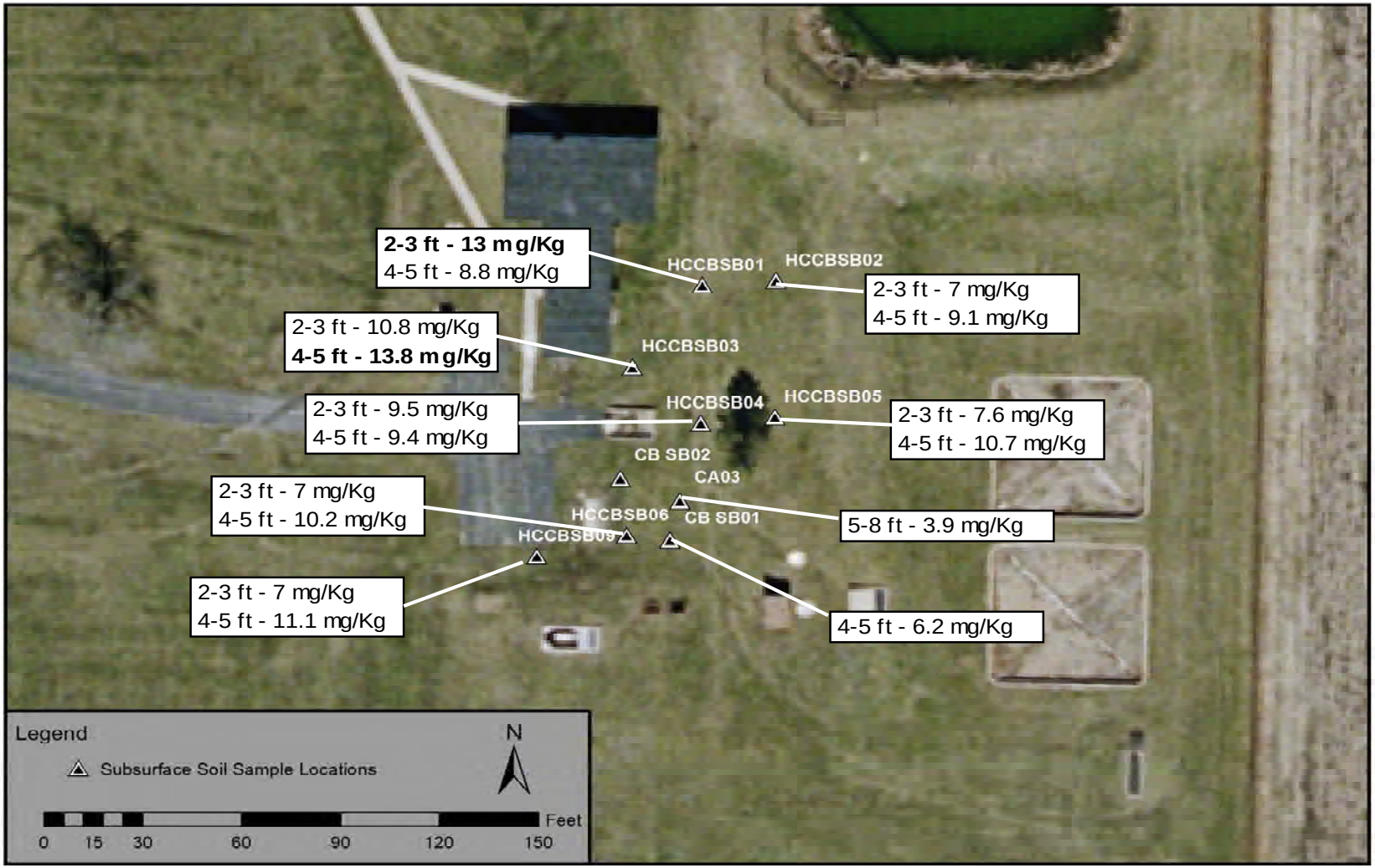
Figure 4-1. Arsenic concentrations in subsurface soils at Coal Area A

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003



NOTE: Concentrations shown in bold exceed the TACO Tier 1 Residential Soil Criteria

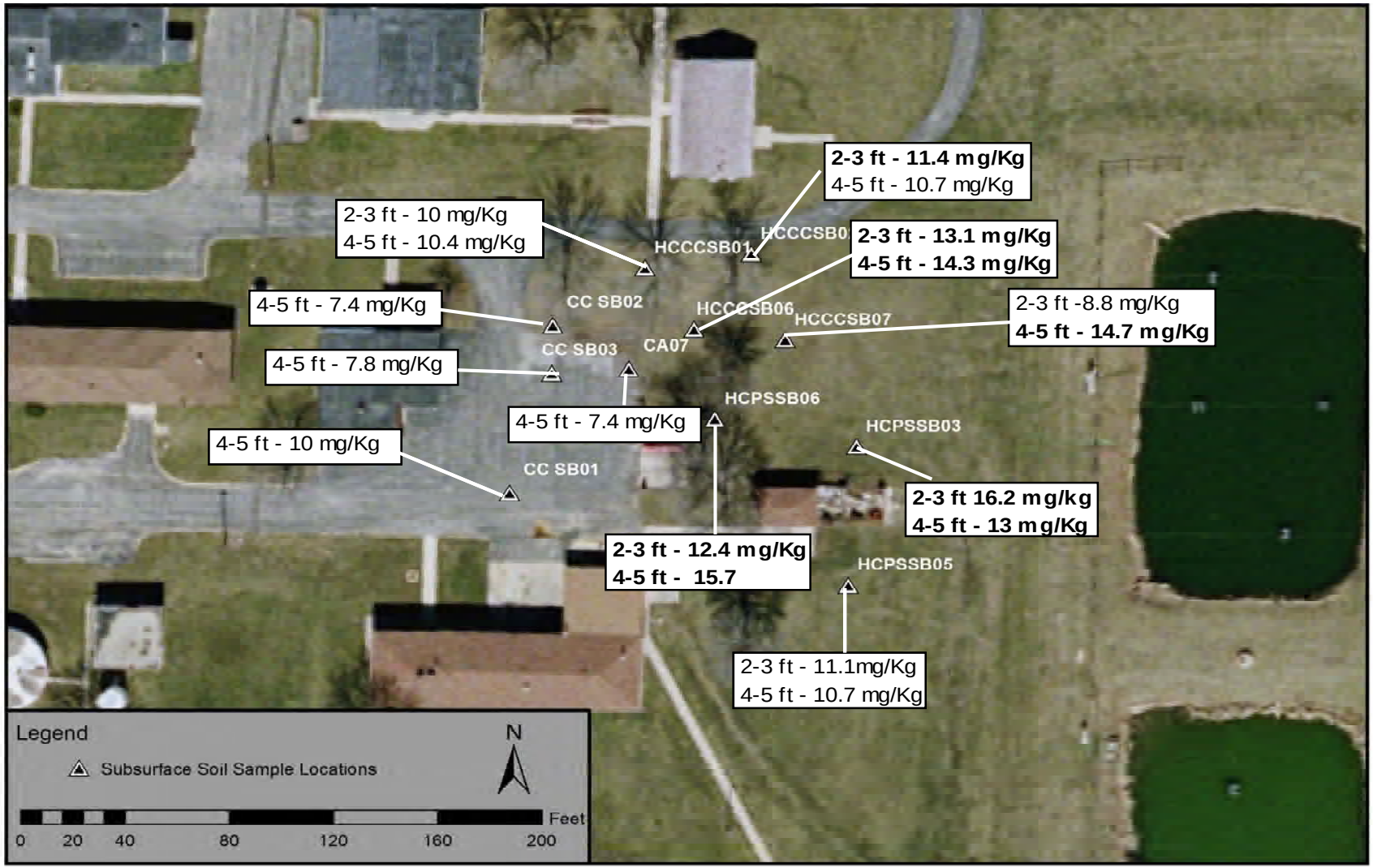
Figure 4-2. Arsenic concentrations in subsurface soils at Coal Area B

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003



NOTE: Concentrations shown in bold exceed the TACO Tier 1 Residential Soil Criteria

Figure 4-3. Arsenic concentrations in subsurface soils at Coal Area C and Paint Shed

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

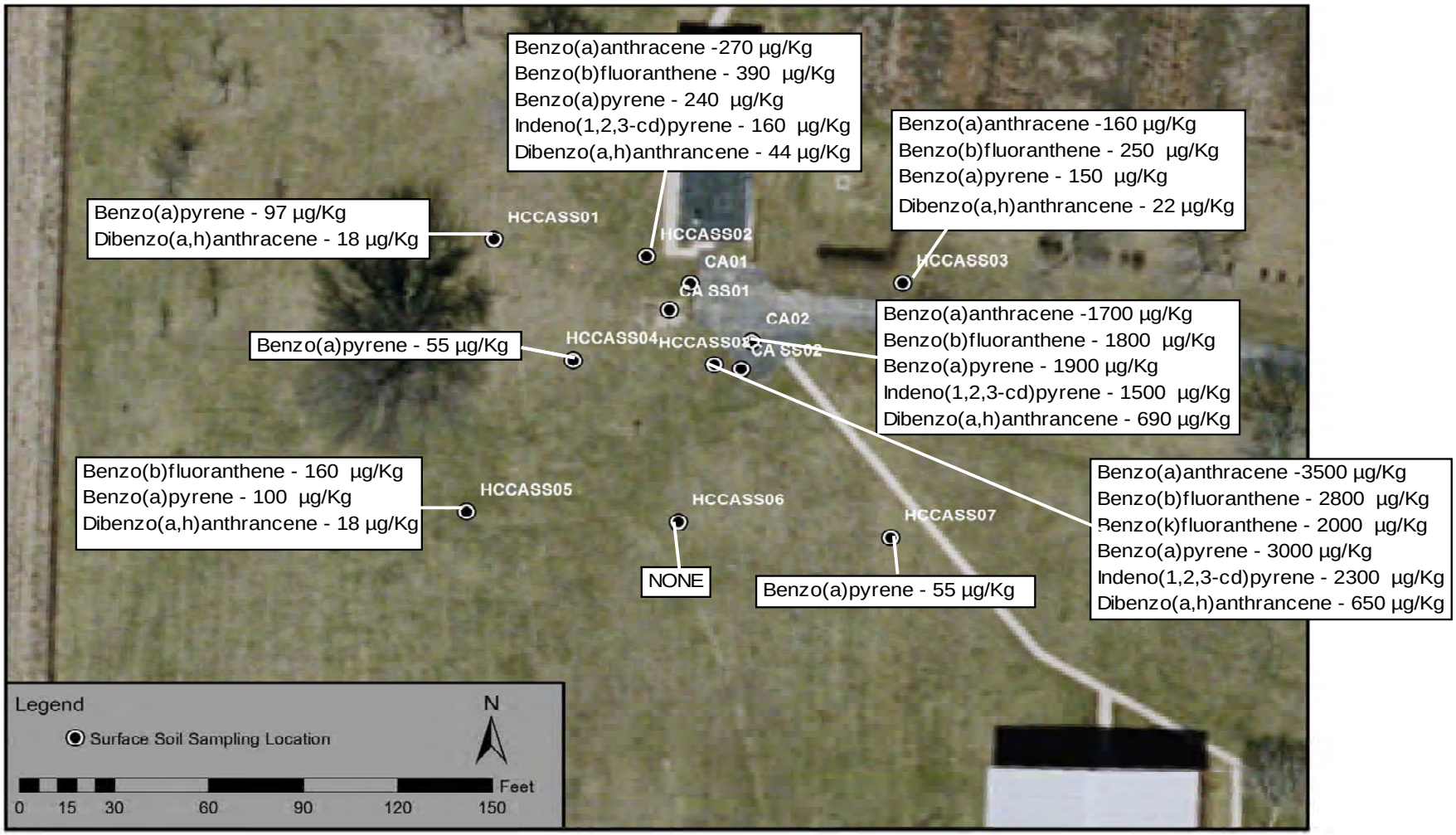


Figure 4-4. PAH exceedances of human health screening criteria in surface soils at Coal Area A

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

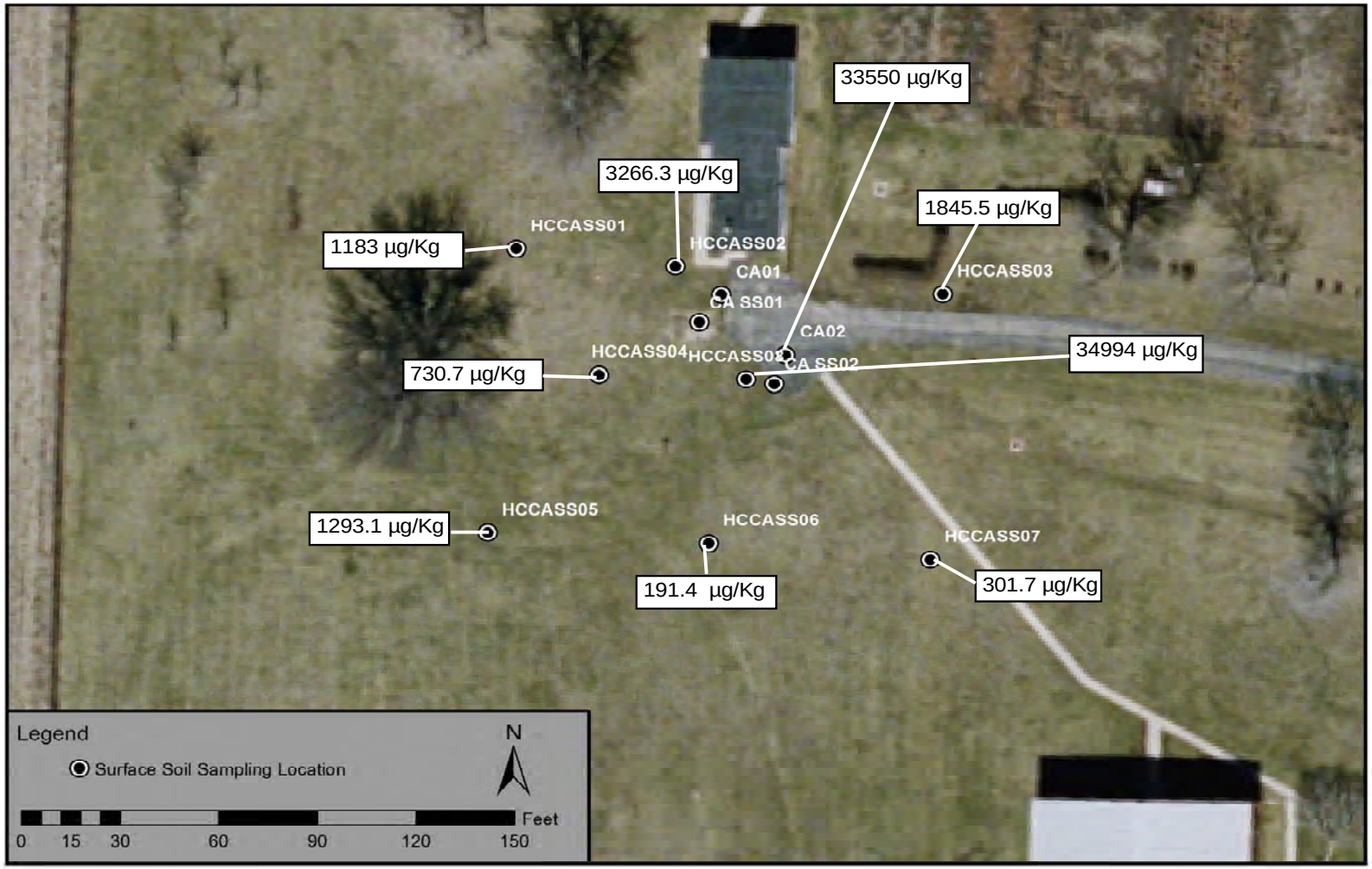


Figure 4-5. Total PAH concentrations in surface soils at Coal Area A

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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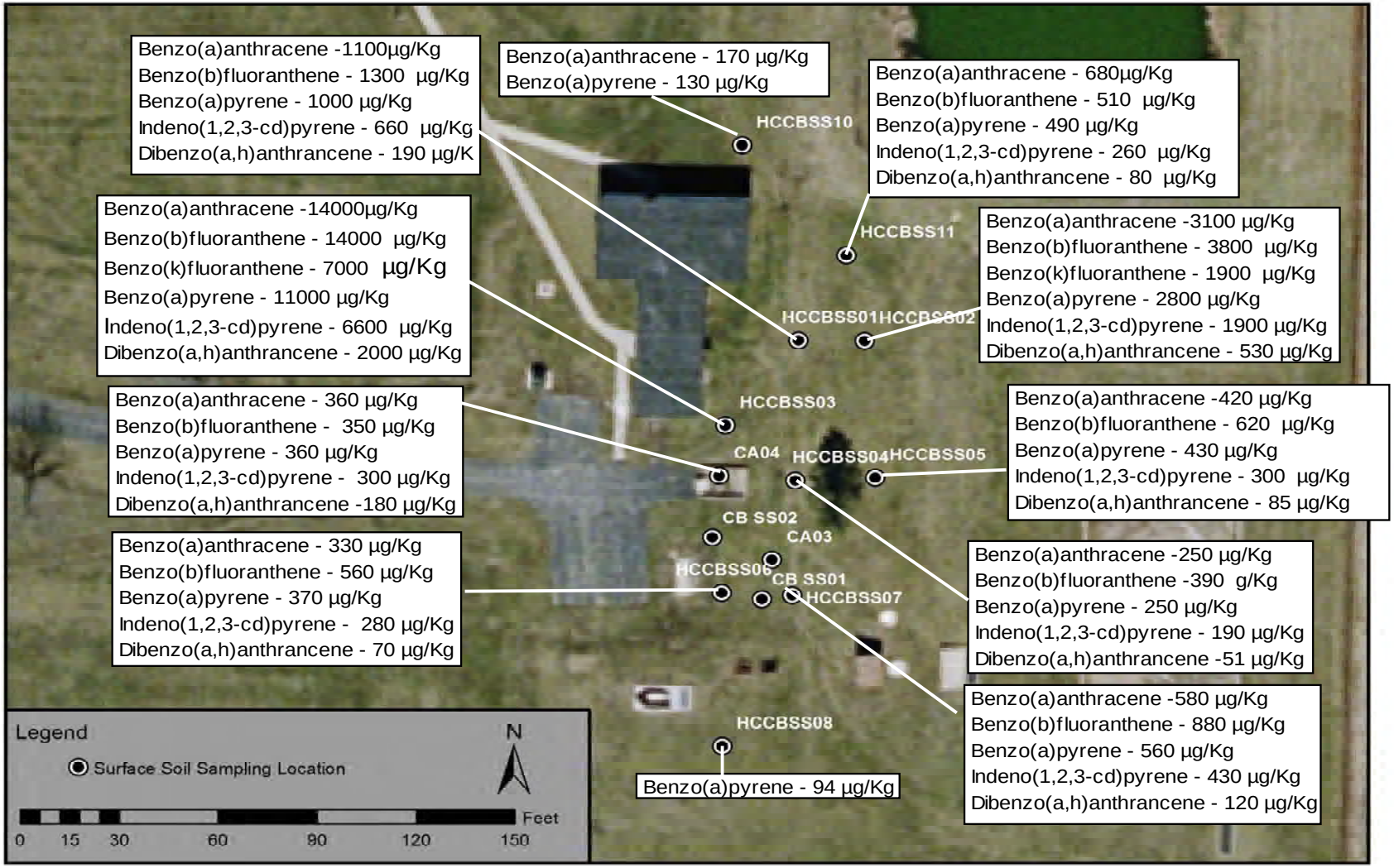
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



Source for base photo map: Peoria County GIS, 2003

Figure 4-6. PAH exceedances of human health screening criteria in surface soils at Coal Area B

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

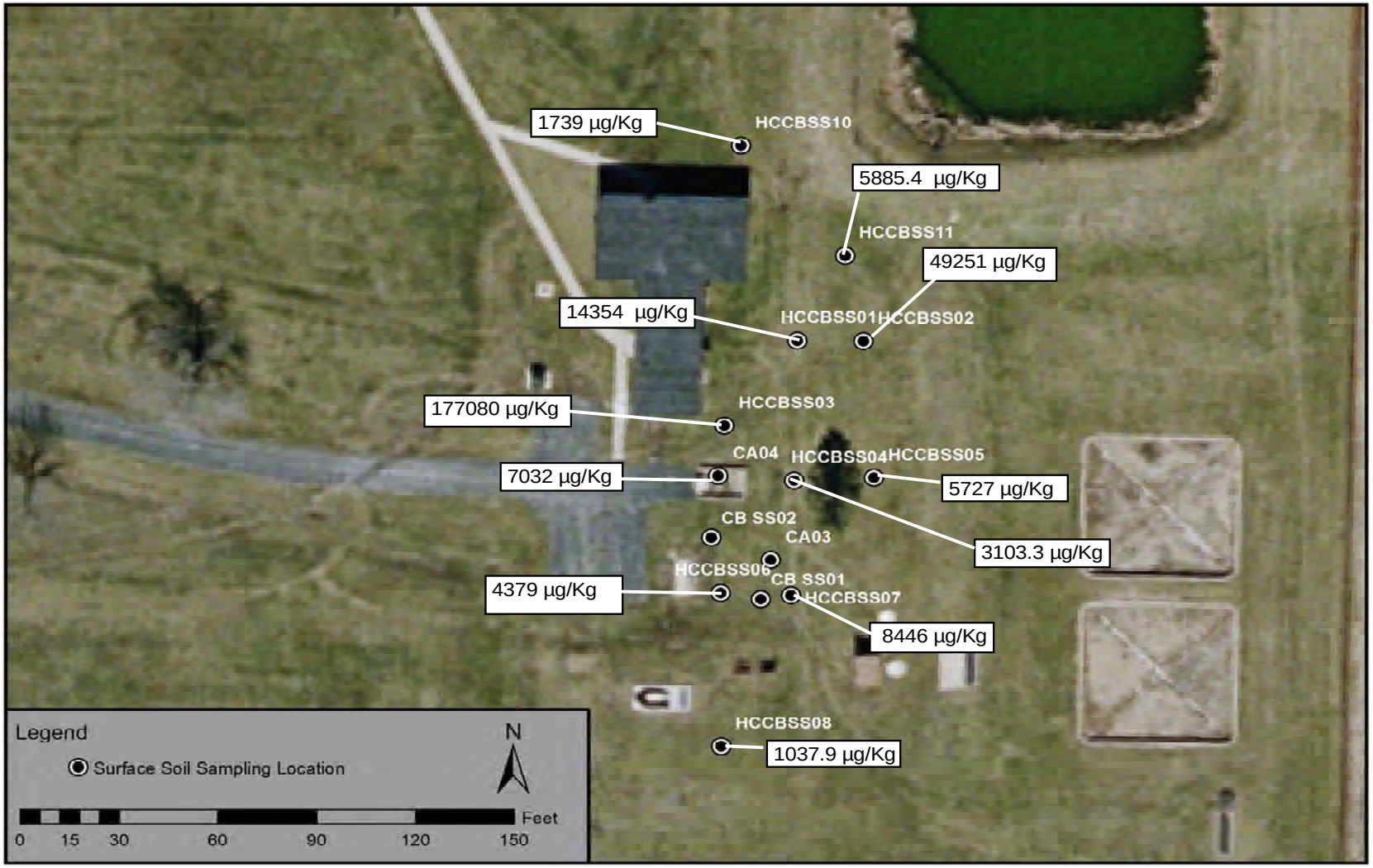


Figure 4-7. Total PAH concentration in surface soils at Coal Area B

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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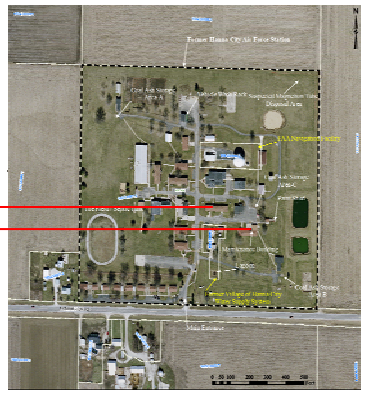
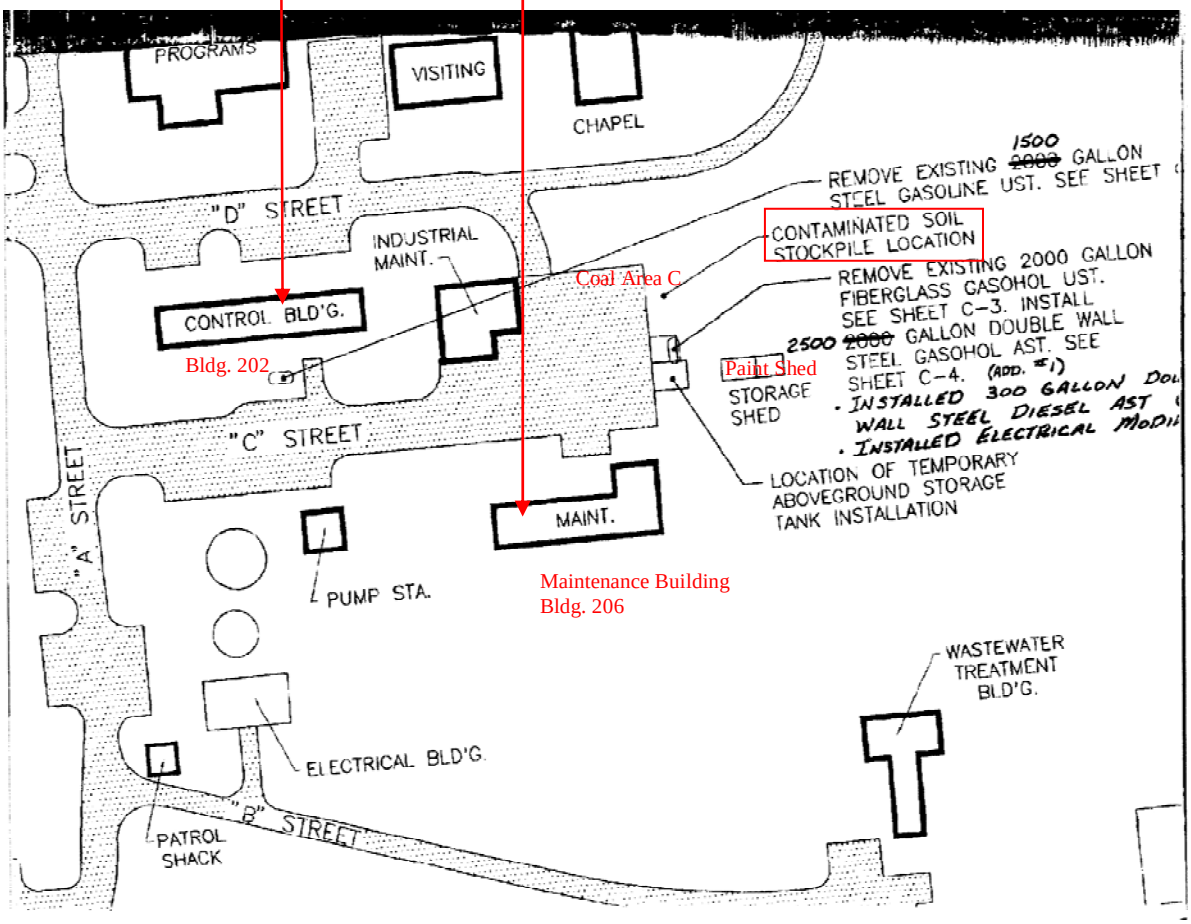
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois





Former Hanna City Air Force Station **Hanna City, Illinois**	**Figure 4-8. Former UST locations near Control Building/Bldg 202 and Maintenance Building/Bldg 206**
U.S. Army Corps of Engineers **Louisville District**	**GEO Consultants, LLC** *A Geological Engineering and Environmental Services Company* Kevil, Kentucky

Source for base photo map: Peoria County GIS, 2003

Figure 4-9. PAH exceedances of human health screening criteria in surface soils at Coal Area C

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

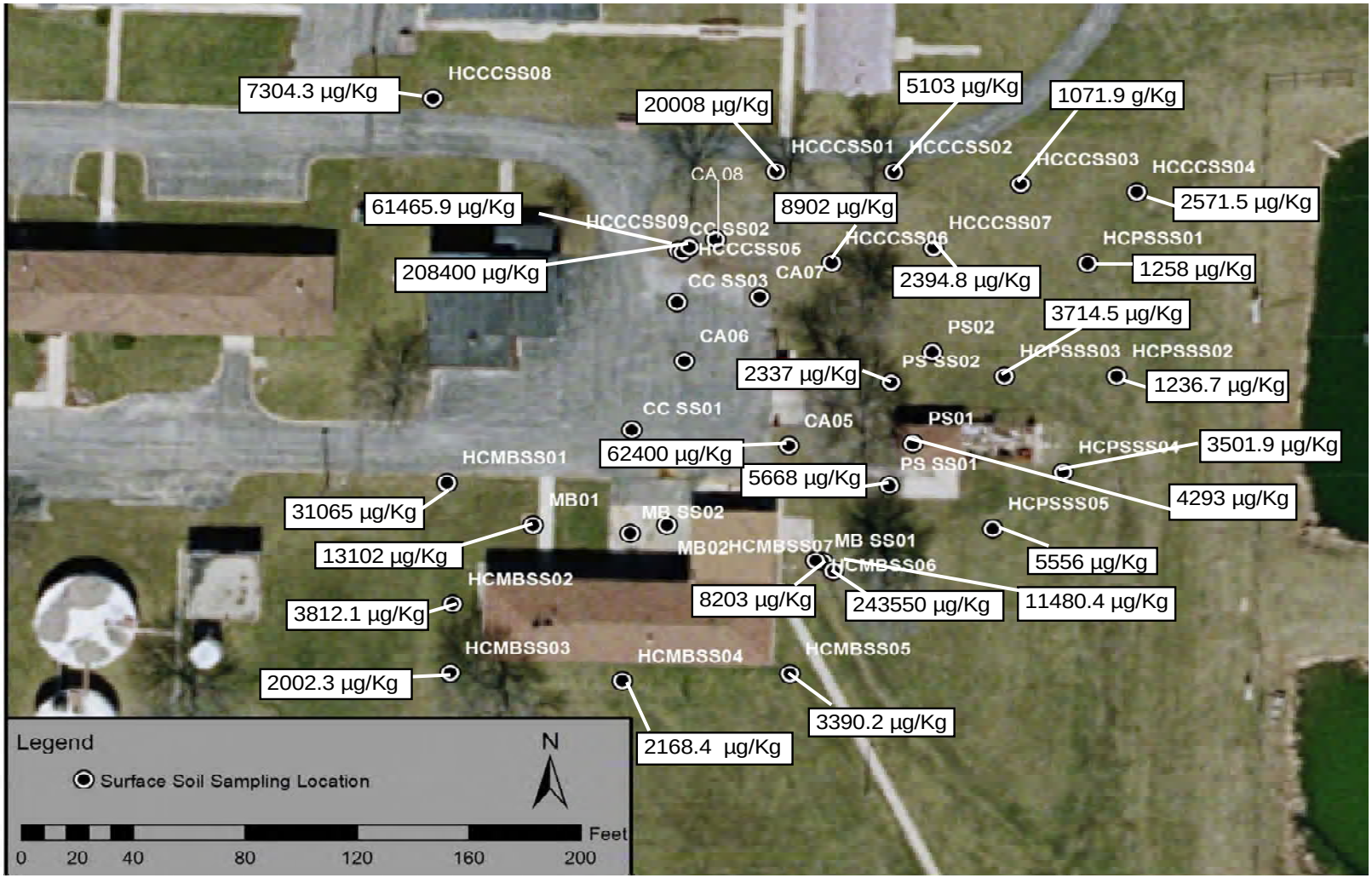

Figure 4-10. Total PAH concentration in surface soils at Coal Area C

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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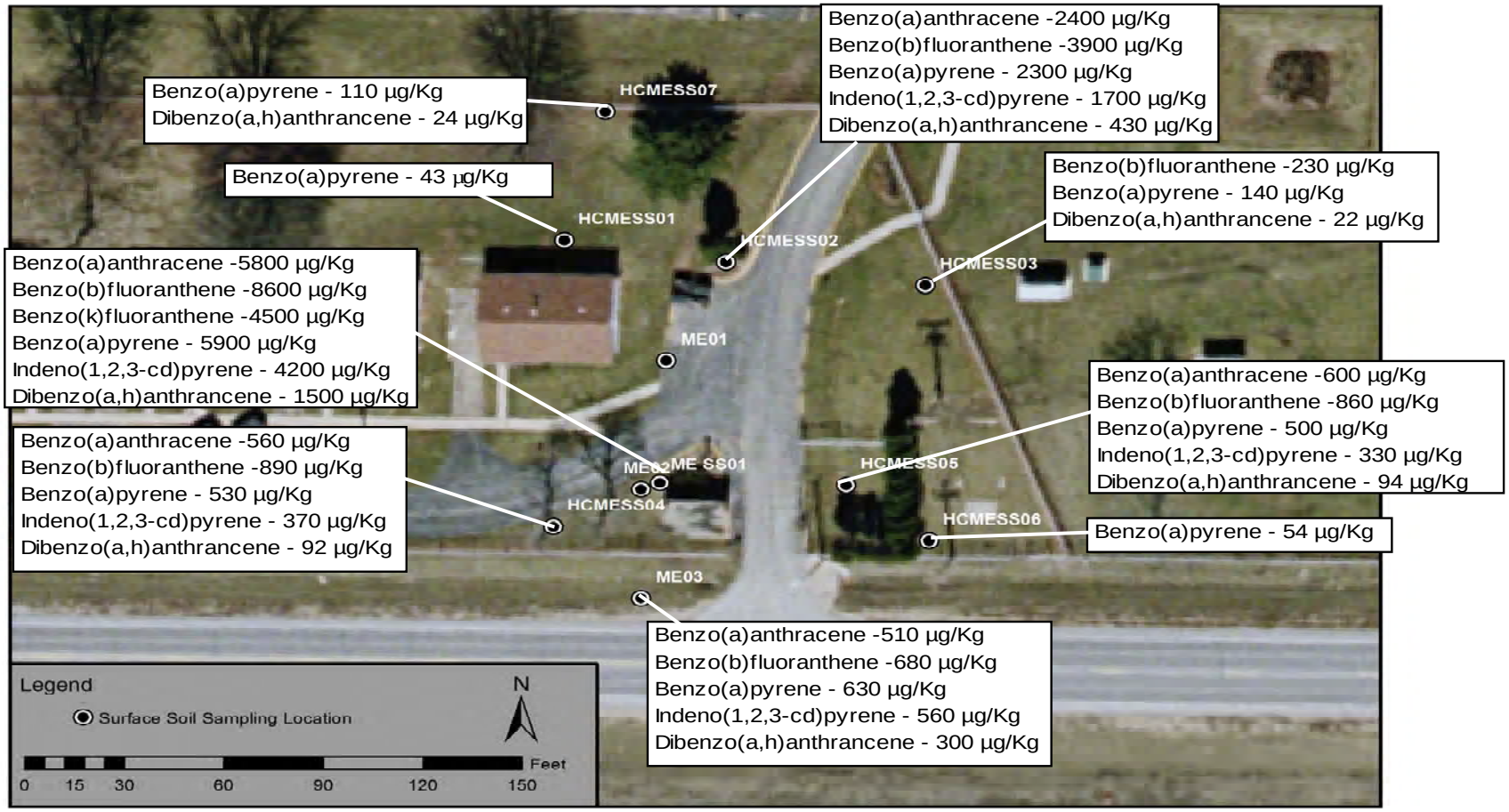
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



Source for base photo map: Peoria County GIS, 2003

Figure 4-11. PAH exceedances of human health screening criteria in surface soils at the Main Entrance

U.S. Army Corps of Engineers
Louisville District

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Kevil, Kentucky

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Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

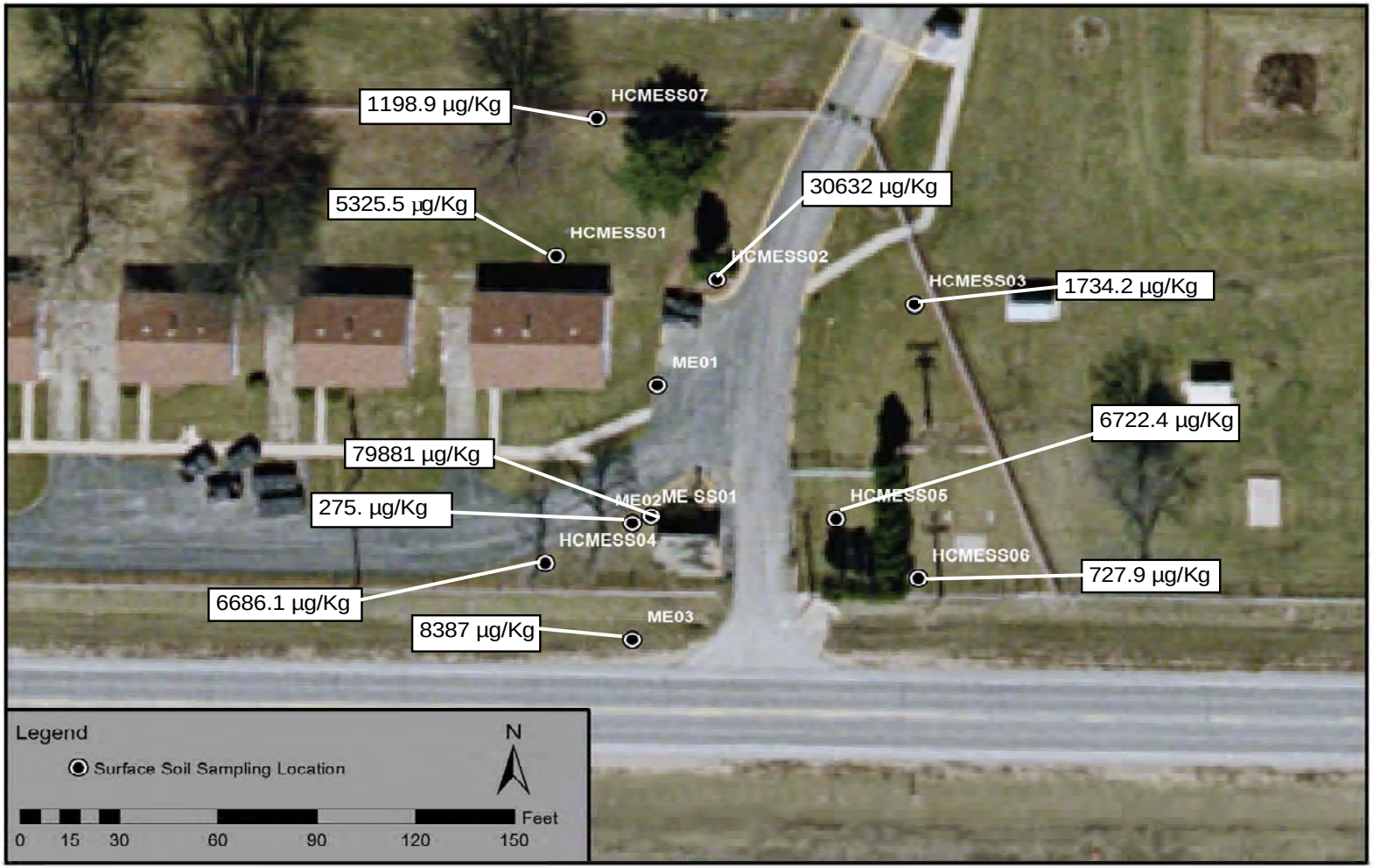

Figure 4-12. Total PAH concentration in surface soils at the Main Entrance

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

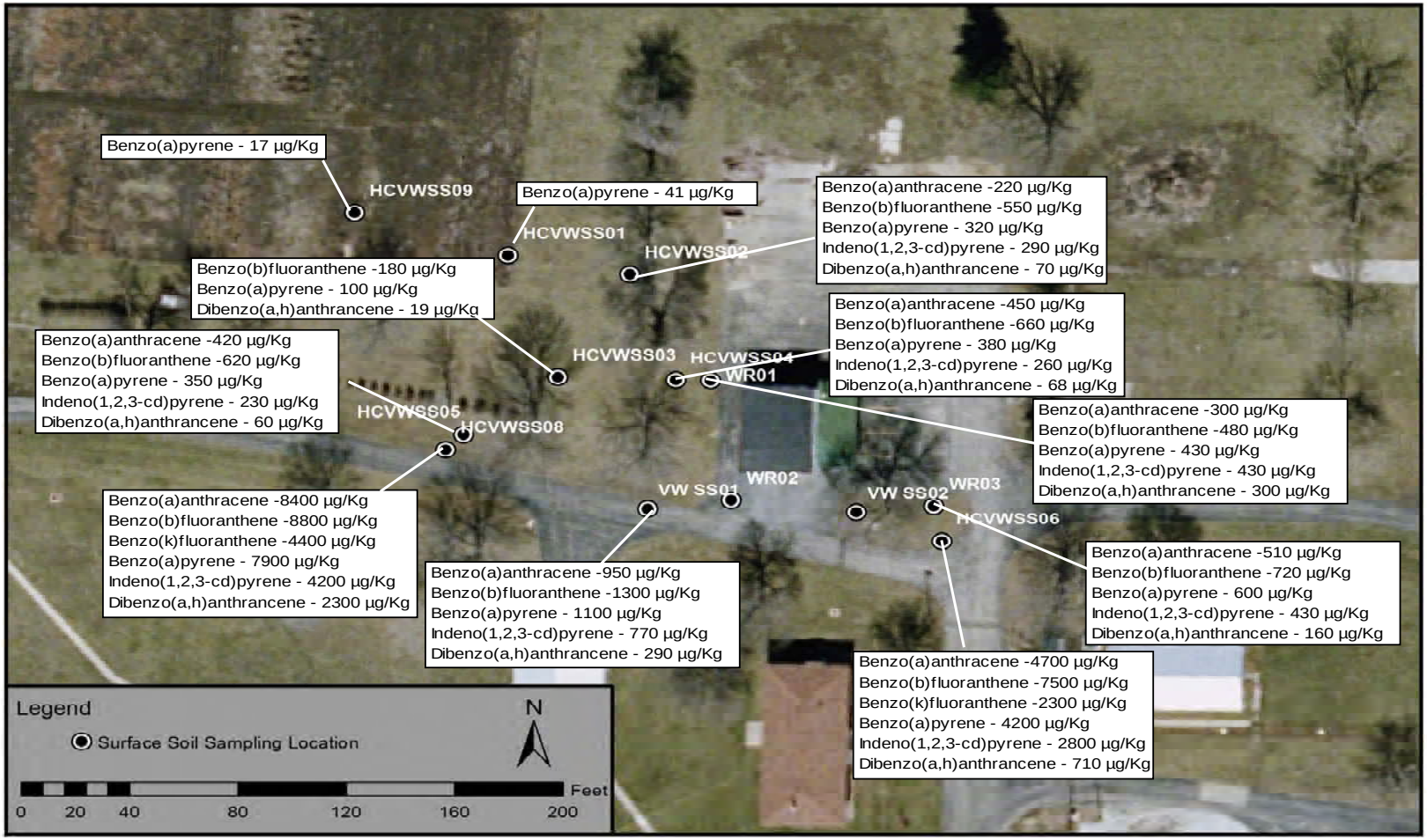


Figure 4-13. PAH exceedances of human health screening criteria in surface soils at the Vehicle Wash Rack

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source for base photo map: Peoria County GIS, 2003

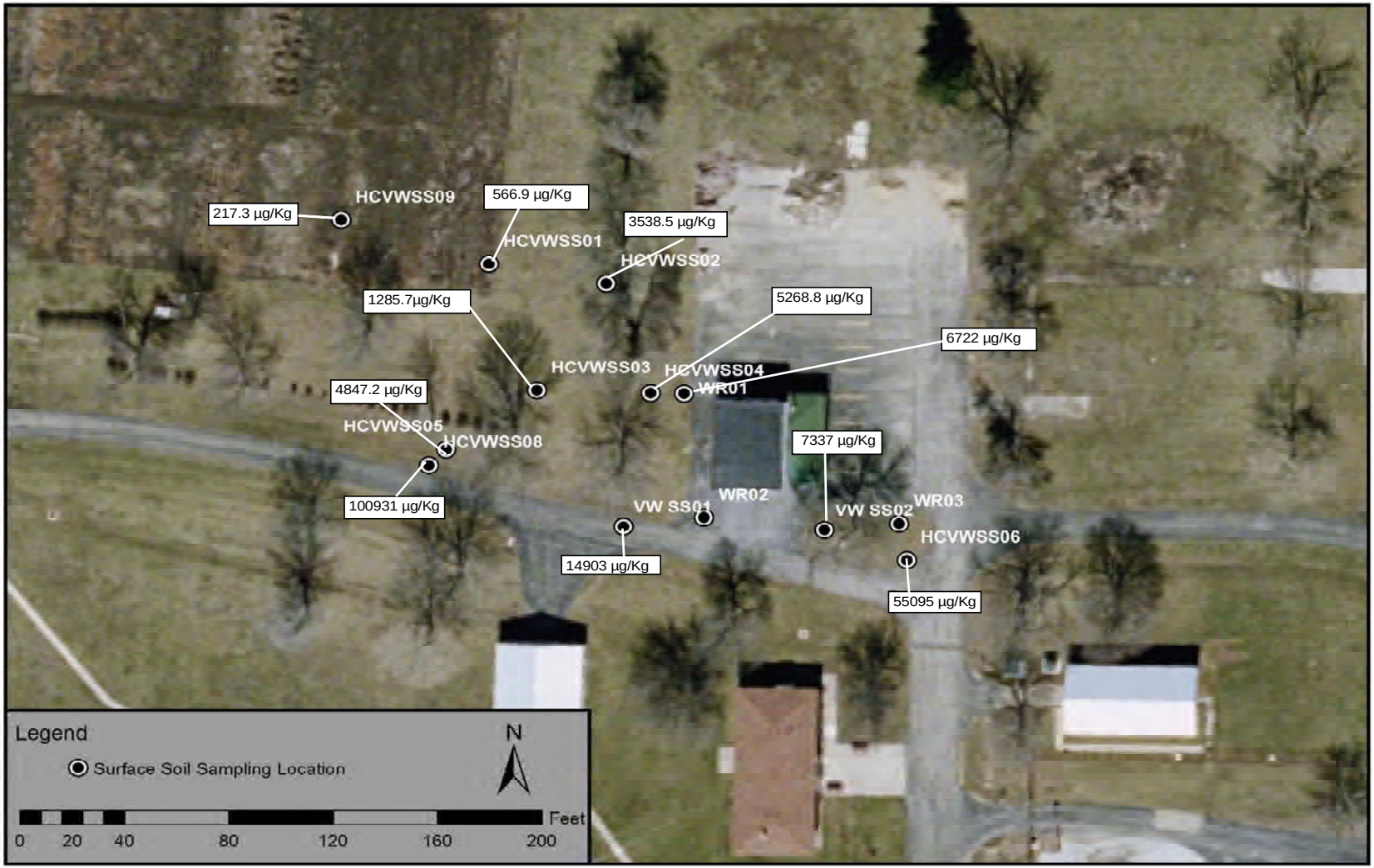


Figure 4-14. Total PAH concentration in surface soils at the Vehicle Wash Rack

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

Source:

Figure 4-15. Benzo(a)pyrene residential TACO exceedances in surface soil at the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station Hanna City, Illinois

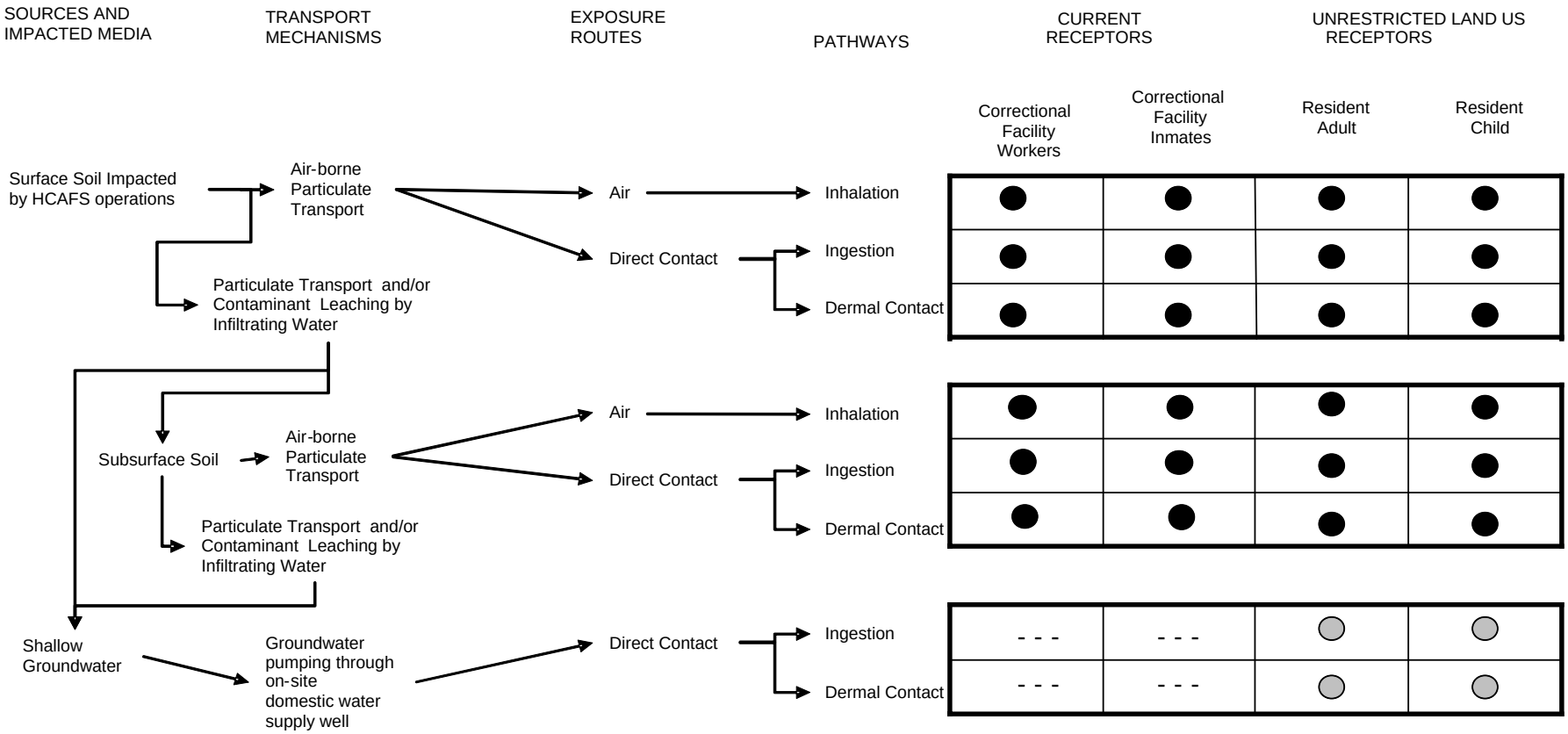
Source:

Figure 4-16. Benzo(a)pyrene industrial/commercial TACO exceedances in surface soil at the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station Hanna City, Illinois



Pathway from impacted medium to receptor considered complete.

- - - Pathway from impacted medium to receptor considered possible but very unlikely to impossible and not analyzed.

Pathway from impacted medium to receptor considered possible and unlikely but analyzed under an unrestricted land use scenario.

Figure 6-1. Conceptual Site Risk Model for the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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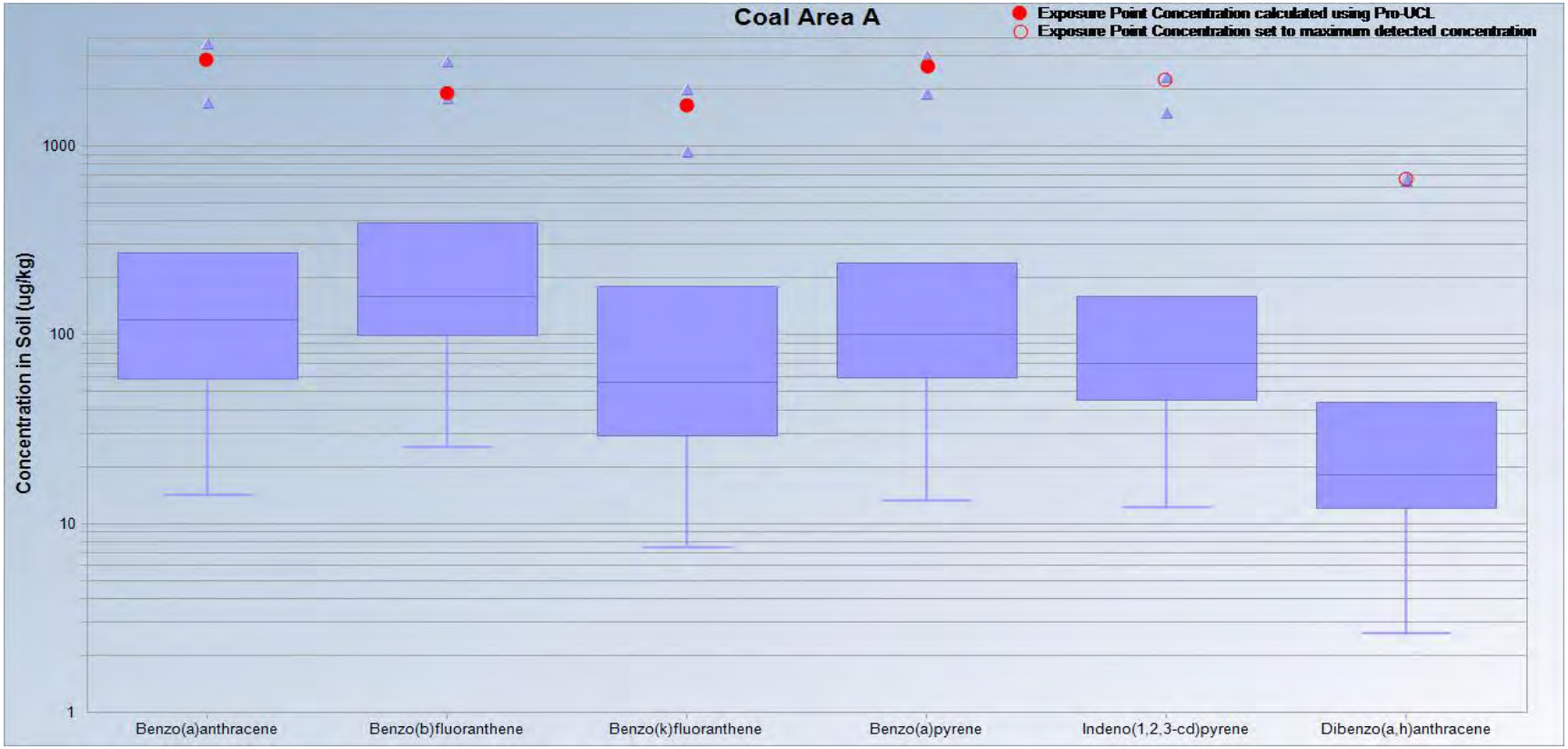
Kevil, Kentucky

Former Hanna City Air Force Station Hanna City, Illinois



Only PAHs with exceedances are shown.

Figure 6-2. Box and whisker plots of select PAHs in surface soils (0-0.5 ft) at the Coal Area A Exposure Unit

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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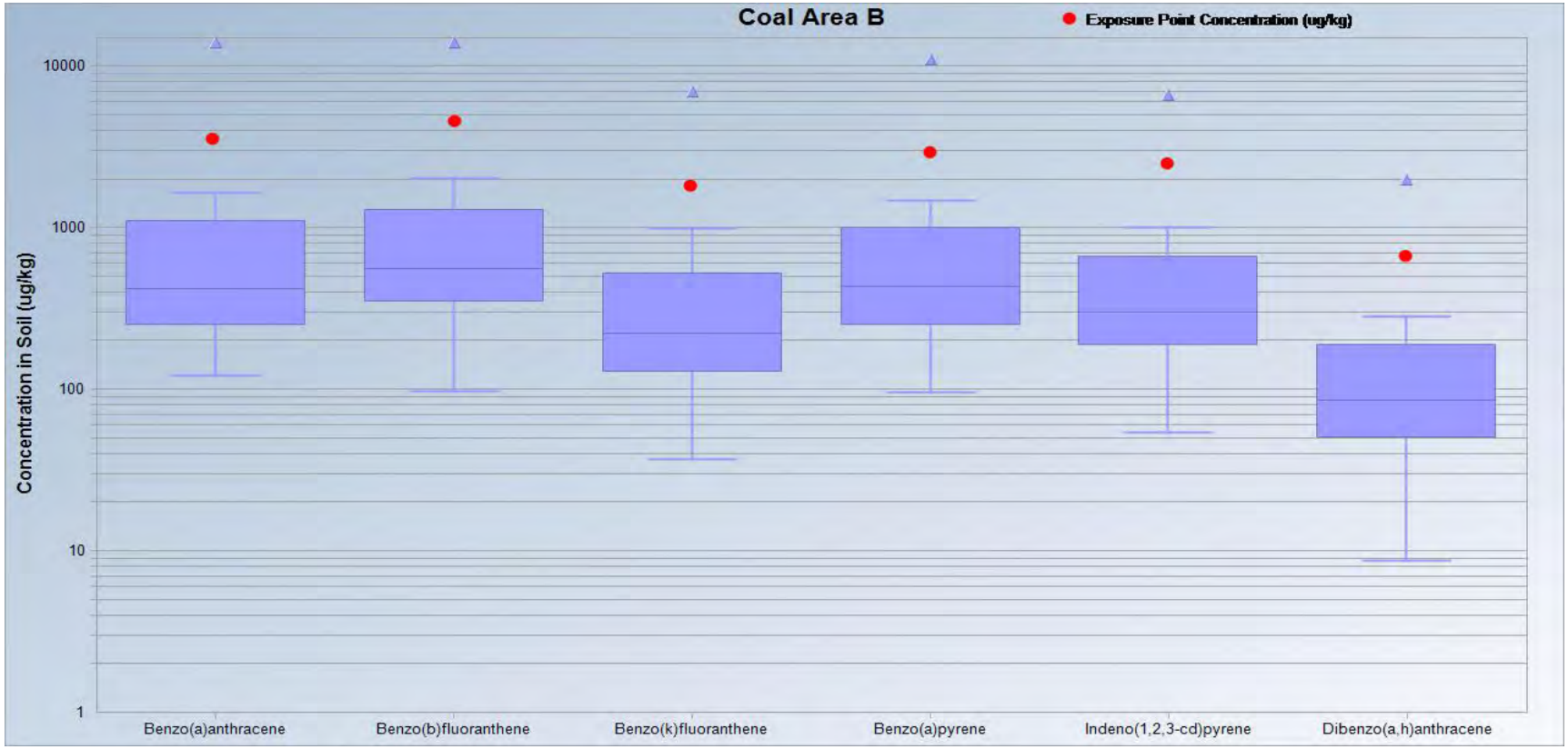
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



Only PAHs with exceedances are shown.

Figure 6-3. Box and whisker plots of select PAHs in surface soils (0-0.5 ft) at the Coal Area B Exposure Unit

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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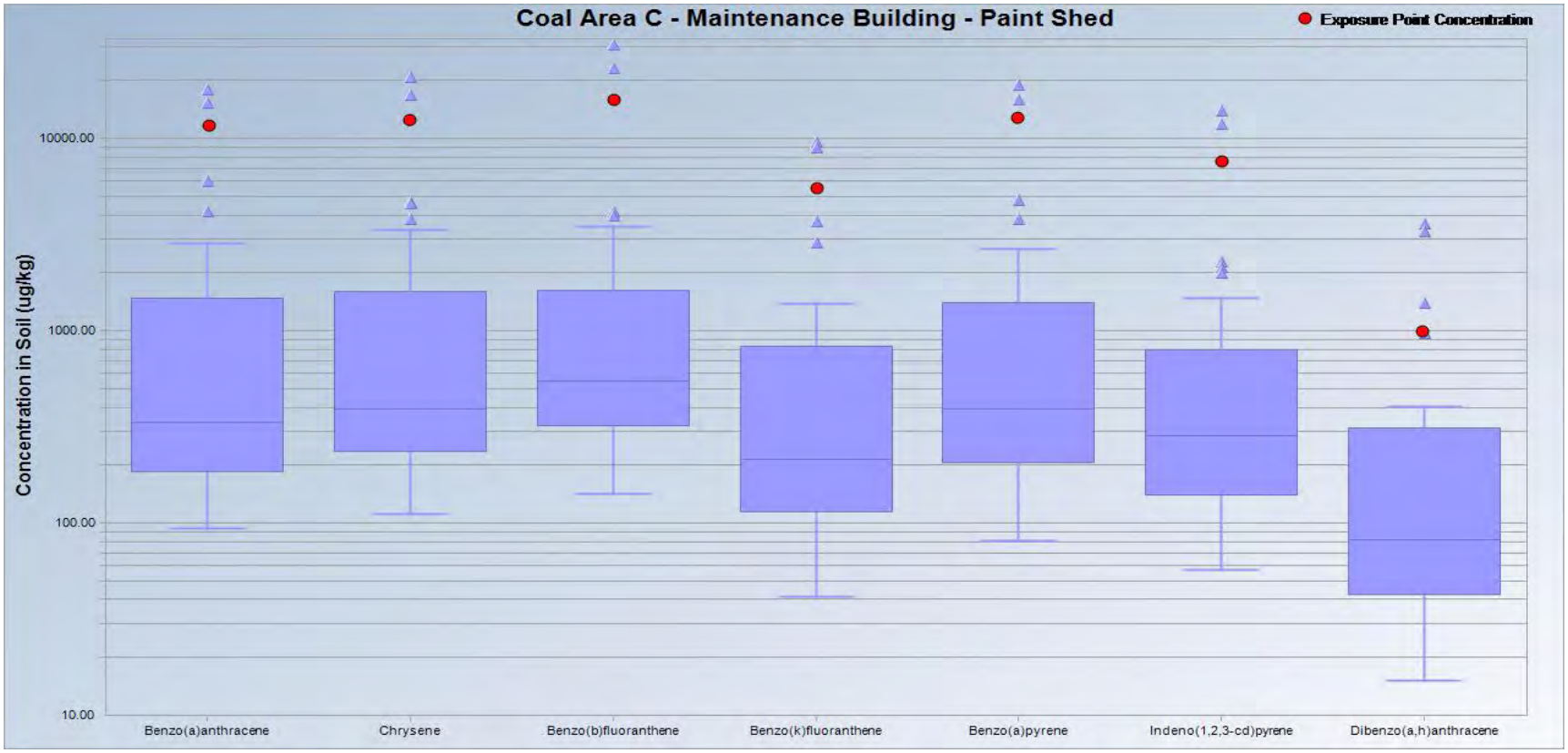
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



Coal Area C Exposure Unit includes Coal Area C, the Maintenance Building, and Paint Shed

Only PAHs with exceedances are shown.

Figure 6-4. Box and whisker plots of PAHs in surface soils (0-0.5 ft) that exceeded human health screening criteria at Coal Area C Exposure Unit

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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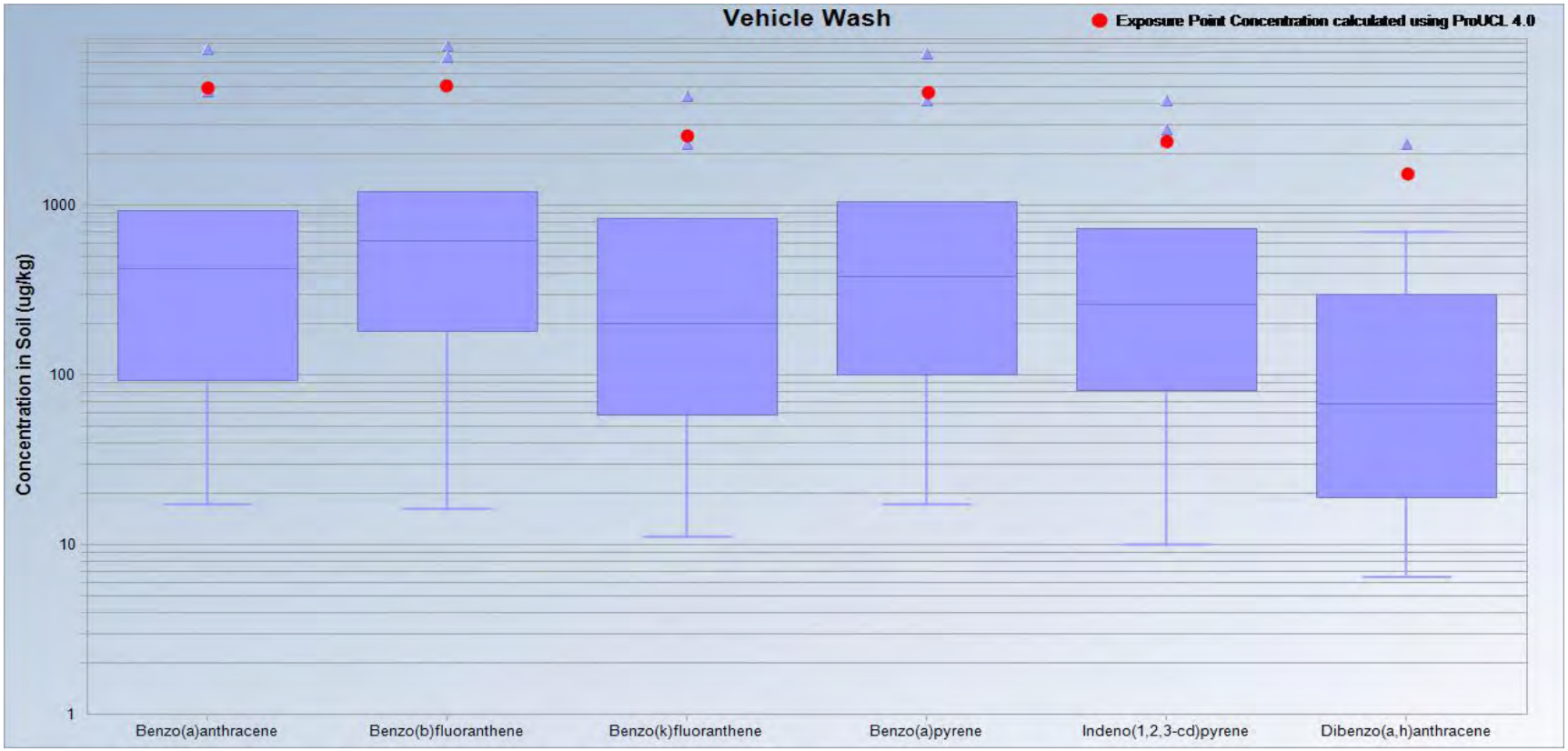
Hanna City, Illinois



Only PAHs with exceedances are shown.

Figure 6-5. Box and whisker plots of PAHs in surface soils (0-0.5 ft) at the Vehicle Wash Rack Exposure Unit

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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Kevil, Kentucky

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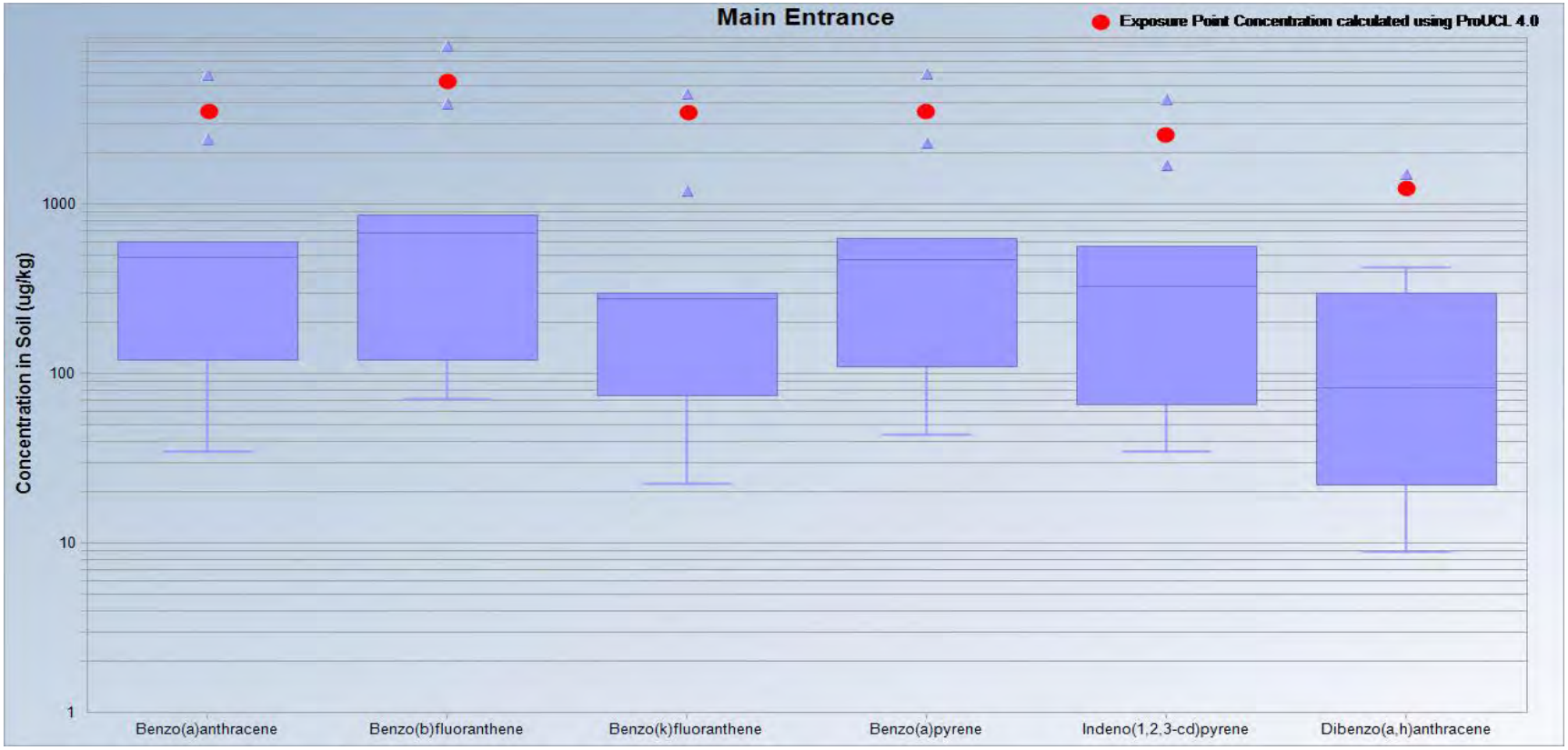
Hanna City, Illinois



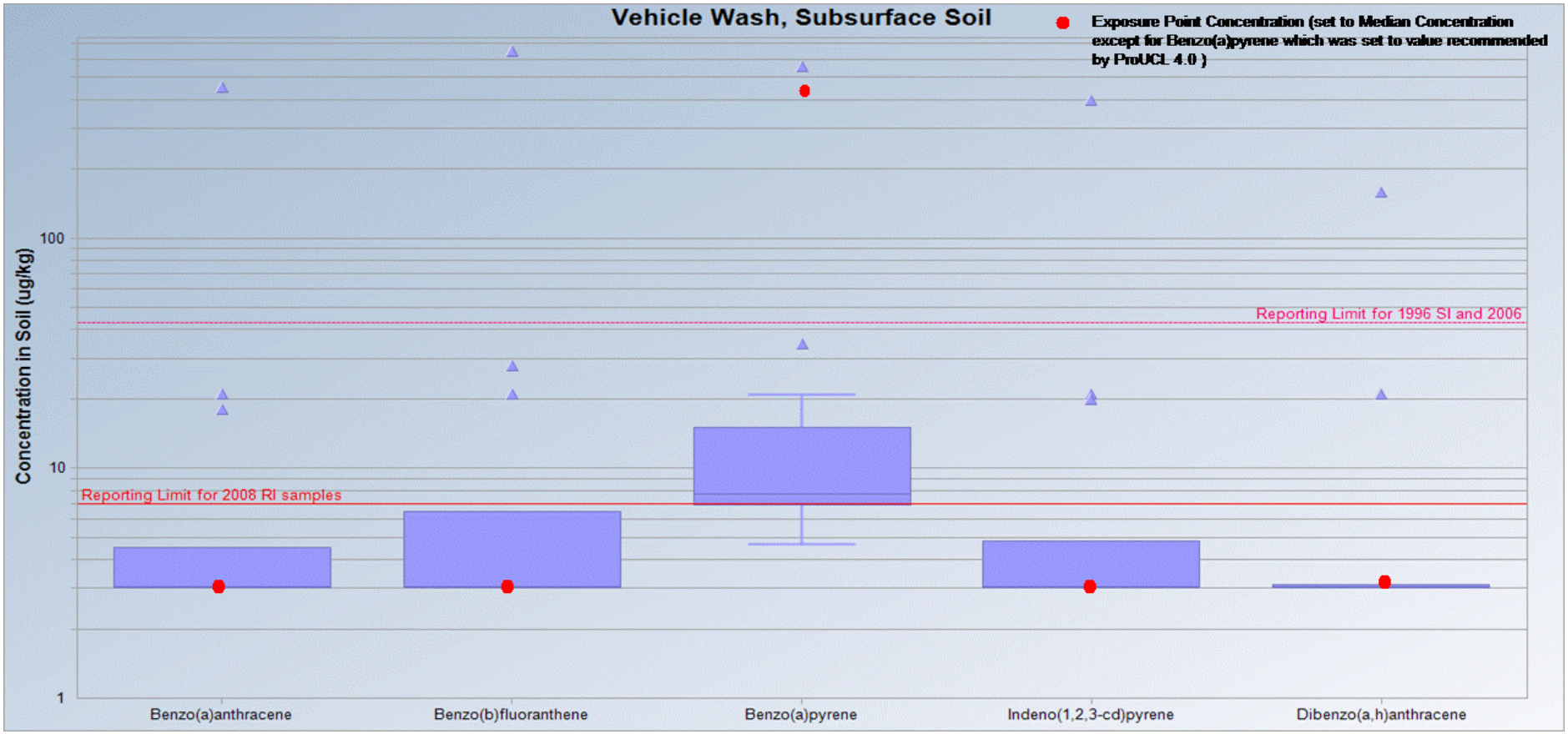
Only PAHs with exceedances are shown.

Figure 6-6. Box and whisker plots of PAHs in surface soils (0-0.5 ft) at the Main Entrance Exposure Unit

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



Only PAHs with exceedances are shown.

Non-detects were plotted as 0.5xReporting Limit

Figure 6-7. Box and whisker plots of PAHs in subsurface soils (>0.5 ft) at the Vehicle Wash Rack Exposure Unit

U.S. Army Corps of Engineers
Louisville District

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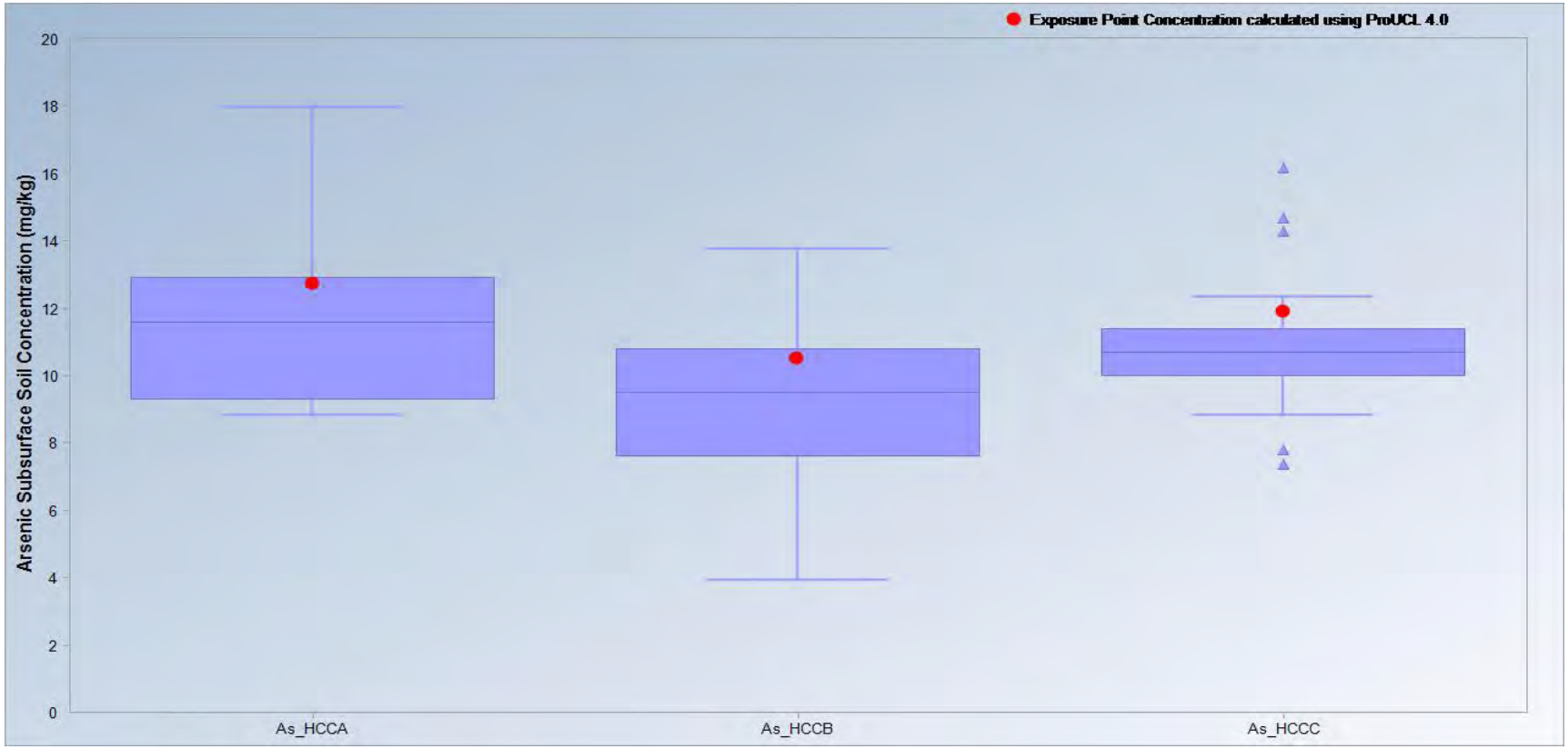
Former Hanna City Air Force Station
Hanna City, Illinois



As_HCCA: Arsenic data from Coal Area A
As_HCCB: Arsenic data from Coal Area B
As_HCCC: Arsenic data from Coal Area C including the Paint Shed

Figure 6-8. Box and whisker plots of arsenic in subsurface soils (>0.5 ft) at the Coal Areas

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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Hanna City, Illinois

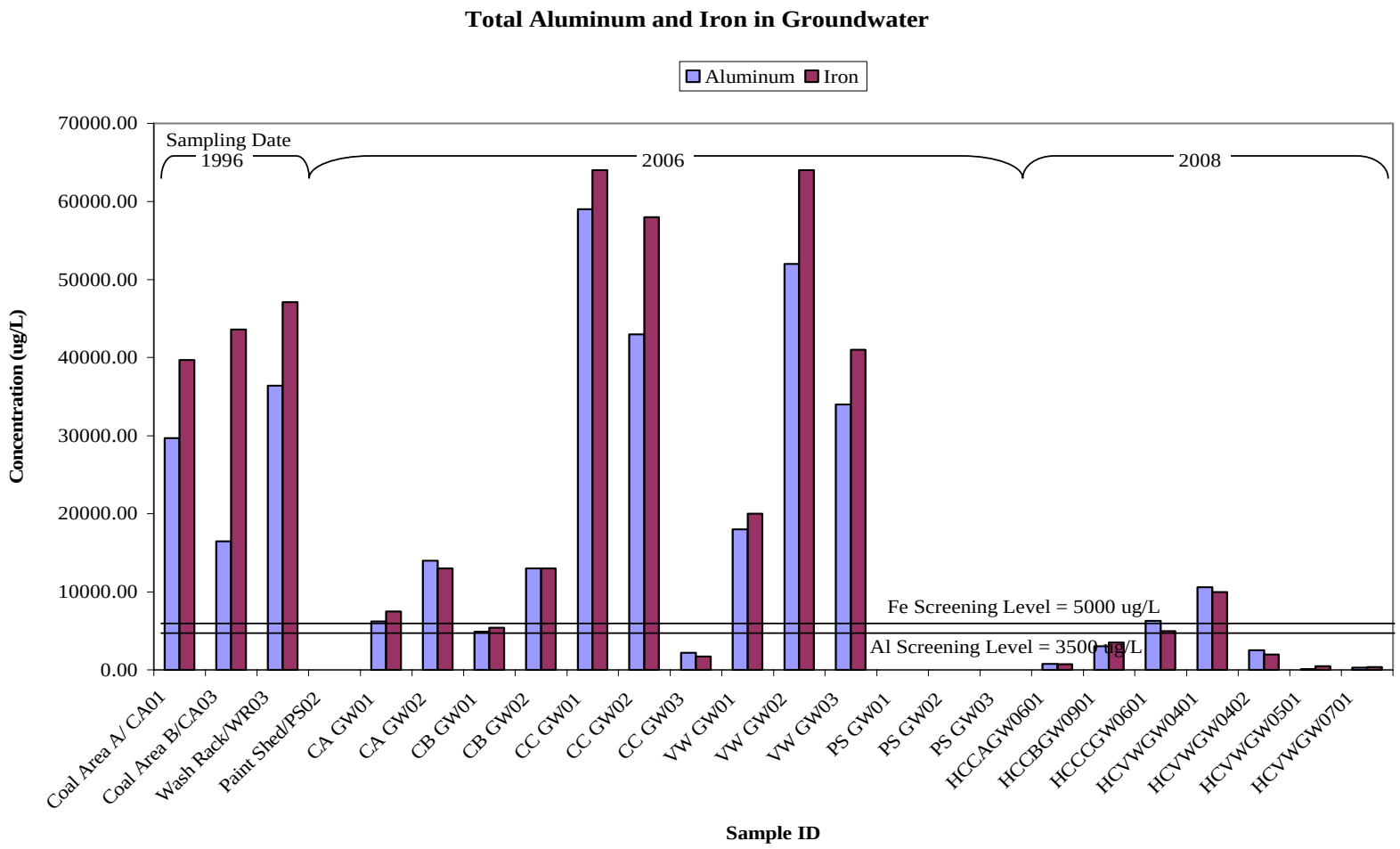

Figure 6-9. Total aluminum and iron concentrations in groundwater samples collected from the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station Hanna City, Illinois

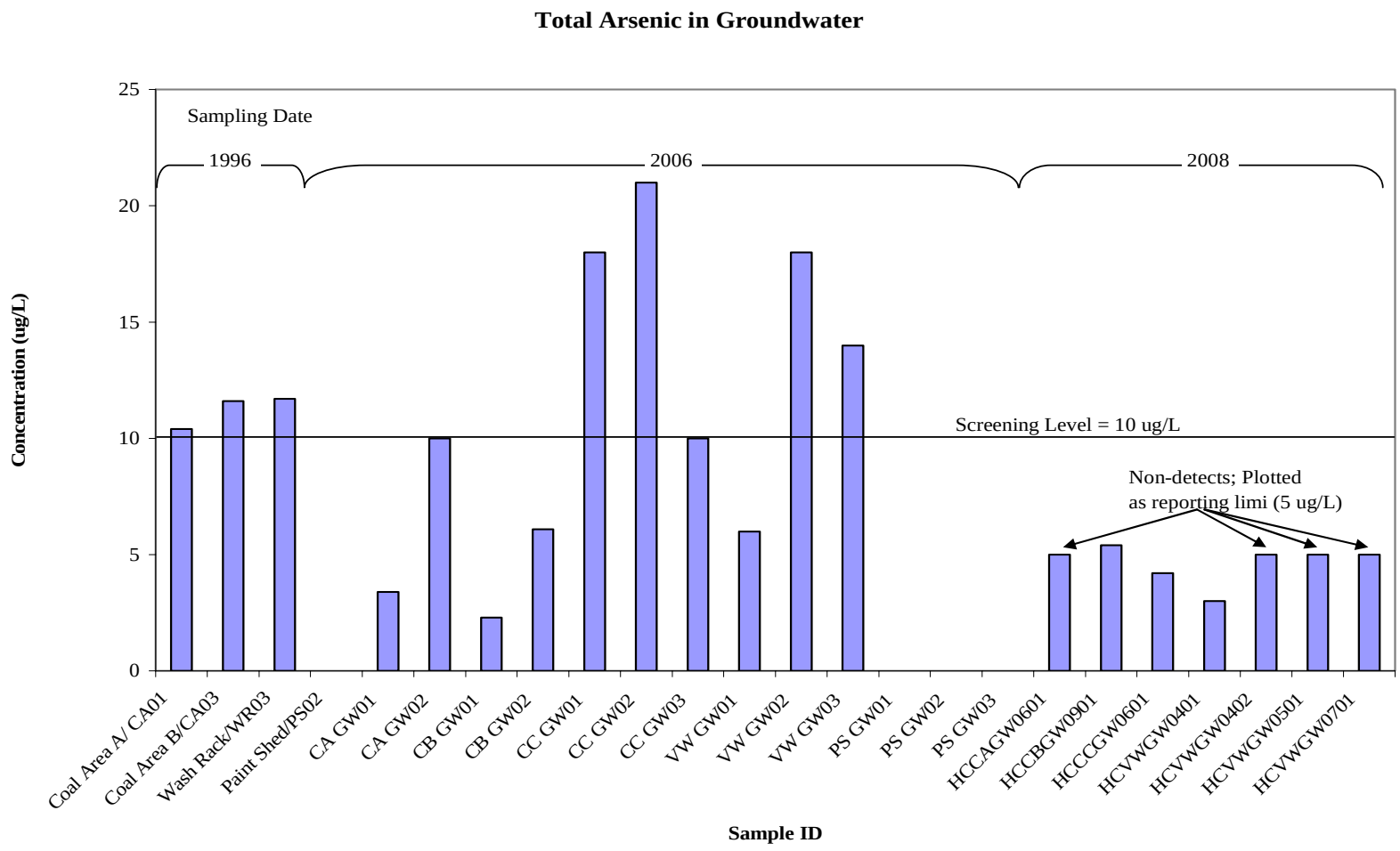

Figure 6-10. Total arsenic in groundwater samples collected from the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
A Geological Engineering and Environmental Services Company
Kevil, Kentucky

Former Hanna City Air Force Station Hanna City, Illinois

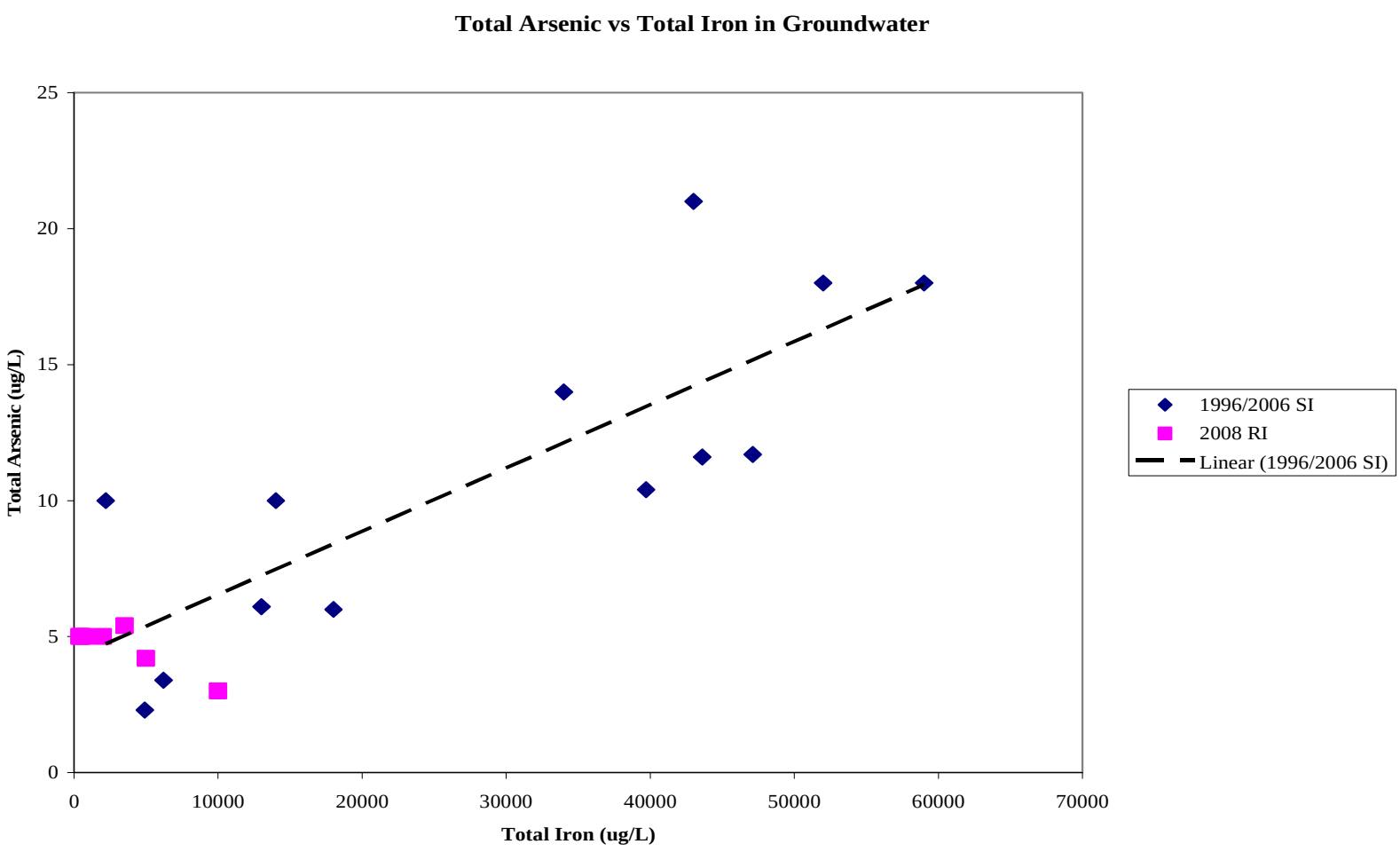

Figure 6-11. Positive correlation between total arsenic and total iron in groundwater samples from the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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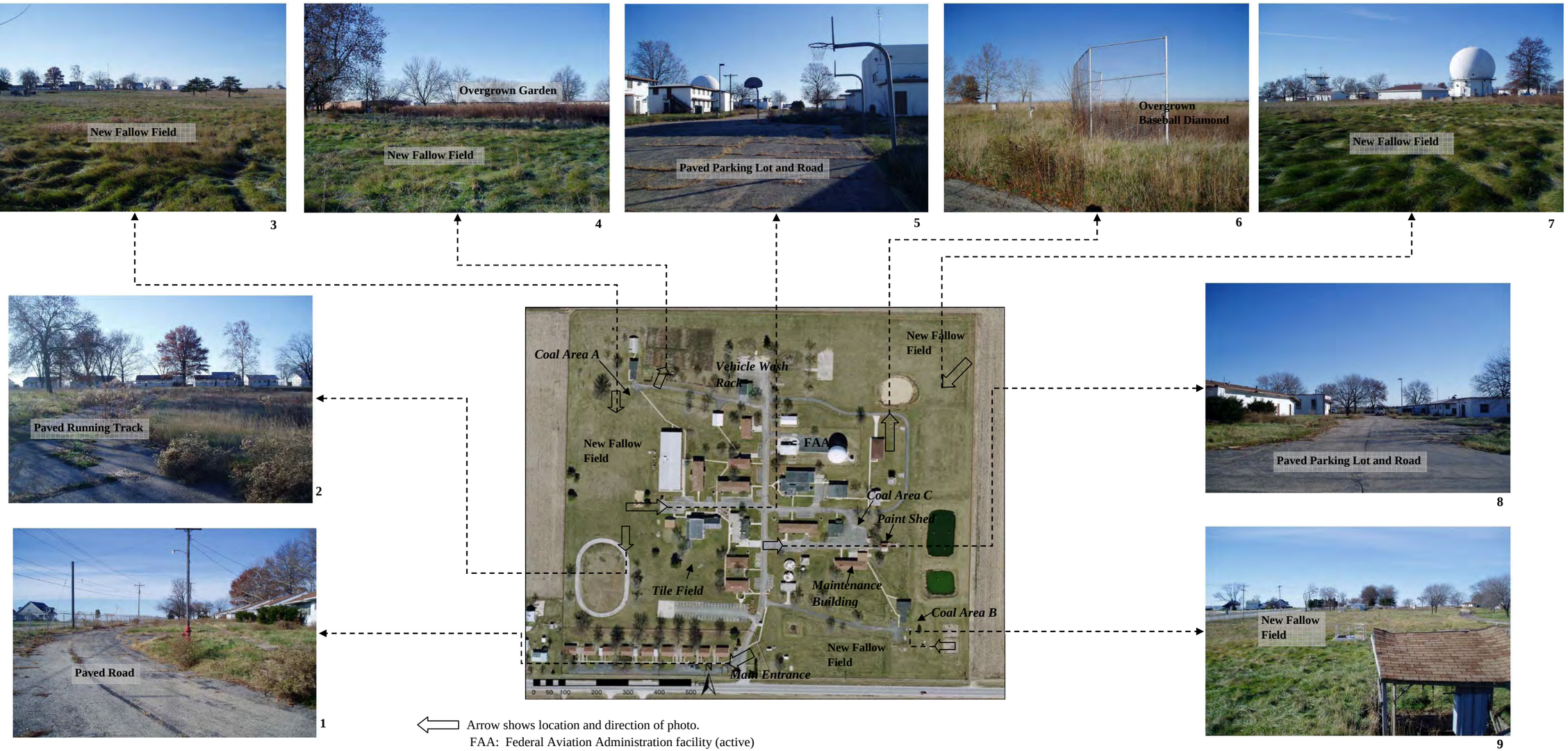
Former Hanna City Air Force Station
Hanna City, Illinois



Arrow shows location and direction of photo.
FAA: Federal Aviation Administration facility (active)

Sources: Center aerial photo, Peoria GIS, 2003. Peripheral photos taken November 18, 2008, EnviroScience, Inc. (Appendix G)
Note: Hanna City Work Camp was closed in 2002; site has been largely unused since this then, except for tract occupied FAA facility.

Figure 7-1. Paved areas and fallow fields at the HCAFS

U.S. Army Corps of Engineers
Louisville District

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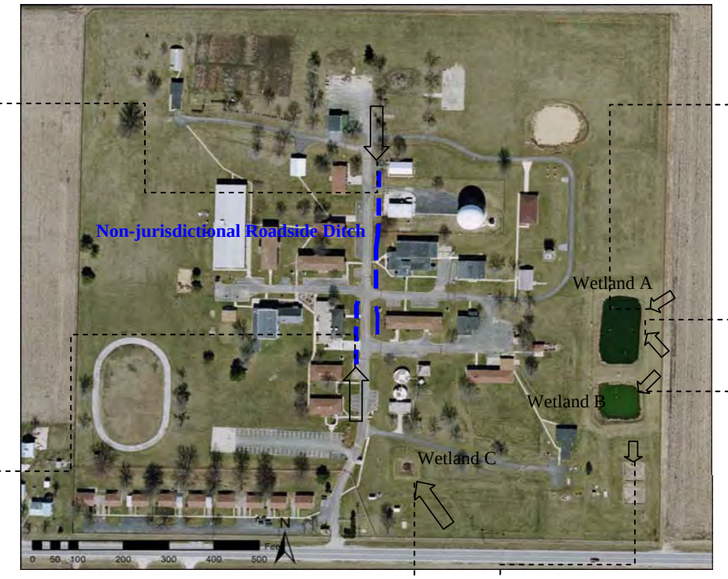
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

7



1

6

2

5

4

3

Arrow shows location and direction of photo.

Sources: Center aerial photo, Peoria GIS, 2003. Peripheral photos taken November 18, 2008, EnviroScience, Inc. (Appendix G)
Note: Hanna City Work Camp was closed in 2002; site has been largely unused since this then, except for tract occupied FAA facility.

Figure 7-2. Wetland areas and drainage features at the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois

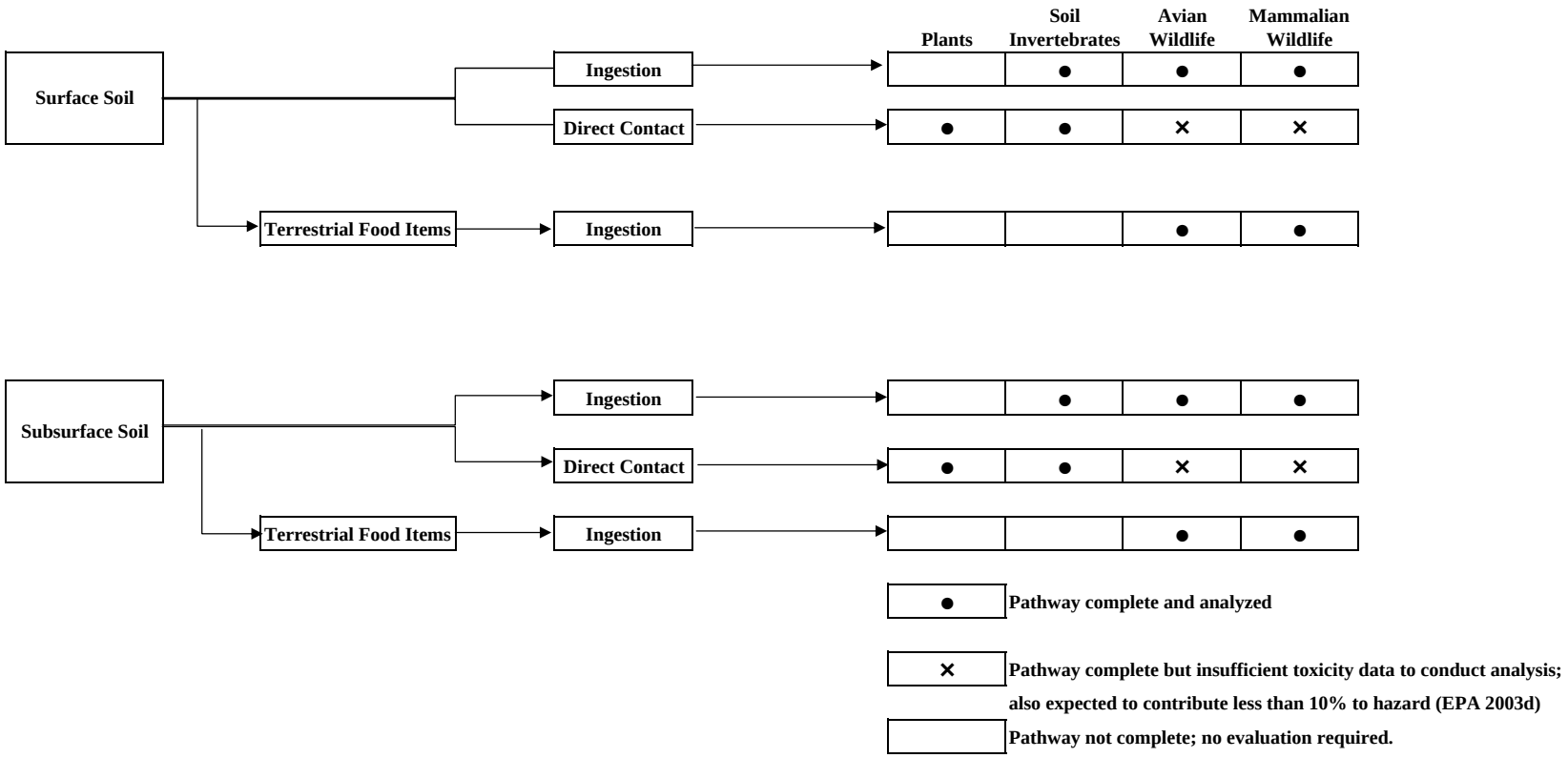

Figure 7-3. Ecological Conceptual Site Risk Model for the HCAFS

U.S. Army Corps of Engineers
Louisville District

GEO Consultants, LLC
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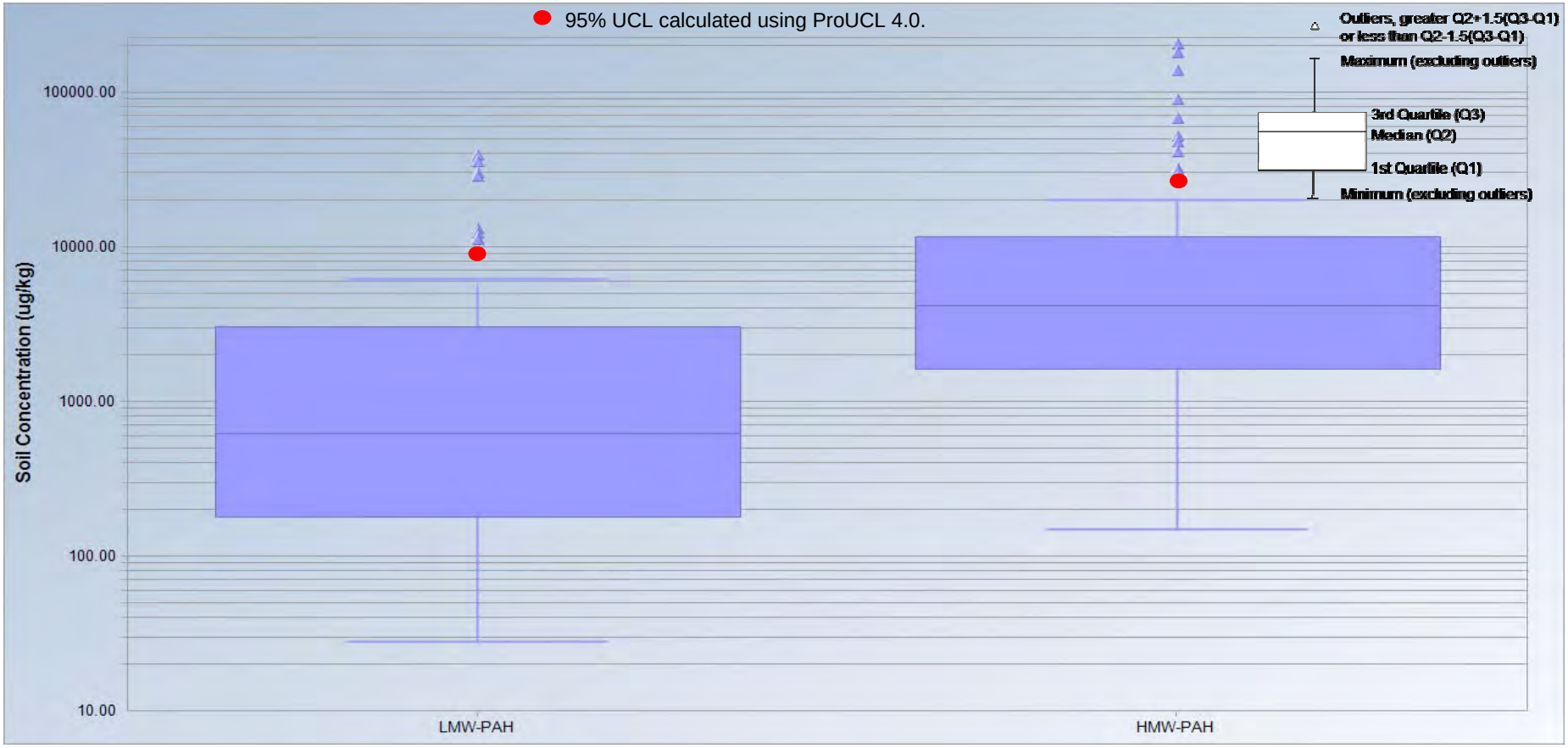
Kevil, Kentucky

Former Hanna City Air Force Station
Hanna City, Illinois



LMW-PAH: Low molecular weight (< 4 rings) PAHs, 95% UCL = 8146 ug/kg
HMW-PAH: High molecular weight (>= 4 rings) PAHs, 95% UCL = 28865 ug/kg
The graphs show PAH data from all AOPCs at the HCAFS combined into one dataset.
Total number of data points for each dataset = 68

Figure 7-4. Box and whisker plots for low-molecular weight and high molecular weight PAHs in surface soils at the HCAFS

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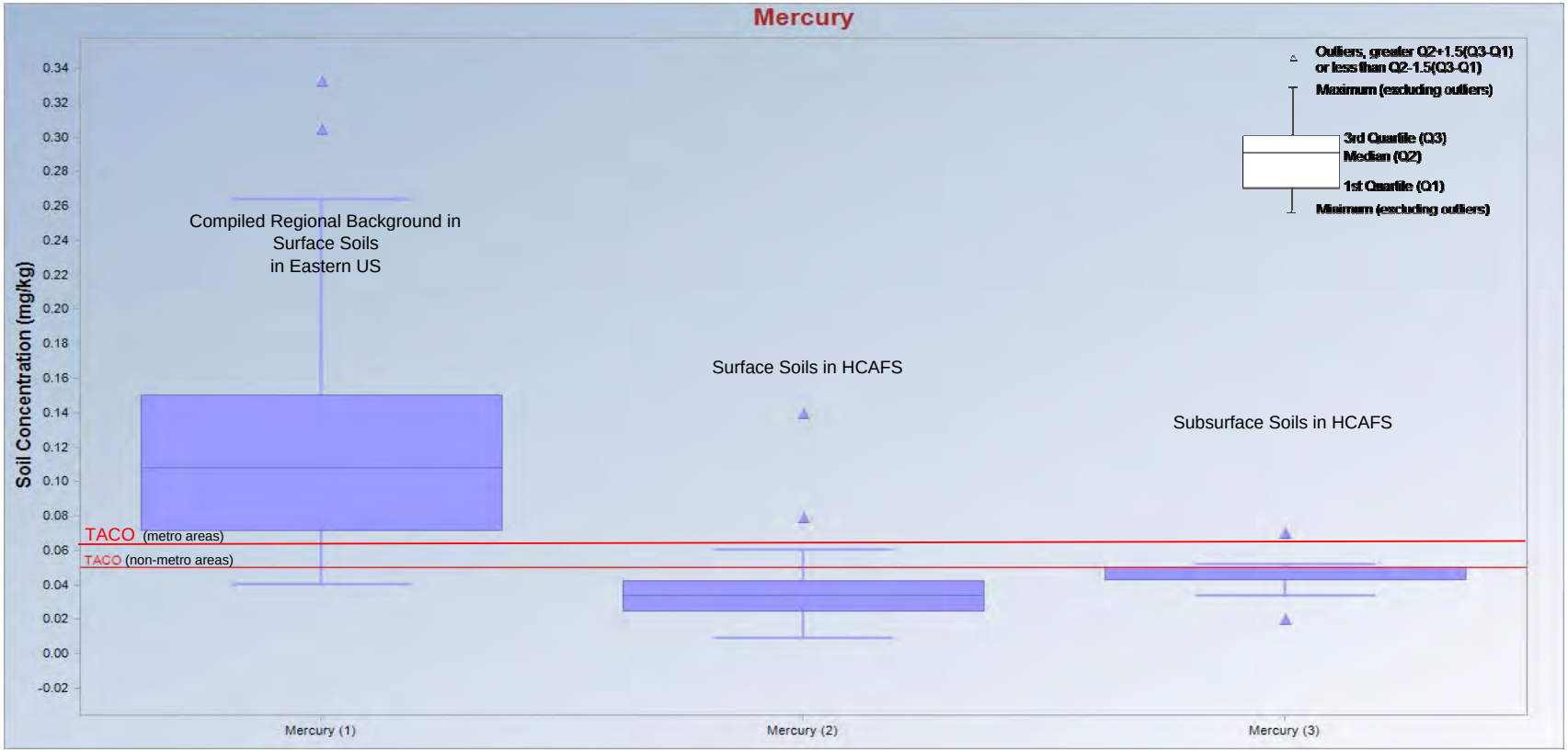

Mercury (1): Average mercury surface soil concentrations in regional background datasets from the Eastern United States compiled by USEPA (2007)
Mercury (2): Mercury concentrations in surface soil from AOPCs at the HCAFS.
Mercury (3): Mercury concentrations in subsurface soil (0.5 ft to 5 ft) from AOPCs at the HCAFS.
"TACO": Illinois regional background concentration for non-metro areas (TACO, Appendix A, Table G)

Figure 7-5. Box and whisker plots of mercury in surface and subsurface soil at the HCAFS, compared with TACO and background mercury levels in the eastern United States

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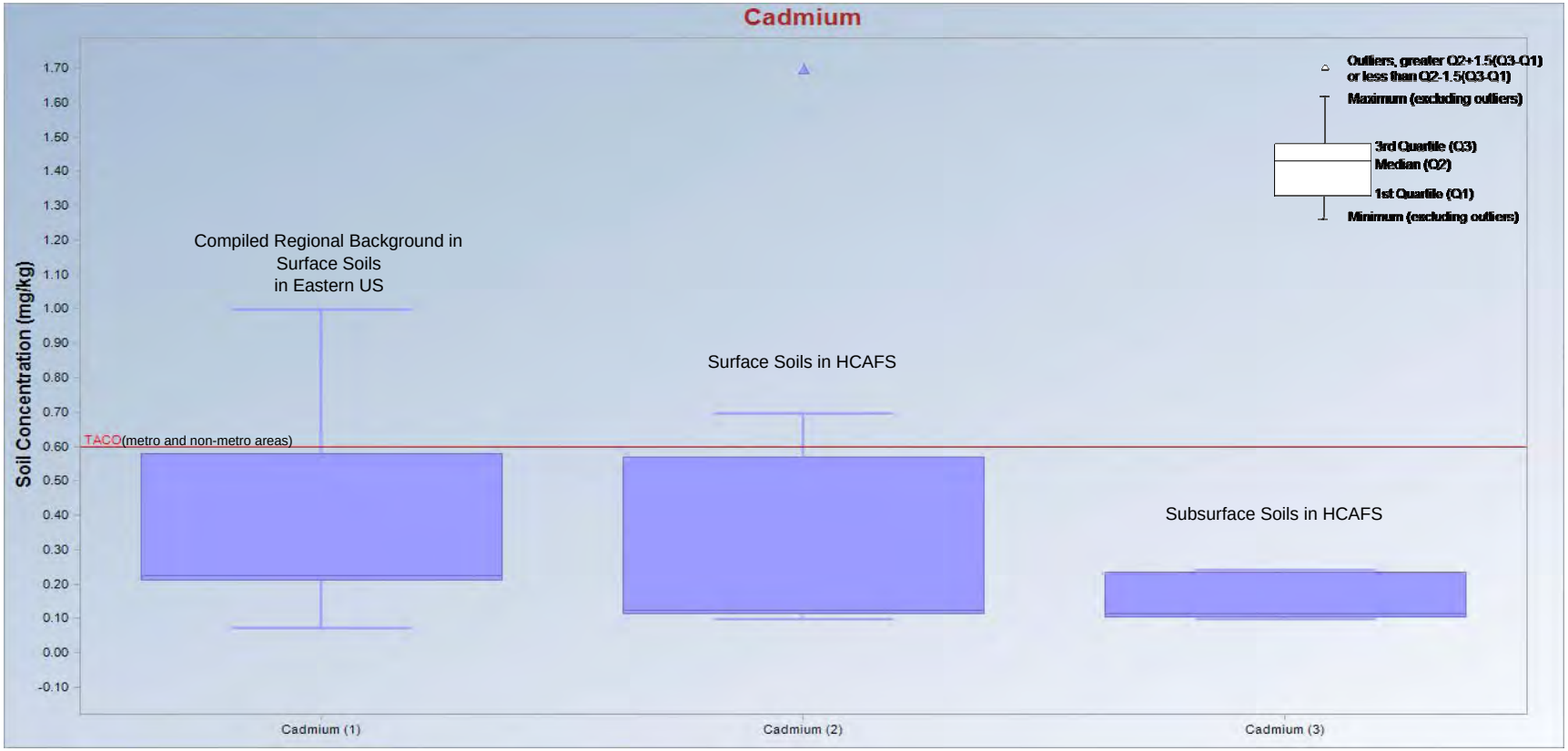

Cadmium (1): Average cadmium surface soil concentrations in regional background datasets from the Eastern United States compiled by USEPA (2007)
Cadmium (2): Cadmium concentrations in surface soil from AOPCs at the HCAFS.
Cadmium (3): Cadmium concentrations in subsurface soil (0.5 ft to 5 ft) from AOPCs at the HCAFS.
"TACO": Illinois regional background concentration for metro and non-metro areas (TACO, Appendix A, Table G); metro area value applies to HCAFS because it is in Peoria County.

Figure 7-6. Box and whisker plots of cadmium in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States

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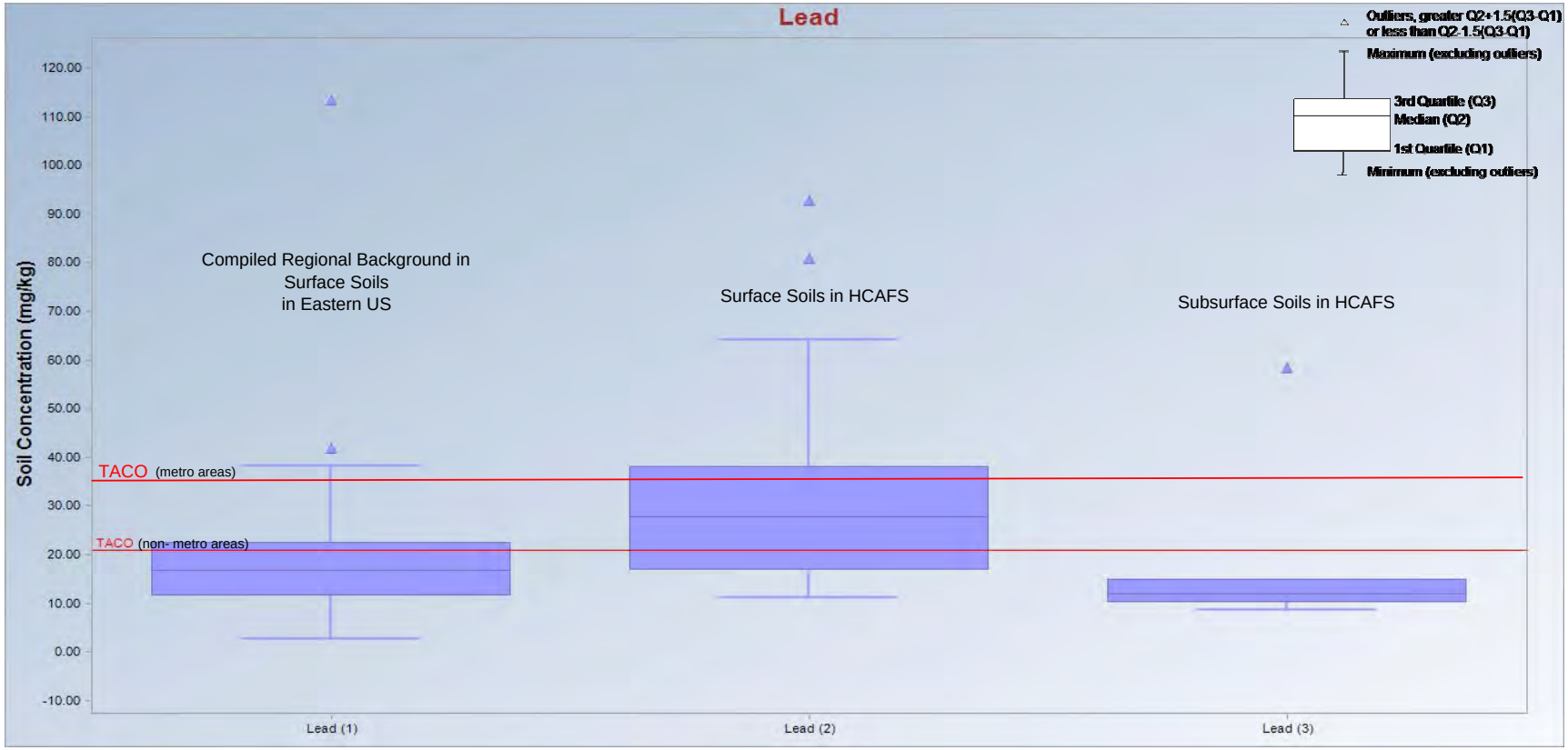

Lead (1): Average lead surface soil concentrations in regional background datasets from the Eastern United States compiled by USEPA (2007)
Lead (2): Lead concentrations in surface soil from AOPCs at the HCAFS.
Lead (3): Lead concentrations in subsurface soil (0.5 ft to 5 ft) from AOPCs at the HCAFS.
"TACO": Illinois regional background concentration for non-metro areas (TACO, Appendix A, Table G)

Figure 7-7. Box and whisker plots of lead in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States

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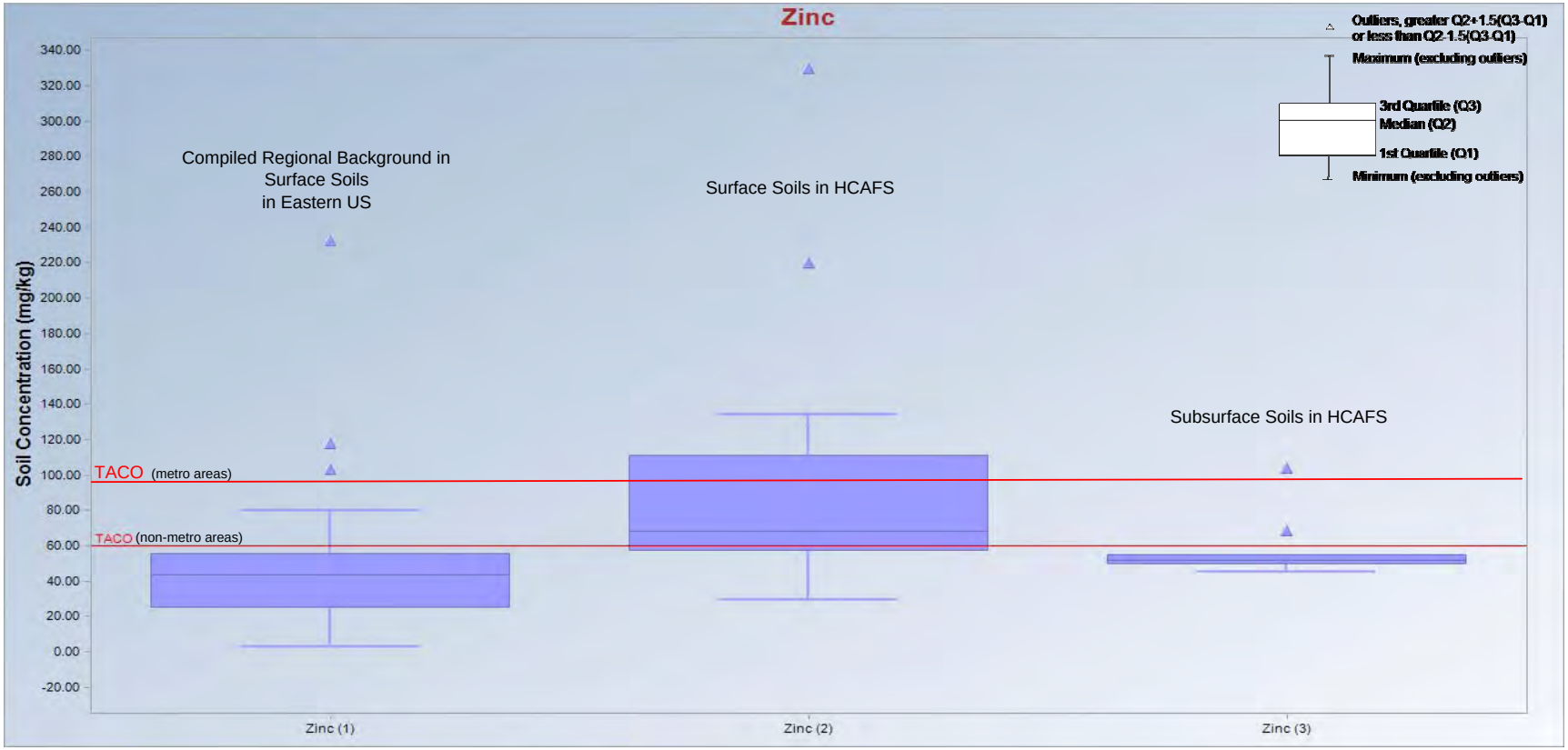

Zinc (1): Average zinc surface soil concentrations in regional background datasets from the Eastern United States compiled by USEPA (2007)
Zinc (2): Zinc concentrations in surface soil from AOPCs at the HCAFS.
Zinc (3): Zinc concentrations in subsurface soil (0.5 ft to 5 ft) from AOPCs at the HCAFS.
"TACO": Illinois regional background concentration for metro and non-metro areas (TACO, Appendix A, Table G); metro area value applies to HCAFS because it is in Peoria County.

Figure 7-8. Box and whisker plots of zinc in surface and subsurface soil at the HCAFS, compared with TACO and background cadmium levels in the eastern United States

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APPENDIX B

TABLES

Table 2-1 AOPCs and associated data points for surface soil samples
Table 2-2 AOPCs and associated data points for subsurface soil samples
Table 2-3 AOPCs and associated data points for groundwater samples
Table 2-4 Analysis of Equipment Blank associated with samples analyzed for PAHs
Table 2-5 Analysis of Equipment Blank associated with samples analyzed for metals
Table 3-2 Federally Endangered, Threatened, Proposed, and Candidate Species of Peoria County, IL
Table 3-3 State listed endangered and threatened species of Peoria County, Illinois
Table 4-1 Comparison between PAH analyses of field duplicate soil samples.
Table 4-2 Comparison between arsenic analyses of field duplicate soil samples.
Table 4-3 Comparison between metals analyses of field duplicate groundwater samples.
Table 4-4 Preliminary ARARs
Table 4-5 Analysis results, metals in groundwater samples
Table 4-6 Analysis results for arsenic in subsurface soils
Table 4-7 Analysis results, PAHs in surface soils from Coal Area A
Table 4-8 Analysis results, PAHs in surface soils from Coal Area B
Table 4-9. PAH shallow soils results Hanna City Coal Area C EU (HCCC, HCMB, HCPS)
Table 4-10. PAH shallow soil results Hanna City Main Entrance (HCME)
Table 4-11(a). PAH shallow soil results Hanna City Vehicle Wash Area (HCVW)
Table 4-11(b) PAH Results Subsurface Soil
Table 6-1 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils at Coal Area A.
Table 6-2 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils at Coal Area B.
Table 6-3 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils (0 to 0.5 feet) at Coal Area C, Maintenance Building, and Paint Shed (combined into one exposure unit)
Table 6-4 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils (0 to 0.5 feet) at the Vehicle Wash Rack
Table 6-5 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils (0 to 0.5 feet) at the Main Entrance
Table 6-6 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in subsurface soils (>0.5 feet) at the Vehicle Wash Rack
Table 6-7 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for arsenic in subsurface soils (>0.5 feet) at the Coal Areas
Table 6-8 Summary statistics, screening against human health criteria, and exposure point concentrations (EPCs) for groundwater at the former HCAFS.
Table 6-9a Summary of recoveries in matrix spike samples for PAH soil analysis, 2006 Supplemental Site Inspection (TtEC 2008)
Table 6-9b Summary of recoveries in matrix spike samples for metals soil analysis, 2006 Supplemental Site Inspection (TtEC 2008)
Table 6-9(c) Summary of recoveries in matrix spike samples for metals groundwater analysis, 2006 Supplemental Site Inspection (TtEC 2008)
Table 6-10(a) Summary of recoveries in matrix spike samples for PAH soil analysis, 2008 Remedial Investigation (this report)

Table 6-10(b) Summary of recoveries in matrix spike samples for metals soil analysis, 2008 Remedial Investigation (this report)
Table 6-10(c) Summary of recoveries in matrix spike samples for metals soil analysis, 2008 Remedial Investigation (this report)
Table 6-11 Parameters for estimating receptor exposure to chemicals in soil at the former HCAFS
Table 6-12 Parameters for estimating receptor exposure from chemicals in groundwater at the former HCAFS
Table 6-13 Toxicity values used in calculating incremental lifetime cancer risks from COPCs at the former HCAFS.
Table 6-14 Toxicity values used in calculating hazard quotients to quantify non-carcinogenic risks from COPCs at the former HCAFS.
Table 6-15 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soil (0 to 0.5 feet) at Coal Area A Exposure Unit
Table 6-16 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0 to 0.5 feet) at Coal Area B Exposure Unit
Table 6-17 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0 to 0.5 feet) at Coal Area C Exposure Unit (includes Maintenance Building and Paint Shed)
Table 6-18 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0 to 0.5 feet) at the Vehicle Wash Rack Exposure Unit
Table 6-19 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0 to 0.5 feet) at the Main Entrance Exposure Unit
Table 6-20 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in subsurface soils (>0.5 feet) at the Vehicle Wash Rack Exposure Unit
Table 6-21 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in subsurface soils (>0.5 feet) at the Coal Areas
Table 6-22 Summary of total incremental lifetime cancer risk (ILCR) for site receptors from surface and subsurface soils at the Exposure Units within the former HCAFS
Table 6-23 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-Metals in unfiltered groundwater at the former HCAFS
Table 6-24 Summary of hazard indices for site receptors from exposure to COPC-Metals in subsurface soil at the Coal Areas
Table 6-25 Summary of hazard indices for site receptors from exposure to COPC-Metals in unfiltered groundwater at the former HCAFS
Table 6-26 Summary of hazard indices for site receptors from exposure to COPC-Metals in filtered (<0.45 um) groundwater at the former HCAFS
Table 7-1(a). Volatile organic compounds detected in soil at the former HCAFS compared against ecological screening values.
Table 7-1(b). Polychlorinated Biphenyls (PCBs) analysis of soil samples from the Maintenance Building compared against ecological screening values.
Table 7-1(c). Polynuclear Aromatic Hydrocarbons (PAH) analysis of soil samples from AOPCs at the former HCAFS compared against ecological screening values.
Table 7-1d. PAH measured in subsurface soil samples collected during the 1996 SI and the 2006 SSI (TtEC 2008) from the Tile Field, Main Entrance, Maintenance Building, and Paint Shop.
Table 7-1(e). Metals analysis of soil samples from AOPCs at the former HCAFS compared against ecological screening values.

Table 7-1(f). Metals measured in surface soil samples collected during the SI and SSI (TtEC, 2008).
Table 7-1(g). Metals (excluding arsenic) measured in subsurface soil samples collected during the SI and SSI (TtEC, 2008).
Table 7-2(b) Ecological soil screening levels and risk characterization from exposure to PAHs in surface soil for mammalian receptors.
Table 7-3. Comparison of site data against USEPA Eco-SSLs and regional USEPA ecological screening levels for tentative metal COPECs (i.e., metals that exceeded minimum of ecological screening levels and TACO metropolitan statistical area background)
Table 7-4(a) Ecological soil screening levels and risk characterization from exposure to metal COPCs in subsurface soil at the former HCAFS for terrestrial receptors.
Table 7-4(b) Ecological soil screening levels and risk characterization for avian receptors from exposure to metal COPECs in surface soil.
Table 7-4(c) Ecological soil screening levels and risk characterization for mammalian receptors from exposure to metals with highest hazard quotients in surface soil
Table 7-5(a) Ecological soil screening levels and risk characterization from exposure to metal COPCs in subsurface soil at the former HCAFS for terrestrial receptors.
Table 7-5(b) Ecological soil screening levels and risk characterization for avian receptors from exposure to metal COPECs in subsurface soil
Table 7-5(c) Ecological soil screening levels and risk characterization for mammalian receptors from exposure to metal COPECs in subsurface soil

Table 2-1. AOPCs and associated data points for surface soil samples.

		Number of Data Points			
		SI/SSI	RI		Total
AOPC	COPCs		Aug-08	Nov-08	
Coal Area Storage A	PAH	1	7	1	9
Coal Area Storage B	PAH	1	7	3	11
Coal Area Storage C	PAH	1	7	2	10
Main Entrance	PAH	2	6	1	9
Vehicle Wash Rack	PAH	3	6	2	11
Maintenance Building	PAH	3	6	1	10
Paint Shed	PAH	3	5	0	8

Table 2-2. AOPCs and associated data points for subsurface soil samples

		Number of Data Points		
AOPC	COPCs	SI/SSI	RI	Total
Coal Area Storage A	arsenic	3	14	17
Coal Area Storage B	arsenic	3	14	17
Coal Area Storage C	arsenic	3	14	17
Vehicle Wash Rack	PAH	2	12	14

Samples for pH analysis were collected at the AOPCs where arsenic is a COPC
Subsurface samples were collected from 2-3 and 4-5 feet bgs at all AOPCs.

Table 2-3. AOPCs and associated data points for groundwater samples

		Number of Data Points		
AOPC	COPCs	SI/SSI	RI	Total
Coal Area Storage A	metals[a]/TSS	3	1	4
Coal Area Storage B	metals[a]/TSS	3	1	4
Coal Area Storage C	metals[a]/TSS	3	1	4
Vehicle Wash Rack	metals[a]/TSS	3	3	6
Paint Shed	lead [a]/TSS	3	4	7

[a] Filtered and unfiltered samples collected

Table 2-4 Analysis of Equipment Blank associated with samples analyzed for PAHs

		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Sample Number	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCEB01020808	Aug-08	0.019	JB	0.046	U	0.046	U	0.046	U	0.016	JB	0.046	U	0.015	JB	0.046	U	0.046	U	0.046	U	0.046	U	0.046	U	0.046	U	0.046	U	0.046	U	0.0074	U	0.046	U

Units - ug/L

NA - No Anaylsis Result

J - Result is an estimated value below the reporting limit.

U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

B - Analyte detected in associated Mehod Blank

Table 2-5 Analysis of equipment blank associated with samples analyzed for metals

Sample Numbers	Sampling Date		Aluminum µg/L	Antimony µg/L	Arsenic µg/L	Barium µg/L	Beryllium µg/L	Cadmium µg/L	Calcium µg/L	Chromium µg/L	Cobalt µg/L	Copper µg/L	Iron µg/L	Lead µg/L	Magnesium µg/L	Manganese µg/L	Mercury µg/L	Nickel µg/L	Potassium µg/L	Selenium µg/L	Silver µg/L	Sodium µg/L	Thallium µg/L	Vanadium µg/L	Zinc µg/L
		Result	NA	NA	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCEB0302	Nov-08	Lab Qualifier			U																				
		Result	NA	NA	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HCEB0202	Nov-08	Lab Qualifier			U																				
		Result	200	**15**	5	40	**5**	**5**	5000	10	15	10	100	3	5000	15	0.2	10	5000	5	10	1240	**10**	50	5.1
HCEB0402	Nov-08	Lab Qualifier	UN	U	U	U	U	U	UE	U	U	U	U	U	U	U	U	U	U	U	U	J	U	U	J
		Result	200	15	5	40	5	5	5000	10	15	10	100	3	5000	15	0.2	10	5000	5	10	1260	10	50	5.1
HCEB0502	Nov-08	Lab Qualifier	UN	U	U	U	U	U	UE	U	U	U	U	U	U	U	U	U	U	U	U	J	U	U	J

NA - Analysis not performed

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

N - Predigested spike recovery not within control limits.

E - Reported value is estimated due to the presence of matrix interfeerence.

Table 3-2. Federally endangered, threatened, proposed, and candidate species of Peoria County, IL

Common Name	Scientific Name	Status	Habitat
Indiana bat	*Myotis sodalis*	Endangered	1. Caves, mines (hibernacula); 2. small stream corridors with well developed riparian woods; upland forests (foraging)
Eastern prairie fringed orchid	*Platanthera leucophaea*	Threatened	Mesic to wet prairies
Prairie bush clover	*Lespedeza leptostachya*	Threatened	Dry to mesic prairies with gravelly soil
Decurrent false aster	*Boltonia decurrens*	Threatened	Disturbed alluvial soils

Source: U.S. Fish and Wildlife Service

Table 3-2. State listed endangered and threatened species of Peoria County, Illinois

Common Name	Scientific Name	State Status	Last Date Observed
Lake Sturgeon	*Acipenser fulvescens*	Endangered	28-Apr-07
Pale False Foxglove	*Agalinis skinneriana*	Threatened	16-Sep-04
Decurrent False Aster	*Boltonia decurrens*	Threatened	9-Sep-06
American Bittern	*Botaurus lentiginosus*	Endangered	Jun-83
Spotted Coral-root Orchid	*Corallorhiza maculata*	Threatened	14-Jun-01
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	28-Mar-07
Least Bittern	*Ixobrychus exilis*	Threatened	19-Jun-04
Loggerhead Shrike	*Lanius ludovicianus*	Threatened	27-Jul-07
King Rail	*Rallus elegans*	Endangered	26-May-88
Arrowwood	*Viburnum molle*	Threatened	29-Oct-04

Source: Illinois Natural Heritage Database, January 2008

Table 4-1 Comparison between PAH analyses of field duplicate soil samples.

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCMBSS05 01 (0-	Aug-08	12		19		13		9.2		250		35		600		450		**320**		350		**450**		140		**260**		**190**		**48**		24		220	
HCMBSS05 03(0-	Aug-08	7.8		11		33		8.2		220		33		680		520		**270**		300		**410**		120		**310**		**180**		**50**		16		190	
1.0')	Aug-08	9.4		4.7	J	25		20		510		64		1200	E	910	E	**560**		730		**890**		310		**530**		**370**		**92**		11		450	
HCMESS04 03 (0-	Aug-08	6.5		2.4	J	23		21		460	M,Y	85	M	1200		910	M,Y	**430**	M	520	M	**660**	M	230	M	**470**	M	**310**	M	**82**	M,Y	8		350	M
HCVWSS09 01 (0-	Nov-08	6	U	6.4	U	6.4	U	7.3	U	11		7.3	U	34		26		17		23	X	16		11		**17**		9.8		6.4	U	6.3	U	6.4	U
HCVWSS09 03 (0-	Nov-08	4.3	U	4.6	U	4.7	U	5.2	U	18		3	J	41		30		15		19		**25**		7.3		**16**		11		4.9	U	4.6	U	11	
HCVWSB06 01 (2-3')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U	6.9	U	6	U	6	U	6.9	U	6	U	6	U	7.2		6	U	6	U	5.9	U	6	U
HCVWSB06 03 (2-3')	Nov-08	2.2	J	4.6	U	4.7	U	5.2	U	5.3	U	5	U	5.2	U	4.9	U	4.8	U	5.1	U	2	J	5	U	4.6	U	4.6	U	4.9	U	4.6	U	4.8	U

Units: ug/kg

NA - No Anaylsis Result

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

X - Indicates a positive bias

Y - Indicates a negative bias

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

Table 4-2 Comparison between arsenic analyses of field duplicate soil samples

Parameters		**Arsenic**
UNITS		mg/Kg
		11.3
Sample Numbers &	**Sampling Date**	
HCCBSB05 01 (2-3')	Nov-08	7.6
HCCBSB05 03 (2-3')		8.4
HCPSSB06 01 (4-5')	Nov-08	**15.7**
HCPSSB06 01 (4-5')	Nov-08	23.1

Table 4-3 Comparison between metals analyses of field duplicate groundwater samples.

Illinois Class I Groundwater Remediation Objective			7.5
Units			µg/L
Sample Numbers	**Sampling Date**		Lead
HCPSGW0501	Nov-08	Result	3
		Lab Qualifier	U
HCPSGW0503	Nov-08	Result	10
		Lab Qualifier	U
HCPSGW0503F	Nov-08	Result	10
		Lab Qualifier	U
HCCCGW0601	Nov-08	Result	3
		Lab Qualifier	U
HCCCGW0603	Apr-06	Result	2.5
		Lab Qualifier	J

J - Result is an estimated value below the reporting limit.
U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

Table 4-4 Preliminary ARARs

Regulation	Type of ARAR	Description	Site Applicability
Archeological Preservation			
Historic Sites Act of 1935 (P.L. 74-292; 49 Stat. 666; 16 U.S.C. 461-467)	Location	Requires the preservation of properties of "national historical or archeological significance."	Remedial Action
National Historic Preservation Act (16 USC 469 36 CFR 65)	Location	Requires that action be taken to preserve artifacts prior to alterations, which would threaten significant scientific, prehistoric, historic or archeological data.	Remedial Action
Archeological Resources Protection Act (P.L. 96-95; 93 Stat. 721; 16 USC 470a)	Location	Details procedures for permits and civil penalties for violations.	Remedial Action
National Environmental Policy Act	Location	Requires evaluation of the effects of major Federal actions on environmental (including cultural) resources.	Remedial Action
Hazardous Waste			
Resource Conservation and Recovery Act 40 CFR 262, 264-268, 270, 279	Action/Location	Outlines standards for the generation, transportation, and disposal of hazardous waste. Outlines groundwater protection, closure and post closure for the management of hazardous waste in surface impoundments, waste piles, land treatment, landfills, tanks, containers, miscellaneous units, and incinerators. Requires treatment of RCRA hazardous wastes prior to being placed in or on the land. Facilities must be designed operated and maintained to avoid washout by 100-year flood.	Remedial Action
Department of Transportation 40 CFR 171-177	Action	Regulates the transportation of hazardous materials.	Remedial Action
Department of Transportation, HM-164	Action	Outlines routing requirements for transport of hazardous materials through states	Remedial Action
Department of Transportation, Tariff # 6000	Action	Details regulations for transportation of hazardous materials and explosives	Remedial Action

Table 4-6 Analysis results for arsenic in subsurface soils

Parameters		Arsenic	pH
UNITS		mg/Kg	Standard Unit
Soil Criteria*		**13**	
Sample Numbers & Depth	**Sampling Date**		
HCCASB 01 01 (2-3')	Nov-08	9.3	7.2
HCCASB01 01 (4-5')	Nov-08	11	
HCCASB02 01 (2-3')	Nov-08	8.8	
HCCASB02 01 (4-5')	Nov-08	9	
HCCASB03 01 (2-3')	Nov-08	12.2	
HCCASB03 01(4-5')	Nov-08	12.9	
HCCASB04 01 (2-3')	Nov-08	11.5	
HCCASB04 01 (2-3') DL	Nov-08	**15.2**	
HCCASB04 01 (4-5')	Nov-08	**14**	
HCCASB05 01 (2-3')	Nov-08	12.1	
HCCASB05 01 (4-5')	Nov-08	11.6	
HCCASB06 01 (2-3')	Nov-08	9.8	
HCCASB06 01 (4-5')	Nov-08	11.8	
HCCASB07 01 (2-3')	Nov-08	8.9	
HCCASB07 01 (4-5')	Nov-08	9.3	
CA SB01 (4-5')	Apr-06	**18**	
CA01 (5-8')	Jul-96	**14.60**	
CA SB02 (4-5')	Apr-06	9.5	
HCCBSB01 01 (2-3')	Nov-08	**13**	6.7
HCCBSB01 02 (2-3') DL	Nov-08	NA	6.9
HCCBSB01 01 (4-5')	Nov-08	8.8	
HCCBSB02 01 (2-3')	Nov-08	7	
HCCBSB02 01 (4-5')	Nov-08	9.1	
HCCBSB03 01 (2-3')	Nov-08	10.8	
HCCBSB03 01 (4-5')	Nov-08	**13.8**	
HCCBSB04 01 (2-3')	Nov-08	9.5	
HCCBSB04 01 (4-5')	Nov-08	9.4	
HCCBSB04 02 (4-5')DL	Nov-08	11.7	
HCCBSB05 01 (2-3')	Nov-08	7.6	
HCCBSB05 01 (4-5')	Nov-08	10.7	
HCCBSB06 01 (2-3')	Nov-08	7	
HCCBSB06 01 (4-5')	Nov-08	10.2	
HCCBSB09 01 (2-3')	Nov-08	7	
HCCBSB09 01 (4-5')	Nov-08	11.1	
CB SB01 (4-5')	Apr-06	6.2	
CB SB02 (4-5')	Apr-06	12	
CB SB04 (4-5')	Apr-06	12	
CA03 (5-8')	Jul-96	3.90	
HCCCSB01 01 (2-3')	Nov-08	10	6.7
HCCCSB01 01 (4-5')	Nov-08	10.4	
HCCCSB02 01 (2-3')	Nov-08	11.4	
HCCCSB02 01 (4-5')	Nov-08	10.7	
HCCCSB06 01 (2-3')	Nov-08	**13.1**	
HCCCSB06 02 (2-3') DL	Nov-08	9.4	
HCCCSB06 01 (4-5')	Nov-08	**14.3**	
HCCCSB07 01 (2-3')	Nov-08	8.8	
HCCCSB07 01 (4-5)	Nov-08	**14.7**	
CC SB01 (4-5')	Apr-06	10	
CC SB02 (4-5')	Apr-06	7.4	
CA07 (5-8')	Apr-06	7.4	
CC SB03 (4-5')	Apr-06	7.8	
HCPSSB03 01 (2-3')	Nov-08	**16.2**	
HCPSSB03 01 (4-5')	Nov-08	**13**	
HCPSSB03 02 (4-5') DL	Nov-08	7.3	
HCPSSB05 01 (2-3')	Nov-08	11.1	
HCPSSB05 01 (4-5')	Nov-08	10.7	
HCPSSB06 01 (2-3')	Nov-08	12.4	
HCPSSB06 01 (4-5')	Nov-08	**15.7**	

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Criteria - from Tired Approach to Corrective Action Objectives (TACO) Appendix A, Table G,Concentrations of Inorganic Chemicals in Background Soils, Counties Within Metropolitan Statistical Areas.

Table 4-7 Analysis results, PAHs in surface soils from Coal Area A

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCASS01 01 (0-1.0')	Aug-08	5.4	J	7.4	U	5.9	J	5	J	94		14		190		150		120	
HCCASS02 01 (0-1.0')	Aug-08	6.9		7.4		26		21		310		61		610		480		**270**	
HCCASS03 01 (0-1.0')	Aug-08	5.2	U	1.7	J	6.6		5.5	J	140		17		350		270		**160**	
HCCASS04 01 (0-1.0')	Aug-08	7.8		7.1	U	3.1	J	2.3	J	63		7.5	J	140		110		53	
HCCASS04 02 (0-1.0')	Aug-08	6.4	J	7.1	U	4.9	J	3.3	J	75		8.9		150		110		64	
HCCASS05 01 (0-1.0')	Aug-08	4.9	J	2.4	J	12		8.5		120		16		230		170		120	
HCCASS06 01 (0-1.0')	Aug-08	5.2	U	5.6	U	5.6	U	6.4	U	12		1.5	J	30		23		14	
HCCASS07 01 (0-1.0')	Aug-08	6.1		5.7	U	2.1	J	1.8	J	20		2.7	J	49		37		29	
HCCASS08 01 (0-1.0')	Nov-08	38		42		130		120		2400	D	790		6300	D	5300	D	**3500**	DX
CA02 (0-0.5')	Jul-96	4100		400		4200		390		3,400		770		5,400		3,300		**1,700**	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-7 Analysis results, PAHs in surface soils from Coal Area A

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCASS01 01 (0-1.0')	Aug-08	120		150		56		**97**		65		**18**		6.3	J	79	
HCCASS02 01 (0-1.0')	Aug-08	270		**390**		180		**240**		**160**		**44**		10		180	
HCCASS03 01 (0-1.0')	Aug-08	190		**250**		86		**150**		86		**22**		5.5	U	100	
HCCASS04 01 (0-1.0')	Aug-08	56		89		28		**55**		42		11		4.9	J	51	
HCCASS04 02 (0-1.0')	Aug-08	68		110		30		**63**		48		13		12		60	
HCCASS05 01 (0-1.0')	Aug-08	120		**160**		53		**100**		70		**18**		4.3	J	84	
HCCASS06 01 (0-1.0')	Aug-08	17		25		7.4		13		12		2.6	J	5.5	U	5.6	U
HCCASS07 01 (0-1.0')	Aug-08	31		41		12		**20**		16		3.7	J	3.6	J	21	
HCCASS08 01 (0-1.0')	Nov-08	3300	D	**2800**	DY	**2000**		**3000**	D	**2300**		**650**		24		2300	
CA02 (0-0.5')	Jul-96	2,200		**1,800**		930		**1,900**		**1,500**		**690**		NA		870	

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-8 Analysis results, PAHs in surface soils from Coal Area B

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCBSS01 01 (0-1.0')	Aug-08	32		28		210		170		1900		440		2800		2100		**1100**	
HCCBSS02 01 (0-1.0')	Aug-08	330	D	860	D	71	UD	740	D	9400	D	870	D	10000	D	7300	D	**3100**	**D**
HCCBSS02 02 (0-1.0')	Aug-08	6.3		3	J	15		11		160		35		400		310		**220**	
HCCBSS03 01 (0-1.0')	Aug-08	710	D	310	UD	3300	D	2400	D	26000	D	6100	D	35000	D	27000	D	**14000**	D
HCCBSS04 01 (0-1.0')	Aug-08	8.7		3.6	J	20		16		250		51		560		450		**250**	
HCCBSS05 01 (0-1.0')	Aug-08	14	D	13	UD	79	D	56	D	650	D	150	D	1100	D	840	D	**420**	D
HCCBSS06 01 (0-1.0')	Aug-08	7.5		7.1		15		12		290		52		860		670		**330**	
HCCBSS07 01 (0-1.0')	Aug-08	28	JD	32	UD	140	D	120	D	1200	D	220	D	1600	D	1200	D	**580**	D
HCCBSS08 01 (0-1.0')	Nov-08	5.7	U	6.1	U	3.4	J	3.1	J	72		7	U	200		140		120	
HCCBSS10 01 (0-1.0')	Nov-08	13		6	U	24		21		250		60		280		220		**170**	
HCCBSS11 01 (0-1.0')	Nov-08	10		5.8	J	70		61		690		160		830	D	780		**680**	
CA04 (0-0.5')	Jul-96	86	U	86	U	2300		120		620		90		870		640		**360**	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-8 Analysis results, PAHs in surface soils from Coal Area B

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCBSS01 01 (0-1.0')	Aug-08	1100		**1300**		520		**1000**		**660**		**190**		74		730	
HCCBSS02 01 (0-1.0')	Aug-08	3500	D	**3800**	D	**1900**	D	**2800**	D	**1900**	D	**530**	D	150	D	2000	D
HCCBSS02 02 (0-1.0')	Aug-08	210		**290**		110		**200**		150		**39**		4.9	J	170	
HCCBSS03 01 (0-1.0')	Aug-08	14000	D	**14000**	D	**7000**	D	**11000**	D	**6600**	D	**2000**	D	660	D	7000	D
HCCBSS04 01 (0-1.0')	Aug-08	240		**390**		130		**250**		**190**		**51**		13		230	
HCCBSS05 01 (0-1.0')	Aug-08	400	D	**620**	D	220	D	**430**	D	**300**	D	**85**	D	10	JD	340	D
HCCBSS06 01 (0-1.0')	Aug-08	340		**560**		180		**370**		**280**		**70**		5.4	J	330	
HCCBSS07 01 (0-1.0')	Aug-08	560	D	**880**	D	260	D	**560**	D	**430**	D	**120**	D	26	JD	490	D
HCCBSS08 01 (0-1.0')	Nov-08	130	X	96	Y	36		**94**		53		8.6		6	U	57	
HCCBSS10 01 (0-1.0')	Nov-08	190	X	130	Y	77		**130**		65		12		25		66	
HCCBSS11 01 (0-1.0')	Nov-08	710	X	**510**	Y	290		**490**		**260**		**80**		8.6		250	
CA04 (0-0.5')	Jul-96	390		**350**		160		**360**		**300**		**180**		NA		120	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-9. PAH SHALLOW SOILS RESULTS HANNA CITY COAL AREA C EU (HCCC,HCMB,HCPS)

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCCSS01 01 (0-1.0')	Aug-08	32	D	28	D	110	D	150	D	2400	D	970	D	4000	DE	3000	D	**1700**	D
HCCCSS02 01 (0-1.0')	Aug-08	14	D	15	D	32	D	25	D	490	D	74	D	1000		780	D	**350**	
HCCCSS03 01 (0-1.0')	Aug-08	4.2	J	1.7	J	6.3		4.7	J	100		12		190		140		92	
HCCCSS04 01 (0-1.0')	Aug-08	4.4	J	5	J	9.8		7.4	J	160		32		480		360		**240**	
HCCCSS05 01 (0-1.0')	Aug-08	510	UD	550	UD	1500		1200	D	21000	D	3500	D	42000	DE	32000	D	**15000**	D
HCCCSS05 02 (0-1.0')	Aug-08	260	UD	370	UD	1700		1300	D	21000	D	5100	D	41000	D	31000	D	**14000**	D
HCCCSS06 01 (0-1.0')	Aug-08	31	D	26	D	45		40		1100	D	120	D	1700	D	1300	D	**550**	D
HCCCSS07 01 (0-1.0')	Aug-08	7.4		6.4	U	20		13		240		37		440		340		**180**	
HCCCSS08 01 (0-1.0')	Nov-08	5.7		5.8	U	43		33		640		140		1200	D	1000	D	**820**	
HCCCSS08 02 (0-1.0')	Nov-08	13		5.7	U	100		100		2400		360		3900	D	3100	D	**1700**	D
HCCCSS09 01 (0-1.0')	Nov-08	130		5.9		700		540		7400	D	340	UD	13000	D	11000	D	**6000**	DX
CA05 (0-0.5')	Jul-96	**10,000**		1,200		6,900		5,600		5,400		1,100		7,800		5,400		**2,700**	
HCMBSS01 01 (0-1.0')	Aug-08	64	D	40	D	120	D	110	D	2600	D	380	D	5700	D	4200	D	**2900**	D
HCMBSS02 01 (0-1.0')	Aug-08	8.2		22		12		9.9		240		33		710		560		**280**	
HCMBSS03 01 (0-1.0')	Aug-08	5.5		6.2		11		8.7		160		24		370		280		**180**	
HCMBSS04 01 (0-1.0')	Aug-08	5	J	9		8.9		6.7	J	140		22		400		310		**160**	
HCMBSS05 01 (0-1.0')	Aug-08	12		19		13		9.2		250		35		600		450		**320**	
HCMBSS06 01 (0-1.0')	Aug-08	560	UD	610	UD	1100	D	1300	D	27000	D	4900	D	52000	D	39000	D	**18000**	D
HCMBSS07 01 (0-1.0')	Nov-08	78		6.4	U	120		58		1500		210		1800	D	1500	D	**1200**	
MB SS01 (0-0.5')	Apr-06	38	Ja JD	180		26	Ja	29	Ja	500		110		960		750		**530**	
MB SS02 (0-0.5')	Apr-06	16	Ja	40	U	8.3	Ja	11	Ja	250		30	Ja	610		420		**190**	
MB SS03 (0-0.5')	Apr-06	130		120		48		37	Ja	920		130		1200		1100		**600**	
MB01 (0-0.5')	Jul-96	2100		92	U	1500		110		1200		160		1800		1300		**730**	
HCPSSS01 01 (0-1.0')	Aug-08	7.8		2.4	J	7.6		6.6	J	6.6	J	20		240		180		120	
HCPSSS02 01 (0-1.0')	Aug-08	6.1		2.6	J	8.2		4.8	J	100		13		200		150		110	
HCPSSS03 01 (0-1.0')	Aug-08	19		6.5	U	28		20		350		57		660		520		**290**	
HCPSSS04 01 (0-1.0')	Aug-08	15		5.9	U	50		32		350		57		680		550		**240**	
HCPSSS05 01 (0-1.0')	Aug-08	21	D	12	UD	87		51	D	600	D	110	D	990	D	790	D	**400**	D
PS SS01(0-0.5')	Apr-06	32	Ja JD	44		24	Ja JD	28	Ja JD	550	JD	70	JD	890	JD	710	JD	**420**	JD
PS SS02 (0-0.5')	Apr-06	54		41	U	11	Ja	11	Ja	240		27	Ja	350		270		140	
PS SS03 (0-0.5')	Apr-06	540		53		2400		1700		15000		2400		16000		14000		**8000**	
PS01 (0-0.5')	Jul-96	320		94	U	550		23	U	110		16		480		440		**260**	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

H - Alternate peak selection upon analytical review.

Table 4-9. PAH SHALLOW SOILS RESULTS HANNA CITY COAL AREA C EU (HCCC,HCMB,HCPS)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCCCSS01 01 (0-1.0')	Aug-08	1700	D	**2000**	D	760	D	**1300**	D	**720**	D	**200**	D	98		840	D
HCCCSS02 01 (0-1.0')	Aug-08	430	D	**620**	D	220	D	**390**	D	**260**	D	**70**	D	13	D	320	D
HCCCSS03 01 (0-1.0')	Aug-08	110		140		41		**80**		56		**15**		10		69	
HCCCSS04 01 (0-1.0')	Aug-08	260		**340**		110		**210**		140		**37**		5.9	J	170	
HCCCSS05 01 (0-1.0')	Aug-08	13000	D	**24000**	D	**8500**	D	**16000**	D	**12000**	D	**3300**	D	340	JD	14000	D
HCCCSS05 02 (0-1.0')	Aug-08	**18000**	D	**20000**	D	**11000**	D	**15000**	D	**12000**	D	**3300**	D	320	JD	15000	D
HCCCSS06 01 (0-1.0')	Aug-08	730	D	**960**	D	320	D	**620**	D	**500**	D	**130**	D	140	D	590	D
HCCCSS07 01 (0-1.0')	Aug-08	220		**270**		97		**170**		130		**34**		20		170	
HCCCSS08 01 (0-1.0')	Nov-08	1100	X	**870**	Y	400		**710**		**400**		**70**		6.8		400	
HCCCSS08 02 (0-1.0')	Nov-08	1900	D	**1600**	D	1400		**2300**		**1300**		**360**		13		1300	
HCCCSS09 01 (0-1.0')	Nov-08	4700	D	**4200**	DY	2900	D	**4800**	D	**2000**	D	**970**		180		2600	D
CA05 (0-0.5')	Jul-96	3,800		**3,100**		1,400		**2,700**		**2,300**		**1,400**		NA		1,600	
HCMBSS01 01 (0-1.0')	Aug-08	3400	D	**4000**	D	1400	D	**2400**	D	**1500**	D	**410**	D	41	D	1800	D
HCMBSS02 01 (0-1.0')	Aug-08	310		**480**		180		**330**		**260**		**63**		14		300	
HCMBSS03 01 (0-1.0')	Aug-08	210		**260**		84		**150**		100		**25**		7.9		120	
HCMBSS04 01 (0-1.0')	Aug-08	200		**310**		87		**180**		130		**34**		5.8	J	160	
HCMBSS05 01 (0-1.0')	Aug-08	350		**450**		140		**260**		**190**		**48**		24		220	
HCMBSS06 01 (0-1.0')	Aug-08	**21000**	D	**31000**	D	**9000**	D	**19000**	D	**14000**	D	**3600**	D	740	D	740	D
HCMBSS07 01 (0-1.0')	Nov-08	1500	X	**1000**	Y	420		**820**		**440**		**78**		280		470	
MB SS01 (0-0.5')	Apr-06	640	H	**940**	M	700	M	**850**		**750**		**300**		NA		900	
MB SS02 (0-0.5')	Apr-06	290	H	**360**	H	230	M	**260**		**220**		**87**		NA		270	
MB SS03 (0-0.5')	Apr-06	710	H	**810**	M	690	M	**770**		**720**	H	**310**		NA		880	
MB01 (0-0.5')	Jul-96	830		**800**		360		**800**		**680**		**320**		NA		320	
HCPSSS01 01 (0-1.0')	Aug-08	140		**170**		60		**100**		74		**18**		14		91	
HCPSSS02 01 (0-1.0')	Aug-08	120		**180**		48		**100**		72		**19**		13		90	
HCPSSS03 01 (0-1.0')	Aug-08	290		**440**		160		**290**		**220**		**60**		44		260	
HCPSSS04 01 (0-1.0')	Aug-08	250		**360**		120		**250**		**200**		**50**		42		250	
HCPSSS05 01 (0-1.0')	Aug-08	490	D	**620**	D	210	D	**390**	D	**310**	D	**85**	D	30	D	360	D
PS SS01(0-0.5')	Apr-06	550	JD	**590**	M JD	390	M JD	**500**	JD	**320**	JD	**140**	JD	NA		410	JD
PS SS02 (0-0.5')	Apr-06	210		**220**	M	170	M	**200**		140		**53**		NA		200	
PS SS03 (0-0.5')	Apr-06	8700		**6500**	M	**7000**	M	**7100**		**4000**		**1800**		NA		4300	
PS01 (0-0.5')	Jul-96	280		**330**		160		**440**		**340**		**240**		NA		210	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

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U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

H - Alternate peak selection upon analytical review.

Table 4-10. PAH Shallow Soil Resulrt Hanna City Main Entrance (HCME)

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCMESS01 01 (0-1.0')	Aug-08	6.5	U	7	U	2.1	J	1.8	J	33		4.4	J	99		78		34	
HCMESS02 01 (0-1.0')	Aug-08	53	UD	16	JD	94	D	93	D	2600	D	390	D	6000	D	4500	D	**2400**	**D**
HCMESS03 01 (0-1.0')	Aug-08	3.6	J	2.1	J	6.2		5.6	J	130		15		330		250		140	
HCMESS04 01 (0-1.0')	Aug-08	9.4		4.7	J	25		20		510		64		990	D	760	D	**560**	
HCMESS05 01 (0-1.0')	Aug-08	11	D	5	JD	56	D	34	D	670	D	73	D	1200	D	910		**600**	**D**
HCMESS06 01 (0-1.0')	Aug-08	4.6	J	5	U	6.6		4.6	J	74		8.2		130		100		52	
HCMESS07 01 (0-1.0')	Nov-08	5.7	U	1.7	J	4.6	J	3.9	J	79		7	U	200		150		120	
ME SS01 (0-0.5')	Apr-06	120		21	Ja	850		690		9300		1400		14000		11000		**5800**	
ME03 (0-0.5')	Jul-96	91	U	91	U	970		56		620		69		1400		1100		**510**	
ME02 (15-18')	Jul-96	98	U	98	U	20	U	2.4	U	9.8	U	0.49	U	4.9		9.8	U	2	U

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

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JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-10. PAH Shallow Soil Resulrt Hanna City Main Entrance (HCME)

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCMESS01 01 (0-1.0')	Aug-08	42		70		22		**43**		34		8.8		6.9		43	
HCMESS02 01 (0-1.0')	Aug-08	2900	D	**3900**	D	1200	D	**2300**	D	**1700**	D	**430**	D	56		2000	D
HCMESS03 01 (0-1.0')	Aug-08	180		**230**		80		**140**		86		**22**		3.7		110	
HCMESS04 01 (0-1.0')	Aug-08	730		**890**		310		**530**		**370**		**92**		11		450	
HCMESS05 01 (0-1.0')	Aug-08	700	D	**860**	D	280	D	**500**	D	**330**	D	**94**	D	9.4		390	D
HCMESS06 01 (0-1.0')	Aug-08	70		92		32		**54**		35		9		6.9		44	
HCMESS07 01 (0-1.0')	Nov-08	160	X	120	Y	74		**110**		66		**24**		6	U	67	
ME SS01 (0-0.5')	Apr-06	7400		**8600**	M	**4500**	M	**5900**		**4200**		**1500**		NA		4600	
ME03 (0-0.5')	Jul-96	740		**680**		300		**630**		**560**		**300**		NA		270	
ME02 (15-18')	Jul-96	9.8	U	4.9	U	2.8	U	0.39		2.4	U	4.9	U	NA		4.9	U

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-11(a). PAH Shallow Soil Results Hanna City Vehicle Wash Area (HCVW)

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene		Fluoranthene		Pyrene		Benzo(a)anthracene	
Soil Criteria		**3,900**		**85,000**		**570,000**		**560,000**		**200,000**		**12,000,000**		**2,300,000**		**1,700,000**		**150**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSS01 01 (0-1.0')	Aug-08	5.5	U	5.9	U	2.2	J	2.2	J	39		6.3	J	100		81		43	
HCVWSS02 01 (0-1.0')	Aug-08	4.2	J	3.3	J	5.5	J	5.9	J	160		27		580		460		**220**	
HCVWSS02 02 (0-1.0')	Aug-08	3.8	J	2.9	J	4.8	J	4.6	J	120		20		420		330		**240**	
HCVWSS03 01 (0-1.0')	Aug-08	3	J	2.2	J	5.3	J	4	J	98		8.6		220		170		93	
HCVWSS04 01 (0-1.0')	Aug-08	11	UD	4.5	JD	24	D	19	D	460	D	66	D	1000	D	790	D	**450**	D
HCVWSS05 01 (0-1.0')	Aug-08	6.7	JD	6.5	JD	18	D	16	D	420	D	57	D	910	D	700	D	**420**	D
HCVWSS06 01 (0-1.0')	Aug-08	53	UD	26	JD	160	D	170	D	4600	D	620	D	9000	D	7900	D	**4700**	D
HCVWSS08 01 (0-1.0')	Nov-08	61		120		570		440		8000	D	1900	D	22000	D	19000	D	**8400**	DX
HCVWSS09 01 (0-1.0')	Nov-08	6	U	6.4	U	6.4	U	7.3	U	11		7.3	U	34		26		17	
VW SS01 (0-0.5')	Apr-06	12	Ja	41	U	170		130		2100		260		2500		2300		**950**	
VW SS02 (0-0.5')	Apr-06	42	U	42	U	30	Ja	33	Ja	640		100		1400		1000		**510**	
VW SS03 (0-0.5')	Apr-06	18	Ja	41	U	77		75		1500		230		2300		2100		**900**	
WR01 (0-0.5')	Jul-96	900		94	U	480		22		410		36		1100		850		**300**	

Units: ug/kg

NA - No analysis result reported

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

Bold values indicate exceedance of the Soil Criteria.

J - Result is an estimated value below the reporting limit.

JD - Result is an estimated value due to high RPD.

U - The analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

H - Alternate peak selection upon analytical review.

E - Exceeds the highest concentration level on the standard curve for the comopund

Table 4-11(a). PAH Shallow Soil Results Hanna City Vehicle Wash Area (HCVW) continued

Parameters		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15,000**		**150**		**1,500**		**15**		**150**		**15**		**310,000**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSS01 01 (0-1.0')	Aug-08	46		74		21		**41**		37		11		5.8	U	46	
HCVWSS02 01 (0-1.0')	Aug-08	320		**550**		160		**320**		**290**		**70**		2.6	J	360	
HCVWSS02 02 (0-1.0')	Aug-08	340		**470**		140		**260**		**210**		**50**		2.2	J	260	
HCVWSS03 01 (0-1.0')	Aug-08	140		**180**		58		**100**		81		**19**		3.6	J	100	
HCVWSS04 01 (0-1.0')	Aug-08	530	D	**660**	D	200	D	**380**	D	**260**	D	**68**	D	6.3	JD	340	D
HCVWSS05 01 (0-1.0')	Aug-08	530	D	**620**	D	200	D	**350**	D	**230**	D	**60**	D	13	D	290	D
HCVWSS06 01 (0-1.0')	Aug-08	5900	D	**7500**	D	**2300**	D	**4200**	D	**2800**	D	**710**	D	56	UD	3400	D
HCVWSS08 01 (0-1.0')	Nov-08	8000	D	**8800**	DY	**4400**	D	**7900**	D	**4200**	D	**2300**		40		4800	D
HCVWSS09 01 (0-1.0')	Nov-08	23	X	16		11		**17**		9.8		6.4	U	6.3	U	6.4	U
VW SS01 (0-0.5')	Apr-06	1200		**1300**		870	M	**1100**		**770**		**290**		NA		910	
VW SS02 (0-0.5')	Apr-06	640		**720**		470	M	**600**		**430**		**160**		NA		520	
VW SS03 (0-0.5')	Apr-06	1100		**1100**		790	M	**1000**		**680**		**220**		NA		820	
WR01 (0-0.5')	Jul-96	450		**480**		200		**430**		**430**		**300**		NA		240	

Units: ug/kg

NA - No analysis result reported

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a - Concentration is below the method reporting limit.

D - Values obtained from a dulution run.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

H - Alternate peak selection upon analytical review.

E - Exceeds the highest concentration level on the standard curve for the comopund

4-11(b) PAH results subsurface soil

Parameters		Naphthalene		Acenaphthylene		Acenaphthene		Fluorene		Phenanthrene		Anthracene	
Soil Criteria		3,900		85,000		570,000		560,000		200,000		12,000,000	
Sample Numbers & Depth	Sampling Date	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	5.7	U	6.2	U	6.2	U	7.1	U	7.1	U	7.1	U
HCVWSB01 01 (4-5')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB02 01 (2-3')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB02 01 (4-5')	Nov-08	5.6	U	6.1	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB02 02 (4-5')	Nov-08	5.7	U	6.1	U	6.1	U	7	U	7	U	7	U
HCVWSB04 01 (2-3')	Nov-08	5.8	U	6.2	U	6.2	U	7.1	U	7.1	U	7.1	U
HCVWSB04 01 (4-5')	Nov-08	5.7	U	6.2	U	6.2	U	7	U	5.6	J	7	U
HCVWSB05 01 (2-3')	Nov-08	5.6	U	6.1	U	6.1	U	6.9	U	6.9	U	6.9	U
HCVWSB05 01 (4-5')	Nov-08	5.6	U	6	U	6	U	6.9	U	20		4.1	J
HCVWSB06 01 (2-3')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB06 01 (4-5')	Nov-08	5.6	U	6.1	U	6.1	U	6.9	U	6.9	U	6.9	U
HCVWSB07 01 (2-3')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
HCVWSB07 01 (4-5')	Nov-08	5.6	U	6	U	6	U	6.9	U	6.9	U	6.9	U
VW SB01 (4-5')	Apr-06	11	Ja	43	U	30	Ja	29	Ja	660		130	
VW SB04 (4-5')	Apr-06	43	U	43	U	30	Ja	31	Ja	480		94	
VW SB02 (4-5')	Apr-06	42	U	42	U	42	U	42	U	85	U	42	U
WR01 (15-18')	Jul-96	14		24		19		10		10	U	0.52	U

NA - No Anaylsis Result

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M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 4-11(b) PAH results subsurface soil continued

Parameters		Fluoranthene		Pyrene		Benzo(a)anthracene		Chrysene		Benzo(b)fluoranthene		Benzo(k)fluoranthene	
Soil Criteria		**2,300,000**		**1,700,000**		**150**		**15,000**		**150**		**1,500**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	7.1	U	6.2	U	6.2	U	7.1	U	6.2	U	6.2	U
HCVWSB01 01 (4-5')	Nov-08	3.1	J	2.8	J	6.1	U	7	U	6.1	U	6.1	U
HCVWSB02 01 (2-3')	Nov-08	7	U	6.1	U			7	U	6.1	U	6.1	U
HCVWSB02 01 (4-5')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	U	6	U
HCVWSB02 02 (4-5')	Nov-08	7	U	6.1	U	6.1	U	7	U	6.1	U	6.1	U
HCVWSB04 01 (2-3')	Nov-08	7.1	U	6.2	U	6.2	U	7.1	U	6.2	U	6.2	U
HCVWSB04 01 (4-5')	Nov-08	17		13		4.5	J	6.6	J	6.5		2.6	J
HCVWSB05 01 (2-3')	Nov-08	6.9	U	6.1	U	6.1	U	6.9	U	6.1	U	6.1	U
HCVWSB05 01 (4-5')	Nov-08	64		51		18		29		28		11	
HCVWSB06 01 (2-3')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	U	6	U
HCVWSB06 01 (4-5')	Nov-08	6.9	U	6.1	U	6.1	U	6.9	U	6.1	UY	6.1	U
HCVWSB07 01 (2-3')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	UY	6	U
HCVWSB07 01 (4-5')	Nov-08	6.9	U	6	U	6	U	6.9	U	6	UY	6	U
VW SB01 (4-5')	Apr-06	1500		1400		**510**		670		**730**	M	530	M
VW SB04 (4-5')	Apr-06	1100		810		**400**		480		**570**	M	350	M
VW SB02 (4-5')	Apr-06	42	U	85	U	42	U	42	U	42	U	42	U
WR01 (15-18')	Jul-96	5.2	U	10	U	0.21	U	10	U	2.6	U	1	U

NA - No Anaylsis Result

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U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

4-11(b) PAH results subsurface soil continued

Parameters		Benzo(a)pyrene		Indeno(1,2,3-cd)pyrene		Dibenzo(a,h)anthracene		2-Methylnaphthalene		Benzo(g,h,i)perylene	
Soil Criteria		**15**		**150**		**15**		**1,900**		**2,300,000**	
Sample Numbers & Depth	**Sampling Date**	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers	Result	Lab Qualifiers
HCVWSB01 01 (2-3')	Nov-08	4.6	J	6.2	U	6.2	U	6.1	U	9.4	X
HCVWSB01 01 (4-5')	Nov-08	6.9		6.1	U	6.1	U	6.1	U	4.5	J
HCVWSB02 01 (2-3')	Nov-08	6.4		6.1	U	6.1	U	6	U	6.1	U
HCVWSB02 01 (4-5')	Nov-08	5.9	J	6	U	6	U	6	U	6	U
HCVWSB02 02 (4-5')	Nov-08	8.1		6.1	U	6.1	U	6	U	6.1	U
HCVWSB04 01 (2-3')	Nov-08	7.9		6.2	U	6.2	U	6.1	U	6.2	U
HCVWSB04 01 (4-5')	Nov-08	**15**		4.8	J	6.2	U	6.1	U	6.4	X
HCVWSB05 01 (2-3')	Nov-08	9.4		6.1	U	6.1	U	6	U	6.1	U
HCVWSB05 01 (4-5')	Nov-08	**35**		20		3	J	6	U	29	X
HCVWSB06 01 (2-3')	Nov-08	7.2		6	U	6	U	5.9	U	6	U
HCVWSB06 01 (4-5')	Nov-08	13		6.1	U	6.1	U	6	U	6.1	UY
HCVWSB07 01 (2-3')	Nov-08	7.5		6	U	6	U	5.9	U	6	U
HCVWSB07 01 (4-5')	Nov-08	4.9	J	6	U	6	U	6	U	6	U
VW SB01 (4-5')	Apr-06	**640**		**460**		**180**		NA		560	
VW SB04 (4-5')	Apr-06	**480**		**340**		**140**		NA		400	
VW SB02 (4-5')	Apr-06	42	U	42	U	42	U	NA		42	U
WR01 (15-18')	Jul-96	1	U	5.2	U	5.2	U	NA		5.2	U

NA - No Anaylsis Result

Shaded sample identifier cells indicate a field duplicate of the sample immediately preceeding.

J - Result is an estimated value below the reporting limit.

U - the analyte was analyzed for but was not detected or the concentration of the analyte quantitated below the MDL

a - Concentration is below the method reporting limit.

M - Manually integrated compound.

X - Indicates a positive bias

Y - Indicates a negative bias

Table 6-1 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils at Coal Area A.

Analyte	Number of Sampling Locations	Number of Non-detects	% Non-detects	Sample Statistics [a] Minimum (ug/kg)	Maximum Detected Concentration (MDC; ug/kg)	Mean (ug/kg)	Median (ug/kg)	Standard Deviation (ug/kg)	Soil Screening Level (ug/kg) [b]	Is chemical a COPC?	Exposure Point Concentration (ug/kg) [c]	Basis for Exposure Point Concentration
Naphthalene	9	2	22.2%	ND (RL=5.4)	4100	463.7	6.1	1364.0	3900	No		
Acenaphthylene	9	4	44.4%	ND (RL=7.4)	400	51.8	3.6	131.2	85000	No		
Acenaphthene	9	1	11.1%	ND (RL=5.6)	4200	487.7	6.6	1393.0	570000	No		
Fluorene	9	1	11.1%	ND (RL=6.4)	390	62.0	5.5	128.7	560000	No		
Phenanthrene	9	0	0.0%	12	3400	729.4	120.0	1259.0	200000	No		
Anthracene	9	0	0.0%	1.5	790	186.7	16.0	336.9	12000000	No		
Fluoranthene	9	0	0.0%	30	6300	1478.0	230.0	2495.0	2300000	No		
Pyrene	9	0	0.0%	23	5300	1093.0	170.0	1890.0	1700000	No		
Benzo(a)anthracene	9	0	0.0%	14	3500	663.5	120.0	1189.0	150	Yes	2869	ProUCL 4.0;95% Adjusted Gamma UCL
Chrysene	9	0	0.0%	17	3300	701.1	120.0	1196.0	15000	No		
Benzo(b)fluoranthene	9	0	0.0%	25	2800	635.1	160.0	982.7	150	Yes	1804	ProUCL 4.0;95% Approximate Gamma UCL
Benzo(k)fluoranthene	9	0	0.0%	7.4	2000	372.6	56.0	676.6	1500	Yes	1681	ProUCL 4.0;95% Adjusted Gamma UCL
Benzo(a)pyrene	9	0	0.0%	13	3000	619.9	100.0	1076.0	15	Yes	2746	ProUCL 4.0;95% Adjusted Gamma UCL
Indeno(1,2,3-cd)pyrene	9	0	0.0%	12	2300	472.7	70.0	834.7	150	Yes	2300	Maximum detected concentration [d]
Dibenzo(a,h)anthracene	9	0	0.0%	2.6	690	162.3	18.0	288.3	15	Yes	690	Maximum detected concentration [d]
2-Methylnaphthalene	8	2	25.0%	ND (RL=5.5)	24	7.8	5.3	7.1	1900	No		
Benzo(g,h,i)perylene	9	1	11.1%	ND (RL=5.6)	2300	410.3	84.0	757.6	2300000	No		

ND: Not detected; RL: Reporting Limit; COPC: Chemical of Potential Concern; MDC: Maximum Detected Concentration; UCL: Upper Concentration Limit

(a) Mean, median and standard deviation were calculated from data sets where non-detects were substituted by 0.5x the Reporting Limit.

Note that 95% UCLs were calculated using ProUCL methods for full datasets because at Coal Area A, none of the COPC datasets had nondetect values.

(b) Soil screening levels for each analyte were set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the residential and industrial Regional Screening Levels (RSL, EPA 2008)

(c) EPCs only calculated for chemicals for which concentrations exceeded the screening criterion.

(d) UCL recommended by ProUCL 4.0 exceeded the MDC.

Table 6-2 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils at Coal Area B.

				Sample Statistics [a]								
Analyte	**Number of Observations**	**Number of Non-detects**	**% Non-detects**	**Minimum (ug/kg)**	**Maximum (ug/kg)**	**Mean (ug/kg)**	**Median (ug/kg)**	**Standard Deviation (ug/kg)**	**Soil Screening Level (ug/kg) [b]**	**Is chemical a COPC?**	**Exposure Point Concentration (ug/kg) [c]**	**Basis for Exposure Point Concentration**
Naphthalene	11	2	18.2%	2.85	710	94.3	14.0	209.5	3900	No		
Acenaphthylene	11	6	54.6%	3	431.5	63.9	7.1	129.8	85000	No		
Acenaphthene	11	0	0.0%	3.4	3300	561.5	70.0	1131.0	570000	No		
Fluorene	11	0	0.0%	3.1	2400	305.0	61.0	703.1	560000	No		
Phenanthrene	11	0	0.0%	72	26000	3337.0	650.0	7635.0	200000	No		
Anthracene	11	1	9.1%	3.5	6100	707.2	150.0	1795.0	12000000	No		
Fluoranthene	11	0	0.0%	200	35000	4482.0	870.0	10224.0	2300000	No		
Pyrene	11	0	0.0%	140	27000	3440.0	780.0	7884.0	1700000	No		
Benzo(a)anthracene	11	0	0.0%	120	14000	1788.0	420.0	4076.0	150	Yes	3429	ProUCL 4.0;95% Chebyshev UCL
Chrysene	11	0	0.0%	130	14000	1810.0	400.0	4074.0	15000	No		
Benzo(b)fluoranthene	11	0	0.0%	96	14000	1898.0	560.0	4053.0	150	Yes	4636	ProUCL 4.0;95% Approximate Gamma UCL
Benzo(k)fluoranthene	11	0	0.0%	36	7000	898.0	220.0	2042.0	1500	Yes	1853	ProUCL 4.0;95% Chebyshev UCL
Benzo(a)pyrene	11	0	0.0%	94	11000	1471.0	430.0	3186.0	15	Yes	2993	ProUCL 4.0;95% Chebyshev UCL
Indeno(1,2,3-cd)pyrene	11	0	0.0%	53	6600	923.9	300.0	1903.0	150	Yes	2188	ProUCL 4.0;95% Approximate Gamma UCL
Dibenzo(a,h)anthracene	11	0	0.0%	8.6	2000	280.1	85.0	576.4	15	Yes	689	ProUCL 4.0;95% Approximate Gamma UCL
2-Methylnaphthalene	10	1	10.0%	3	660	90.3	19.0	202.0	1900	No		
Benzo(g,h,i)perylene	11	0	0.0%	57	7000	972.5	330.0	2023.0	2300000	No		

ND: Not detected; RL: Reporting Limit; COPC: Chemical of Potential Concern; MDC: Maximum Detected Concentration; UCL: Upper Concentration Limit

(a) Mean, median and standard deviation were calculated from data sets where non-detects were substituted by 0.5x the Reporting Limit.

Note that 95% UCLs were calculated using ProUCL methods for full datasets because at Coal Area B, none of the COPC datasets had nondetect values.

(b) Soil screening levels for each analyte were set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the residential and industrial Regional Screening Levels (RSL, EPA 2008)

(c) EPCs only calculated for chemicals for which concentrations exceeded the screening criterion.

Table 6-3 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils (0-0.5 ft) at Coal Area C

Analyte	Number of Observations	Number of Non-detects	% Non-detects	Sample Statistics [a] Minimum (ug/kg)	Maximum (ug/kg)	Mean (ug/kg)	Median (ug/kg)	Standard Deviation (ug/kg)	Soil Screening Level (ug/kg) [b]	Is chemical a COPC?	Exposure Point Concentration (ug/kg) [d]	Basis for Exposure Point Concentration
Naphthalene	28	2	7.1%	4.2	10000	490.9	20.0	1905.0	3900	No [c]		
Acenaphthylene	28	12	42.9%	1.7	1200	79.5	17.0	229.7	85000	No		
Acenaphthene	28	0	0.0%	6.3	6900	515.9	41.0	1343.0	570000	No		
Fluorene	28	1	3.6%	4.7	5600	371.6	28.5	1088.0	560000	No		
Phenanthrene	28	0	0.0%	6.6	27000	3014.0	420.0	6454.0	200000	No		
Anthracene	28	1	3.6%	12	4900	514.8	65.5	1191.0	12000000	No		
Fluoranthene	28	0	0.0%	190	52000	5391.0	850.0	12297.0	2300000	No		
Pyrene	28	0	0.0%	140	39000	4139.0	670.0	9293.0	1700000	No		
Benzo(a)anthracene	28	0	0.0%	92	18000	2096.0	335.0	4361.0	150	Yes	10296	ProUCL 4.0;99% Chebyshev
Chrysene	28	0	0.0%	110	21000	2344.0	390.0	4929.0	15000	Yes	11612	ProUCL 4.0;99% Chebyshev
Benzo(b)fluoranthene	28	0	0.0%	140	31000	2914.0	550.0	7031.0	150	Yes	16134	ProUCL 4.0;99% Chebyshev
Benzo(k)fluoranthene	28	0	0.0%	41	9600	1199.0	215.0	2446.0	1500	Yes	5798	ProUCL 4.0;99% Chebyshev
Benzo(a)pyrene	28	0	0.0%	80	19000	2084.0	390.0	4527.0	15	Yes	10596	ProUCL 4.0;99% Chebyshev
Indeno(1,2,3-cd)pyrene	28	0	0.0%	56	14000	1455.0	285.0	3335.0	150	Yes	7725	ProUCL 4.0;99% Chebyshev
Dibenzo(a,h)anthracene	28	0	0.0%	15	3600	458.4	81.5	910.4	15	Yes	993	ProUCL 4.0;95% Chebyshev
2-Methylnaphthalene	28	0	0.0%	0	740	74.3	13.5	156.5	1900	No		
Benzo(g,h,i)perylene	28	0	0.0%	69	14333	1095.0	310.0	2682.0	2300000	No		

ND: Not detected; RL: Reporting Limit; COPC: Chemical of Potential Concern; MDC: Maximum Detected Concentration; UCL: Upper Concentration Limit

(a) Summary statistics were calculated from data sets where non-detects were substituted by 0.5x the reporting limit.

Note that 95% UCLs were calculated using ProUCL methods for full datasets because at Coal Area C, none of the COPC datasets had nondetect values.

(b) Soil screening levels for each analyte were set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the residential and industrial Regional Screening Levels (RSL, EPA

(c) There was only one exceedance and it was an outlier at 1% significance level. The next highest concentration was 2100 ug/kg which is below the screening level of 3900 ug/kg.

(d) EPCs only calculated for chemicals for which concentrations exceeded the screening criterion.

، 2008)

Table 6-4 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in surface soils (0-0.5 ft) at the Vehicle Wash Rack

Analyte	Number of Observations	Number of Non-detects	% Non-detects	Sample Statistics [a] Minimum (ug/kg)	Maximum (ug/kg)	Mean (ug/kg)	Median (ug/kg)	Standard Deviation (ug/kg)	Soil Screening Level (ug/kg) [b]	Is chemical a COPC?	Exposure Point Concentration (ug/kg) [c]	Basis for Exposure Point Concentration
Naphthalene	11	5	45.5%	2.75	900	95.3	6.7	267.4	3900	No		
Acenaphthylene	11	5	45.5%	2.2	120	23.4	6.5	35.0	85000	No		
Acenaphthene	11	1	9.1%	2.2	570	129.2	24.0	203.6	570000	No		
Fluorene	11	1	9.1%	2.2	440	74.3	19.0	132.1	560000	No		
Phenanthrene	11	0	0.0%	11	8000	1511.0	420.0	2536.0	200000	No		
Anthracene	11	1	9.1%	3.65	1900	278.7	57.0	567.4	12000000	No		
Fluoranthene	11	0	0.0%	34	22000	3606.0	1000.0	6723.0	2300000	No		
Pyrene	11	0	0.0%	26	19000	3010.0	790.0	5759.0	1700000	No		
Benzo(a)anthracene	11	0	0.0%	17	8400	1463.0	420.0	2660.0	150	No	4811	ProUCL 4.0;95% Adjusted Gamma UCL
Chrysene	11	0	0.0%	23	8000	1613.0	530.0	2699.0	15000	No		
Benzo(b)fluoranthene	11	0	0.0%	16	8800	1887.0	620.0	3128.0	150	No	4945	ProUCL 4.0; 95% Approximate Gamma UCL
Benzo(k)fluoranthene	11	0	0.0%	11	4400	803.6	200.0	1364.0	1500	No	2543	ProUCL 4.0;95% Adjusted Gamma UCL
Benzo(a)pyrene	11	0	0.0%	17	7900	1396.0	380.0	2462.0	15	No	4441	ProUCL 4.0; 95% Adjusted Gamma UCL
Indeno(1,2,3-cd)pyrene	11	0	0.0%	9.8	4200	859.3	260.0	1358.0	150	No	2163	ProUCL 4.0; 95% Approximate Gamma UCL
Dibenzo(a,h)anthracene	11	1	9.1%	3.2	2300	358.7	68.0	676.1	15	No	1252	ProUCL 4.0;95% KM (Chebyshev) UCL
2-Methylnaphthalene	11	3	37.5%	0	40	9.0	3.2	13.2	1900	No		
Benzo(g,h,i)perylene	11	1	9.1%	3.2	4800	992.2	310.0	1586.0	2300000	No		

ND: Not detected; RL: Reporting Limit; COPC: Chemical of Potential Concern; MDC: Maximum Detected Concentration; UCL: Upper Concentration Limit

(a) Summary statistics were calculated from data sets where non-detects were substituted by 0.5x the reporting limit.

Note that 95% UCLs were calculated using ProUCL methods for datasets with non-detects if there are non-detects in the dataset.

(b) Soil screening levels for each analyte were set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the residential and industrial Regional Screening Levels (RSL, EPA 2008)

(c) EPCs only calculated for chemicals for which concentrations exceeded the screening criterion.

Table 6-6 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for polynuclear aromatic hydrocarbons (PAHs) in subsurface soils (>0.5 ft) at the Vehicle Wash Rack

				Sample Statistics [a]								
Analyte	**Number of Observations**	**Number of Non-detects**	**% Non-detects**	**Minimum (ug/kg)**	**Maximum (ug/kg)**	**Mean (ug/kg)**	**Median (ug/kg)**	**Standard Deviation (ug/kg)**	**Soil Screening Level (ug/kg) [b]**	**Is chemical a COPC?**	**Exposure Point Concentration (ug/kg) [c]**	**Basis**
Naphthalene	14	13	92.9%	2.8	21	4.7	2.8	5.2	3900	No		
Acenaphthylene	14	14	100.0%	3	21.5	5.6	3.1	6.6	85000	No		
Acenaphthene	14	13	92.9%	3	30	6.3	3.1	8.3	570000	No		
Fluorene	14	13	92.9%	3.45	30	6.6	3.5	8.2	560000	No		
Phenanthrene	14	11	78.6%	3.45	570	48.1	3.5	150.6	200000	No		
Anthracene	14	12	85.7%	3.45	112	12.5	3.5	29.0	12000000	No		
Fluoranthene	14	10	71.4%	3.1	1300	102.6	3.5	345.0	2300000	No		
Pyrene	14	10	71.4%	2.8	1105	88.7	3.1	292.9	1700000	No		
Benzo(a)anthracene	14	10	71.4%	3	455	37.8	3.1	120.2	150	Yes	3.1	Median concentration [d]
Chrysene	14	11	78.6%	3.45	575	47.6	3.5	152.0	15000	No		
Benzo(b)fluoranthene	14	11	78.6%	3	650	52.6	3.1	172.1	150	Yes	3.1	Median concentration [d]
Benzo(k)fluoranthene	14	11	78.6%	2.6	440	36.1	3.1	116.4	1500	No		
Benzo(a)pyrene	14	1	7.1%	4.6	560	50.4	7.7	146.9	15	Yes	441.0	Pro UCL 4.0; 99% Chebyshev UCL
Indeno(1,2,3-cd)pyrene	14	11	78.6%	3	400	34.0	3.1	105.5	150	Yes	3.1	Median concentration [d]
Dibenzo(a,h)anthracene	14	12	85.7%	3	160	15.5	3.1	41.9	15	Yes	3.1	Median concentration [d]
2-Methylnaphthalene	12	12	100.0%	2.95	3.05	3.0	3.0	0.0	1900	No		
Benzo(g,h,i)perylene	14	9	64.3%	3	480	41.0	3.1	126.6	2300000	No		

ND: Not detected; RL: COPC: Chemical of Potential Concern; UCL: Upper Concentration Limit

(a) Summary statistics were calculated from data sets where non-detects were substituted by 0.5x the reporting limit.

Note that 95% UCLs for benzo(a)pyrene was calculated using ProUCL methods for datasets with non-detects.

(b) Soil screening levels for each analyte were set to the lowest of the TACO Tier 1 residential, industrial, and construction worker remediation objectives, the residential and industrial Regional Screening Levels (RSL, EPA 2008)

(c) EPCs only calculated for chemicals for which concentrations exceeded the screening criterion.

(d) The median concentration was used as the EPC because of the high percentage of non-detects in the data set.

Table 6-7 Summary statistics, screening against human health criteria, and calculated exposure point concentrations (EPCs) for arsenic in subsurface soils (>0.5 ft) at the Coal Areas

Exposure Unit	Number of Observations	Number of Non-detects	% Non-detects	Sample Statistics					Soil Screening Level (ug/kg) [a]	Is chemical a COPC?	Exposure Point Concentration (ug/kg)	Basis for Exposure Point Concentration
				Minimum (mg/kg)	Maximum (mg/kg)	Mean (mg/kg)	Median (mg/kg)	Standard Deviation (ug/kg)				
Coal Area A	17	0	0.0%	8.8	18	11.5	11.6	2.5	13	Yes	12.6	Use 95% Student's-t UCL
Coal Area B	17	0	0.0%	3.9	13.8	9.5	9.5	2.5	13	Yes	10.53	Use 95% Student's-t UCL
Coal Area C; Paint Shed [b]	17	0	0.0%	7.4	16.2	10.9	10.7	2.5	13	Yes	11.91	Use 95% Student's-t UCL

COPC: Chemical of Potential Concern; UCL: Upper Concentration Limit

(a) Soil screening levels for arsenic was set to TACO background for metropolitan areas.

(b) Maintenance Building is part of this exposure unit but RI samples were all taken from Coal Area C and the Paint Shed where levels measured during the SI and SSI exceeded the screening criterion.

RL/2 substituted

Table 6-8 Summary statistics, screening against human health criteria, and exposure point concentrations (EPCs) for groundwater at the former HCAFS.

	Screening Levels				Filtered Groundwater Samples [a] 13 sampling locations for Lead, 10 sampling locations for other metals			Unfiltered Groundwater Samples 25 sampling locations for Lead, 18 sampling locations for other metals				
Analyte	**Maximum Contaminant Level (ug/L)**	**Illinois Class I Groundwater Remediation Objectives (ug/L)**	**Nutrient Level [b] (ug/L)**	**Minimum Screening Level (ug/L)**	**Minimum concentration (ug/L)**	**Maximum concentration (ug/L)**	**Is Max or 0.5xRL > Min Screen?**	**Minimum concentration (ug/L)**	**Maximum concentration [c] (ug/L)**	**Is Max or 0.5xRL > Min Screen?**	**Exposure Point Concentration (ug/L) [d]**	**Basis**
Aluminum	None	3500		3500	21.9U	893	No	106	52000	Yes	52000	Max. detected in unfiltered GW
Antimony	6	6		6	ND(2.6U-15U)	ND(2.6U-15U)	No [e]	ND(2.6U-15U)	3.9B	No [e]		
Arsenic	10	50		10	ND(1.4U-5U)	ND	No	2.3B	21	Yes	21	Max. detected in unfiltered GW
Barium	2000	2000		2000	35.1B	158	No	46.6	1250	No		
Beryllium	4	4		4	ND(0.7U-5U)	ND	No	0.29B	2.4B	No		
Cadmium	5	5		5	ND(0.1U-5U)	0.1BW	No	0.28B	2	No		
Calcium	None	None	1200000	1200000	60700	99200	No	5400	210000	No		
Chromium	100	100		100	1.4B	4.2W	No	2.1J	74	No		
Cobalt	None	1000		1000	ND (3.6U-15U)	6.8J	No	1.7B	13.7B	No		
Copper	1300	650		650	ND(2U-10U)	4.6B	No	5.8B	56	No		
Iron	None	5000		5000	4.5U	1570B	No	370	64000	Yes	64000	Max. detected in unfiltered GW
Lead	15	7.5		7.5	ND(1.2U-3U)	4.4	No	2.6B	96.9	Yes	96.9	Max. detected in unfiltered GW
Magnesium	None	*	1200000	1200000	31100	48500	No	27000	120000	No		
Manganese	None	150		150	67	490	Yes	100	1810	Yes	1810	Max. detected in unfiltered GW
Mercury	2	2		2	ND(0.1U-0.2U)	0.11B	No	0.12B	0.2	No		
Nickel	None	100		100	ND(8.7U-10U)	10U	No	2.6B	48	No		
Potassium	None	*	1200000	1200000	ND(690U-5000U)	3730J	No	1200	5900	No		
Selenium	50	50		50	ND(1.8U-5U)	3.3J	No	1.8U	12B	No		
Silver	None	50		50	ND(3.1U-10U)	ND	No	1.1B	5	No		
Sodium	None	*	1200000	1200000	8780	89900	No	6800	90100	No		
Thallium	2	2		2	ND(1.5-10U)	ND	No [e]	ND(1.5U-10U)	ND	No [e]		
Vanadium	None	490		490	ND(2.5U-50U)	3.9	No	6J	140	No		
Zinc	None	5000		5000	7.1J	15.4E	No	8.5J	241	No		

ND: Not detected (range of reporting limits shown in parentheses)

U: Not detected, reporting limit shown; B: Below instrument detection limit, estimated value; J: Estimated value; W: Post-digestion spike outside of 85-115% control limits

(a) Samples were field-filtered through a 0.45 um filter.

(b) For nutrients calcium, magnesium, potassium, and sodium, the TACO Class I groundwater standard for total solids is used (1200 mg/L).

(c) Excludes data from CA08, which likely had a very high suspended solids content.

(d) EPCs shown only for metals for which the maximum detected concentration in unfiltered groundwater samples exceeded screening criteria.

(e) Antimony and thallium were quantified using element-specific methods with lower detection limits during the SSI;
because SSI results were below screening levels, antimony and thallium were not COPCs and were quantified using Method 6010 together with the metal COPCs for the SI.

Table 6-9(a) Summary of recoveries in matrix spike samples for PAH soil analysis, 2006 Supplemental Site Inspection (TtEC 2008)

	MS-179784-17/18			MSD-179784-18			MS-179784-7			MSD-179784-8			MS-180183-6			MSD-180183-7		
Chemical	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**	**Original Sample Conc. (ug/kg)**	**Spike Concentration (ug/kg)**	**Matrix Spike Recovery (%)**
Acenaphthene	0	2102	70	0	2158	75	29.8	2197	67	29.8	2231	68	0.0	2118	69	0.0	2144	68
Acenaphthylene	0	2102	73	0	2158	77	0.0	2197	68	0.0	2231	68	0.0	2118	70	0.0	2144	68
Anthracene	0	2102	74	0	2158	74	125.0	2197	69	125.0	2231	71	0.0	2118	73	0.0	2144	74
Benzo(a)anthracene	0	2102	75	0	2158	76	506.1	2197	67	506.1	2231	72	0.0	2118	78	0.0	2144	82
Benzo(a)pyrene	0	2102	80	0	2158	84	636.5	2197	66	636.5	2231	69	0.0	2118	79	0.0	2144	78
Benzo(b)fluoranthene	0	2102	81	0	2158	84	725.2	2197	66	725.2	2231	62	0.0	2118	79	0.0	2144	80
Benzo(ghi)perylene	0	2102	88	0	2158	93	564.1	2197	71	564.1	2231	76	17.5	2118	74	17.5	2144	75
Benzo(k)fluoranthene	0	2102	74	0	2158	75	525.0	2197	55	525.0	2231	60	0.0	2118	79	0.0	2144	79
Chrysene	0	2102	68	0	2158	71	672.2	2197	53	672.2	2231	57	0.0	2118	75	0.0	2144	77
Dibenzo(a,h)anthracene	0	2102	86	0	2158	90	181.3	2197	79	181.3	2231	86	0.0	2118	73	0.0	2144	75
Fluoranthene	0	2102	74	0	2158	76	1451.9	2197	24	1451.9	2231	17	9.4	2118	79	9.4	2144	89
Fluorene	0	2102	74	0	2158	78	29.1	2197	72	29.1	2231	76	0.0	2118	72	0.0	2144	73
Indeno(1,2,3-cd)pyrene	0	2102	85	0	2158	89	456.5	2197	71	456.5	2231	76	15.7	2118	73	15.7	2144	75
Naphthalene	0	2102	61	0	2158	73	10.6	2197	55	10.6	2231	54	0.0	2118	62	0.0	2144	53
Phenanthrene	0	2102	81	0	2158	84	662.4	2197	63	662.4	2231	65	0.0	2118	83	0.0	2144	85
Pyrene	0	2102	66	0	2158	65	1357.1	2197	21	1357.1	2231	22	0.0	2118	75	0.0	2144	74

"0": Not detected

Table 6-9(b) Summary of recoveries in matrix spike samples for metals soil analysis, 2006 Supplemental Site Inspection (TtEC 2008)

	MD-179119-30				MD-179119-55			
	Original Sample Conc. (mg/kg)				Original Sample Conc. (mg/kg)			
Chemical	Analysis 1	Analysis 2	Spike Conc. (ug/kg)	Recovery (%)	Analysis 1	Analysis 2	Spike Conc. (ug/kg)	Recovery (%)
Aluminum	12340.77	11864.17	255.3	2049	9866.11	10174.85	234.9	1976
Antimony	0.86	1.06	63.82	36	0.72	0.55	58.72	36
Arsenic	10.06	10.67	12.76	79	10.25	6.27	11.74	55
Barium	175.44	157.74	255.3	76	96.24	90.45	234.9	91
Beryllium	0.71	0.74	6.38	83	0.55	0.49	5.87	83
Cadmium	0.08	0.08	6.38	79	0	0	5.87	75
Calcium	4646.61	4209.88	1276	75	19745.66	21340.29	1174	228
Chromium	22.5	21.37	25.53	101	15.82	15.7	23.49	103
Cobalt	11.22	14.39	63.82	76	6.72	5.2	58.72	78
Copper	20.28	19.83	31.91	86	18.72	14.47	29.36	77
Iron	21950.83	21239	127.6	662	18967.08	15721.34	117.4	-1231
Lead	68.85	67.29	12.76	57	11.09	7.39	11.74	51
Magnesium	3422.48	3097.84	1276	118	13240.06	14292.35	1174	208
Manganese	762.24	561	63.82	-414	516.48	413.02	58.72	-44
Nickel	22.77	21.13	63.82	80	19.18	15.61	58.72	75
Potassium	1039.42	970.34	1276	116	1020.98	1064.02	1174	157
Selenium	1.02	0	12.76	79	0	0	11.74	79
Silver	0	0	6.38	86	0	0	5.87	89
Sodium	127.07	131.53	1276	103	129.34	125.27	1174	106
Thallium	0	0	12.76	79	0	0	11.74	74
Vanadium	31.16	31.44	63.82	96	31.36	26.35	58.72	89
Zinc	107.89	104.41	63.82	81	44.88	41.3	58.72	75
	MS-178973-67				MS-179178-22			
Mercury	0.02		0.1	121	0.06		0.11	98

Table 6-9(c) Summary of recoveries in matrix spike samples for metals groundwater analysis, 2006 Supplemental Site Inspection (TtEC 2008)

	MD-179668-26/MD-179775-30 Original Sample Conc. (mg/L)				MD-179668-37 Original Sample Conc. (mg/L)			
Chemical	**Analysis 1**	**Analysis 2**	**Spike Conc. (mg/L)**	**Recovery (%)**	**Analysis 1**	**Analysis 2**	**Spike Conc. (mg/L)**	**Recovery (%)**
Aluminum	51.825	51.38587	2	785	--	--	--	--
Arsenic	0.018	0.01713	0.1	87	--	--	--	--
Barium	0.609	0.59812	2	89	--	--	--	--
Beryllium	0.002	0.00208	0.05	88	--	--	--	--
Cadmium	0.000	0	0.05	77	--	--	--	--
Calcium	203.041	201.22543	10	82	--	--	--	--
Chromium	0.074	0.07561	0.2	89	--	--	--	--
Cobalt	0.015	0.01476	0.5	80	--	--	--	--
Copper	0.056	0.05519	0.25	91	--	--	--	--
Iron	64.095	64.71257	1	210	--	--	--	--
Lead	0.025	0.02518	0.1	85	0.00768	0.00827	0.1	97
Magnesium	119.387	118.29688	10	98	--	--	--	--
Manganese	0.664	0.65296	0.5	85	--	--	--	--
Nickel	0.048	0.04746	0.5	79	--	--	--	--
Potassium	5.717	5.64637	10	124	--	--	--	--
Selenium	0.000	0	0.1	87	--	--	--	--
Silver	0.000	0	0.05	92	--	--	--	--
Sodium	47.319	45.55765	10	78	--	--	--	--
Vanadium	0.142	0.14366	0.5	91	--	--	--	--
Zinc	0.122	0.12199	0.5	77	--	--	--	--
		MD-180258-50						
Antimony	0.000	0	0.05	25	--	--	--	--
		MD-179729-43						
Mercury	0.000	8.00E-05	0.001	110	--	--	--	--
		MD-180257-89						
Thallium	0.000	0	0.05	92	--	--	--	--

0: not-detected; "--" not analyzed

Table 6-10(a) Summary of recoveries in matrix spike samples for PAH soil analysis, 2008 Remedial Investigation (this report)

	HCCASS06010808				HCCBSS11010811				HCPSSS04010808				HCVWSB0445010811			
Chemical	**Orig. Sample Conc. (ug/kg)**	**Spike Conc. (ug/kg)**	**Matrix Spike Recovery (%)**	**Matrix Spike Duplicate Recovery (%)**	**Orig. Sample Conc. (ug/kg)**	**Spike Conc. (ug/kg)**	**Matrix Spike Recovery (%)**	**Matrix Spike Duplicate Recovery (%)**	**Orig. Sample Conc. (ug/kg)**	**Spike Conc. (ug/kg)**	**Matrix Spike Recovery (%)**	**Matrix Spike Duplicate Recovery (%)**	**Orig. Sample Conc. (ug/kg)**	**Spike Conc. (ug/kg)**	**Matrix Spike Recovery (%)**	**Matrix Spike Duplicate Recovery (%)**
2-Methylnaphthalene	5.5 U	80	90	93	8.6	85.69	99	161	42	84.92	101	102	6.1 U	88.18	79	91
Acenaphthene	5.6 U	80	98	102	70	85.69	81	372	50	84.92	75	74	6.2 U	88.18	78	106
Acenaphthylene	5.6 U	80	102	106	5.8 J	85.69	120	169	5.9 U	84.92	111	110	6.2 U	88.18	90	112
Anthracene	1.5 J	80	90	94	160	85.69	22	623	56	84.92	55	58	7 U	88.18	84	109
Benzo(a)anthracene	14	80	113	118	680	85.69	-119	1884	240	84.92	-35	-23	4.5 J	88.18	104	108
Benzo(a)pyrene	13	80	79	82	490	85.69	-130	1274	250	84.92	-83	-86	15	88.18	69	90
Benzo(b)fluoranthene	25	80	93	93	510 Y	85.69	-146	1557	360	84.92	-124	-120	6.5	88.18	51	68
Benzo(g,h,i)perylene	5.6 U	80	98	105	250	85.69	-44	578	250	84.92	-84	-104	6.4 X	88.18	56	109
Benzo(k)fluoranthene	7.4	80	88	93	290	85.69	-33	673	120	84.92	24	14	2.6 J	88.18	58	67
Chrysene	17	80	95	101	710 X	85.69	-133	1892	250	84.92	-44	-28	6.6 J	88.18	78	97
Dibenz(a,h)anthracene	2.6 J	80	79	85	80	85.69	56	335	50	84.92	49	41	6.2 U	88.18	64	92
Fluoranthene	30	80	84	82	1000 E	85.69	-407	2975	680	84.92	-448	-446	17	88.18	66	85
Fluorene	6.4 U	80	89	94	61	85.69	68	344	32	84.92	80	77	7 U	88.18	84	97
Indeno(1,2,3-cd)pyrene	12	80	79	82	260	85.69	-42	604	200	84.92	-57	-71	4.8 J	88.18	55	89
Naphthalene	5.2 U	80	92	93	10	85.69	105	197	15	84.92	95	94	5.7 U	88.18	69	96
Phenanthrene	12	80	88	93	690	85.69	-263	2004	400	84.92	-215	-196	5.6 J	88.18	85	92
Pyrene	23	80	76	75	780	85.69	-258	2199	550	84.92	-360	-365	13	88.18	70	84

Table 6-10(b) Summary of recoveries in matrix spike samples for metals soil analysis, 2008 Remedial Investigation (this report)

Chemical	Original Sample Conc. (mg/kg)	Spike Conc. (mg/kg)	Matrix Spike Recovery (%)	Matrix Spike Duplicate Recovery (%)
HCCASB0423010811	11.5	64	94.8	90.1
HCCASB0623010811	9.8	64	91.1	93.2
HCCBSB0945010811	11.1	64	88.5	96.7

Table 6-10(c) Summary of recoveries in matrix spike samples for metals soil analysis, 2008 Remedial Investigation (this report)

AnalyteName	Original Sample Conc. (ug/L)	Spike Conc. (ug/L)	Matrix Spike Recovery (%)	Matrix Spike Duplicate Recovery (%)
	HCCBGW09010811			
Aluminum	3030 N	2000	118.9	125.8
Antimony	15 U	250	102.1	106.1
Arsenic	5.4	250	109.4	111.8
Barium	170	2000	99	101.4
Beryllium	5 U	50	108.7	110.8
Cadmium	5 U	125	109	110.8
Calcium	61600 E	5000	109.8	131.9
Chromium	4.1 J	200	101.2	103.1
Cobalt	15 U	500	98.2	100.5
Copper	10 U	250	103.2	105.6
Iron	3510	1000	111	119.4
Lead	3 U	250	105.5	107.4
Magnesium	30700	5000	102	114.2
Manganese	146	500	104.1	106.6
Nickel	10 U	500	99.5	101.8
Potassium	5000 U	5000	116.7	118.9
Selenium	5 U	250	107	108
Silver	10 U	250	98.8	100.9
Sodium	75200	5000	111.7	130.7
Thallium	10 U	250	103.3	103.3
Vanadium	6 J	500	99.2	101.3
Zinc	11.1 J	500	102.3	104.4
Mercury	0.2 U	2	104	101.8
	HCPSGW03010811			
Lead	3 U	250	101	99.9

Table 6-11 Parameters for estimating receptor exposure to chemicals in soil at the former HCAFS

Parameter	Units	Correctional Facility Inmate		Correctional Facility Staff		Resident Adult		Resident Child	
		Value	Source/Note	Value	Source/Note	Value	Source/Note	Value	Source/Note
Incidental Ingestion of Soil									
Soil Ingestion Rate (IRs)	kg/day	0.0001	1	0.0001	1	0.0001	1	0.0002	1
Exposure Frequency (EF)	days/year	365	1	250	1	350	1	350	1
Exposure Duration (ED)	years	15	1,a	25	1	30	1,b	6	1
Body Weight (BW)	kg	70	1	70	1	70	1	15	1
Carcinogen Average Time (AT)	days	25550	1	25550	1	25550	1	25550	1
Non-carcinogen Averaging Time (AT)	days	5475	1	9125	1	10950	1	2190	1
Fraction ingested (FI)	unitless	1		1		1		1	
Dermal Contact with Soil									
Conversion factor	kg/mg	1.00E-06		1.00E-06		1.00E-06		1.00E-06	
Adherence Factor (AF)	mg/cm2	0.1	2, c	0.1	2, c	0.07	2	0.2	2
Absorption Fraction (ABS)	unitless	Chemical-specific	2,e	Chemical-specific	2,e	Chemical-specific	2,e	Chemical-specific	2,e
Skin Area (SA)	cm2	5700	2,d	5700	2,d	5700	2	2800	2
Event Frequency (EV)	events/day	1	2	1	2	1	2	1	2
Exposure Frequency (EF)	days/year	365	2	250	2	350	2	350	2
Exposure Duration (ED)	years	15	2	25	2	30	2, b	6	2
Body weight (BW)	kg	70	1	70	1	70	2	15	2
Carcinogen Averaging Time (AT)	days	25550	1	25550	1	25550	1	25550	1
Non-carcinogen Averaging Time (AT)	days	5475	1	9125	1	10950	1	2190	1
Inhalation of Dust									
Particulate Emission factor (PEF)	m3/kg	1.36E+09	3	1.36E+09	3	1.36E+09	3	1.36E+09	3
Exposure Time (ET)	hrs/day	2.40E+01	1, 4	8.00E+00	1, 4	2.40E+01	1, 4	2.40E+01	1, 4
Exposure Frequency (EF)	days/year	365	1	250	1	350	1	350	1
Exposure Duration (ED)	years	15	1	25	1	30	1, f	6	1, g
Carcinogen averaging time (AT)	hrs	613200	1	613200	1	613200	1	613200	1
Non-carcinogen averaging time (AT)	hrs	131400	1	219000	1	262800	1	52560	1

Sources: 1- EPA RAGS, Vol. I, Part A (EPA 1991); 2- EPA RAGS, Vol. I, Part E (EPA 2004); 3- Soil Screening Guidance, User's Guide (EPA 1996); 4- EPA RAGS, Vol. I, Part F (EPA 2009)

a - Exposure duration for an Inmate is based on the mean length of stay for capital offense prisoners published by the IDOC.

b - 30 years assumed to consist of two parts: 6 years using exposure factors for a child, 24 years using exposure factors for an adult (EPA 1991; EPA 2004)

c - Adherence factor for Gardeners, Construction Workers,and Farmers in Exhibit 3-3 in EPA (2004).

d - Recommended value for resident adult is used.

e - 0.13 for PAHs, 0.03 for Arsenic (EPA 2004, Exhibit 3-4)

f - For mutagenic compounds (PAHs), exposures calculated for 0-2 yrs, 2-16 yrs, 16-30 yrs then risks calculated using Age Dependent Adjustment Factors.

g - For mutagenic compounds (PAHs), exposures calculated for 0-2 yrs, 2-6 yrs, then risks calculated using Age Dependent Adjustment Factors.

Table 6-12 Parameters for estimating receptor exposure from chemicals in groundwater at the former HCAFS

Parameter	Units	Resident Adult		Resident Child	
		Value	Source	Value	Source
Ingestion of Groundwater					
Water ingestion rate (IRw)	L/day	2	1	1	1
Exposure Frequency (EF)	days/year	350	1	350	1
Exposure Duration (ED)	years	30	1	6	1
Body weight (BW)	kg	70	1	15	1
Carcinogen Averaging Time (AT)	days	25550	1	25550	1
Non-carcinogen Averaging Time (AT)	days	10950	1	2190	1
Dermal Contact while showering					
Skin Area (SA)	cm2	18000	2	6600	2
Permeability Constant (Kp)	cm/hr	Chemical-specific	2	Chemical-specific	2
Conversion Factor	L/cm3	0.001		0.001	
Exposure Time (ET)	hours/day	0.58	2	1	2
Exposure Frequency (EF)	days/year	350	1	350	1
Exposure duration (ED)	years	30	1	6	1
Body weight (BW)	kg	70	1	15	1
Carcinogen Averaging Time (AT)	days	25550	1	25550	1
Non-carcinogen Averaging Time (AT)	days	10950	1	2190	1

Sources: 1- EPA 1991; 2- EPA 2004

Table 6-13 Toxicity values used in calculating incremental lifetime cancer risks from COPCs at the former HCAFS.

Chemical of Potential Concern	CAS No.	Carcinogen Classification [a]	Oral Slope Factor (mg/kg-day)-1	Source [b]	Inhalation unit risk (mg/m3)-1	Source [b]	Gastro-intestinal Absorption Factor [c] (GAF)	Calculated Dermal Slope Factor (mg/kg-day)-1
Polynuclear Aromatic Hydrocarbons								
Benzo(a)anthracene	56-55-3	B2	7.3E-01	TEF=0.1	1.10E-01	Cal EPA	1.0	7.30E-01
Benzo(a)pyrene	50-32-8	B2	7.3E+00	IRIS	1.10E+00	Cal EPA	1.0	7.30E+00
Benzo(b)fluoranthene	205-99-2	B2	7.3E-01	TEF=0.1	1.10E-01	Cal EPA	1.0	7.30E-01
Benzo(k)fluoranthene	207-08-9	B2	7.3E-02	TEF=0.01	1.10E-01	Cal EPA	1.0	7.30E-02
Chrysene	218-01-9	B2	7.3E-03	TEF=0.001	1.10E-02	Cal EPA	1.0	7.30E-03
Dibenz(a,h)anthracene	53-70-3	B2	7.3E+00	TEF=1	1.20E+00	Cal EPA	1.0	7.30E+00
Indeno(1,2,3-cd)pyrene	193-39-5	B2	7.3E-01	TEF=0.1	1.10E-01	Cal EPA	1.0	7.30E-01
Metals								
Aluminum	7429-90-5	D	NC		NC			NC
Arsenic	7440-38-2	A	1.5E+00	IRIS	4.30E+00	IRIS	1.00	1.50E+00
Iron	7439-89-6	NA	NA		NA			NA
Lead	7439-92-1	B2	8.5E-03	Cal EPA	1.20E-02	Cal EPA	1.00	8.50E-03
Manganese (Water)	7439-96-5	D	NC		NC		0.04	NC
Vanadium	7440-62-2	NA	NA		NA			NA

NA: Not available; NC: Not carcinogenic; TEF: Toxicity Equivalency Factor

[a] A: Human carcinogen; B1or B2 Probable human carcinogen; C: Possible human carcinogen; D: Not classifiable as human carcinogen

[b] Sources: IRIS (http://www.epa.gov/ncea/iris/search_keyword.htm), PPRTV,
Cal EPA (http://www.oehha.ca.gov/risk/chemicalDB//index.asp), ATSDR (http://www.atsdr.cdc.gov/mrls/index.html); HEAST (EPA 1997)

[c] Referred to as the "ABSGI" in EPA 2004a; Exhibit 4-1

Table 6-14 Toxicity values used in calculating hazard quotients to quantify non-carcinogenic risks from COPCs at the former HCAFS.

Chemical of Potential Concern	CAS No.	Oral Reference Dose (RfD,mg/kg-day)	RfD Source [a]	Inhalation Reference Concen-tration (RfC,mg/m3)	RfC source	Gastro-intestinal Absorption Factor [b] (GAF)	Calculated Dermal Reference Dose (mg/kg-day)
Polynuclear Aromatic Hydrocarbons							
Benzo(a)anthracene	56-55-3	NA		NA		1.0	NA
Benzo(a)pyrene	50-32-8	NA		NA		1.0	NA
Benzo(b)fluoranthene	205-99-2	NA		NA		1.0	NA
Chrysene	218-01-9	NA		NA		1.0	NA
Dibenz(a,h)anthracene	53-70-3	NA		NA		1.0	NA
Indeno(1,2,3-cd)pyrene	193-39-5	NA		NA		1.0	NA
Metals							
Aluminum	7429-90-5	1.00E+00	PPRTV	5.00E-03	PPRTV	1.0	1.0E+00
Arsenic	7440-38-2	3.0E-04	IRIS	3.00E-05	Cal EPA	1.00	3.0E-04
Iron	7439-89-6	7.0E-01	PPRTV	NA		1.00	7.0E-01
Lead	7439-92-1	NA				1.00	NA
Manganese (Water)	7439-96-5	2.0E-02	IRIS [c]	5.00E-05	IRIS	0.04	8.0E-04
Vanadium	7440-62-2	5.0E-03	IRIS [d]	NA		0.026	1.3E-04

NA: Not available

[a] Sources: IRIS (http://www.epa.gov/ncea/iris/search_keyword.htm), PPRTV ,Cal EPA

[b] Referred to as the "ABSGI" in EPA 2004, Exhibit 4-1

[c] Assumes one-half of RfD is consumed in the diet and a modifying factor of 3.

[d] Using Oral RfD for vanadium pentoxide converted to vanadium pentoxide converted to vanadium,

Table 6-15 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soil (0-0.5 ft) at Coal Area A Exposure Unit

		Incremental Lifetime Cancer Risk			
Chemical of Potential Concern	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Benzo(a)anthracene	2869	1.1E-06	1.3E-06	1.9E-05	1.7E-05
Benzo(b)fluoranthene	1804	7.0E-07	8.0E-07	1.2E-05	1.0E-05
Benzo(k)fluoranthene	1681	6.5E-08	7.5E-08	1.1E-06	9.8E-07
Benzo(a)pyrene	2746	1.1E-05	1.2E-05	1.9E-04	1.6E-04
Indeno(1,2,3-cd)pyrene	2300	8.9E-07	1.0E-06	1.6E-05	1.3E-05
Dibenz(a,h)anthracene	690	2.7E-06	3.1E-06	4.7E-05	4.0E-05
$ILCR_{total}$ from surface soil		1.6E-05	1.8E-05	2.8E-04	2.4E-04

Shaded values exceed 10^{-6}.

Table 6-16 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0-0.5 ft) at Coal Area B Exposure Unit

		Incremental Lifetime Cancer Risk			
Chemical of Potential Concern	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Benzo(a)anthracene	3429	1.3E-06	1.5E-06	2.3E-05	2.0E-05
Benzo(b)fluoranthene	4636	1.8E-06	2.1E-06	3.1E-05	2.7E-05
Benzo(k)fluoranthene	1853	7.2E-08	8.2E-08	1.3E-06	1.1E-06
Benzo(a)pyrene	2993	1.2E-05	1.3E-05	2.0E-04	1.7E-04
Indeno(1,2,3-cd)pyrene	2188	8.5E-07	9.7E-07	1.5E-05	1.3E-05
Dibenz(a,h)anthracene	689	2.7E-06	3.1E-06	4.7E-05	4.0E-05
$ILCR_{total}$ from surface soil		1.8E-05	2.1E-05	3.2E-04	2.8E-04

Shaded values exceed 10^{-6}.

Table 6-17 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0-0.5 ft) at Coal Area C Exposure Unit (includes Maintenance Building and Paint Shed)

		Incremental Lifetime Cancer Risk			
Chemical of Potential Concern	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Benzo(a)anthracene	10296	4.0E-06	4.6E-06	7.0E-05	6.0E-05
Chrysene	11612	4.5E-08	5.2E-08	7.9E-07	6.8E-07
Benzo(b)fluoranthene	16134	6.3E-06	7.2E-06	1.1E-04	9.4E-05
Benzo(k)fluoranthene	5798	2.3E-07	2.6E-07	3.9E-06	3.4E-06
Benzo(a)pyrene	10596	4.1E-05	4.7E-05	7.2E-04	6.2E-04
Indeno(1,2,3-cd)pyrene	7725	3.0E-06	3.4E-06	5.2E-05	4.5E-05
Dibenz(a,h)anthracene	993.1	3.9E-06	4.4E-06	6.7E-05	5.8E-05
$ILCR_{total}$ from surface soil		5.9E-05	6.7E-05	1.0E-03	8.8E-04

Shaded values exceed 10^{-6}.

Table 6-18 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0-0.5 ft) at the Vehicle Wash Rack Exposure Unit

Chemical of Potential Concern	Exposure Point Concentration (ug/kg)	Incremental Lifetime Cancer Risk			
		Correctional Facility Inmate	Correctional Facility Worker	Resident Adult	Resident Child
Benzo(a)anthracene	4811	1.9E-06	2.1E-06	3.3E-05	2.8E-05
Benzo(b)fluoranthene	4945	1.9E-06	2.2E-06	3.3E-05	2.9E-05
Benzo(k)fluoranthene	2543	9.9E-08	1.1E-07	1.7E-06	1.5E-06
Benzo(a)pyrene	4441	1.7E-05	2.0E-05	3.0E-04	2.6E-04
Indeno(1,2,3-cd)pyrene	2163	8.4E-07	9.6E-07	1.5E-05	1.3E-05
Dibenz(a,h)anthracene	1252	4.9E-06	5.6E-06	8.5E-05	7.3E-05
$ILCR_{total}$ from surface soil		2.7E-05	3.1E-05	4.7E-04	4.0E-04

Shaded values exceed 10^{-6}.

Table 6-19 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in surface soils (0-0.5 ft) at the Main Entrance Exposure Unit

		Incremental Lifetime Cancer Risk			
Chemical of Potential Concern	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Benzo(a)anthracene	3401	1.3E-06	1.5E-06	2.3E-05	2.0E-05
Benzo(b)fluoranthene	5127	2.0E-06	2.3E-06	3.5E-05	3.0E-05
Benzo(k)fluoranthene	3134	1.2E-07	1.4E-07	2.1E-06	1.8E-06
Benzo(a)pyrene	3379	1.3E-05	1.5E-05	2.3E-04	2.0E-04
Indeno(1,2,3-cd)pyrene	2477	9.6E-07	1.1E-06	1.7E-05	1.4E-05
Dibenz(a,h)anthracene	1142	4.4E-06	5.1E-06	7.7E-05	6.6E-05
$ILCR_{total}$ from surface soil		2.2E-05	2.5E-05	3.8E-04	3.3E-04

Shaded values exceed 10^{-6}.

Table 6-20 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in subsurface soils (>0.5 ft) at the Vehicle Wash Rack Exposure Unit

		Incremental Lifetime Cancer Risk			
Chemical of Potential Concern	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Benzo(a)anthracene	3	1.2E-09	1.4E-09	2.1E-08	1.8E-08
Benzo(b)fluoranthene	3	1.2E-09	1.4E-09	2.1E-08	1.8E-08
Benzo(a)pyrene	441	1.7E-06	2.0E-06	3.0E-05	2.6E-05
Indeno(1,2,3-cd)pyrene	3	1.2E-09	1.4E-09	2.1E-08	1.8E-08
Dibenz(a,h)anthracene	3	1.2E-08	1.4E-08	2.1E-07	1.8E-07
$ILCR_{total}$ from surface soil		1.7E-06	2.0E-06	3.0E-05	2.6E-05

Table 6-21 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-PAHs in subsurface soils (>0.5 ft) at the Coal Areas

		Incremental Lifetime Cancer Risk			
Exposure Unit	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Coal Area A	12.6	6.8E-06	7.7E-06	3.2E-05	2.2E-05
Coal Area B	10.53	5.7E-06	6.5E-06	2.7E-05	1.9E-05
Coal Area C (including Paint Shed)	11.91	6.4E-06	7.3E-06	3.1E-05	2.1E-05

Shaded values exceed 10^{-6}.

Table 6-22 Summary of total incremental lifetime cancer risk (ILCR) for site receptors from surface and subsurface soils at the Exposure Units within the former HCAFS

Exposure Unit	Medium	COPCs	Correctional Facility Inmate	Correctional Facility Worker	Resident Adult	Resident Child
Coal Area A	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.6E-05	1.8E-05	2.8E-04	2.4E-04
	Subsurface Soil	Arsenic	6.8E-06	7.7E-06	3.2E-05	2.2E-05
	Total		**2.3E-05**	**2.6E-05**	**3.1E-04**	**2.6E-04**
Coal Area B	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.8E-05	2.1E-05	3.2E-04	2.8E-04
	Subsurface Soil	Arsenic	5.7E-06	6.5E-06	2.7E-05	1.9E-05
	Total		**2.4E-05**	**2.7E-05**	**3.5E-04**	**2.9E-04**
Coal Area C (including Paint Shed and Maintenance Building)	Surface Soil	Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	5.9E-05	6.7E-05	1.0E-03	8.8E-04
	Subsurface Soil	Arsenic	6.4E-06	7.3E-06	3.1E-05	2.1E-05
	Total		**6.5E-05**	**7.4E-05**	**1.1E-03**	**9.0E-04**
Vehicle Wash Rack	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	2.69E-05	3.1E-05	4.7E-04	4.0E-04
	Subsurface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	1.73E-06	2.0E-06	3.0E-05	2.6E-05
	Total		**2.86E-05**	**3.3E-05**	**5.0E-04**	**4.3E-04**
Main Entrance	Surface Soil	Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene	2.20E-05	2.5E-05	3.8E-04	3.3E-04
	Subsurface Soil	None	--	--	--	--
	Total		**2.20E-05**	**2.5E-05**	**3.8E-04**	**3.3E-04**

Exceeds 10^{-4}

Table 6-23 Summary of chemical-specific and total incremental lifetime cancer risk (ILCR) for site receptors from exposure to COPC-Metals in unfiltered groundwater at the former HCAFS

Chemical of Potential Concern		Exposure Point Concentration (mg/L)	Chemical-specific Incremental Lifetime Cancer Risk (ILCR)	
			Resident Adult	Resident Child
Metals				
Aluminum	7429-90-5	52	NC	NC
Arsenic	7440-38-2	0.021	3.7E-04	1.7E-04
Iron	7439-89-6	64	NA	NA
Lead	7439-92-1	0.0969	9.7E-06	4.5E-06
Manganese	7439-96-5	1.81	NC	NC
Vanadium	7440-62-2	0.14	NA	NA
ILCRtotal from groundwater			**3.8E-04**	**1.8E-04**

NC: Not carcinogenic; NA: Not available due to unavailability of carcinogenic assessment and/or toxicity values.

Values in shaded cells are outside the target risk range of 10^{-4} and 10^{-6}.

Table 6-24 Summary of hazard indices for site receptors from exposure to COPC-Metals in subsurface soil at the Coal Areas

		Hazard Index			
Exposure Unit	**Exposure Point Concentration (ug/kg)**	**Correctional Facility Inmate**	**Correctional Facility Worker**	**Resident Adult**	**Resident Child**
Coal Area A	12.6	7.1E-02	4.8E-02	1.7E-01	5.8E-01
Coal Area B	10.53	5.9E-02	4.0E-02	1.4E-01	4.9E-01
Coal Area C (including Paint Shed)	11.91	6.7E-02	4.6E-02	1.6E-01	5.5E-01

Table 6-25 Summary of hazard indices for site receptors from exposure to COPC-Metals in unfiltered groundwater at the former HCAFS

Chemical of Potential Concern		Exposure Point Concentration (mg/L)	Chemical-specific Hazard Index	
			Resident Adult	Resident Child
Metals				
Aluminum	7429-90-5	52	1.4E+00	3.3E+00
Arsenic	7440-38-2	0.021	1.9E+00	4.5E+00
Iron	7439-89-6	64	2.5E+00	5.9E+00
Lead	7439-92-1	0.0969	NA	NA
Manganese	7439-96-5	1.81	3.0E+00	6.3E+00
Vanadium	7440-62-2	0.14	1.0E+00	2.1E+00
Total Hazard Index from Groundwater			**1.0E+01**	**2.2E+01**

Values in shaded cells are greater than the target hazard index of 1.

NA: Not available due to unavailability of toxicity values.

Table 6.26 Summary of hazard indices for site receptors from exposure to COPC-Metals in filtered (<0.45 um) groundwater at the former HCAFS

Chemical of Potential Concern		Exposure Point Concentration (mg/L)	Chemical-specific Hazard Quotient	
			Resident Adult	Resident Child
Metals				
Manganese	7439-96-5	0.49	8.2E-01	1.7E+00
Total Hazard Index from Groundwater			**8.2E-01**	**1.7E+00**

Values in shaded cells are greater than the target hazard index of 1.

Table 7-1(a). Volatile organic compouds detected in soil at the former HCAFS compared against ecological screening values.

Sample Numbers & Depth	Sampling Date	Carbon disulfide (ug/kg)	Acetone (ug/kg)	cis-1,2-Dichloroethene (ug/kg)	2-Butanone (MEK) (ug/kg)	Trichloroethene (ug/kg)	Toluene (ug/kg)	Xylene (total) (ug/kg)	Ethylbenzene (ug/kg)
	Ecological Screening Level	94.1	2500	784 [a]	89600	12400	5450	10000	5160
	Source	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5	EPA Reg. 5
TF SS01 (0-0.5')	04/20/06	<13	200*	<6.4	11 J	<6.4	<6.4	<6.4	<6.4
TF SS02 (0-0.5')	04/20/06	<15	130*	<7.4	<30	<7.4	<7.4	<5	<5
TF-01 (0-0.5')	7/8-15/96	<6	<6	<6	<6	<6	<6	<6	<6
CA SS01 (0-0.5')	04/18/06	<11*	120	<5.7	7.5 J	<5.7	<5.7	<5	<5
CA SS02 (0-0.5')	04/18/06	<12*	110	<5.8	<23	<5.8	<5.8	<5	<5
CB SS01 (0-0.5')	04/20/06	<14	82*	<7.0	<28	<7.0	<7.0	<5	<5
CB SS03 (0-0.5')	04/20/06	<15	200*	<7.7	11 J	<7.7	<7.7	<5	<5
CB SS02 (0-0.5')	04/20/06	<12	180*	<5.9	9.0 J	<5.9	<5.9	<5	<5
CC SB01 (0-0.5')	04/19/06	<10*	15 J	<5.1	<20	<5.1	<5.1	<5	<5
CC SS02 (0-0.5')	04/19/06	<11	55*	<5.7	<23	<5.7	<5.7	<5	<5
CC SB03 (0-0.5')	04/19/06	<11*	15 J	<5.5	<22	<5.5	<5.5	<5	<5
ME SS01 (0-0.5')	04/20/06	11 J	69*	<5.8	<23	<5.8	6.0	<5	<5
MB SS03 (0-0.5')	04/19/06	7.6 J	350*	8.1	<23	19	<5.8	<5	<5
ME03 (0-0.5')	7/8-15/96	<6	<6	<6	<6	<6	21	3J	1J
VW SS01 (0-0.5')	04/18/06	<15*		<7.5		<7.5	<7.5	<5	<5
VW SS03 (0-0.5')	04/18/06	<10*	160	<5.2	9.6 J	<5.2	<5.2	<5	<5
VW SS02 (0-0.5')	04/18/06	<15*	170	<7.3	<29	<7.3	<7.3	<5	<5
WR 01- WR 03	7/8-15/96	<6	<6	<6	<6	<6	<6	1J	<6
MB SS01 (0-0.5')	04/19/06	<12	370 *	9.2	<25	27	<6.2	<5	<5
MB SS02 (0-0.5')	04/19/06	<12	170*	<5.9	8.6 J	<5.9	<5.9	<5	<5
MB01(0-0.5')	7/8-15/96	<6	<6	<6	<6	<6	<6	<6	<6
PS SS01 (0-0.5')	04/19/06	<10*	110	<5.1	<20	<5.1	<5.1	<5	<5
PS SS03 (0-0.5')	04/19/06	<12*	43	<5.8	<23	<5.8	<5.8	<5	<5
PS SS02 (0-0.5')	04/20/06	<16	R	<8.2	<33	<8.2	<8.2	<5	<5
PS 01 (0-0.5')	7/8-15/96	<6	<6	<6	<6	<6	<6	<6	<6
TF SB01 (4-5')	04/20/06	<10	5.6* J	<5.1	<20	<5.1	<5.1	<5	<5
TF SB02 (4-5')	04/20/06	<10	<20*	<5.0	<20	<5.0	<5.0	<5	<5
CA SB01 (4-5')	04/18/06	<10*	15 J	<5.2	<21	<5.2	<5.2	<5	<5
CA SB02 (4-5')	04/18/06	<9.9*	7.8 J	<5.0	<20	<5.0	<5.0	<5	<5
CB SB01 (4-5')	04/20/06	<10	7.0* J	<5.2	<21	<5.2	<5.2	<5	<5
CB SB04 (4-5')	04/20/06	<10	11* J	<5.2	<21	<5.2	<5.2	<5	<5
CB SB02 (4-5')	04/20/06	<11	5.8* J	<5.3	<21	<5.3	<5.3	<5	<5
CC SB01 (4-5')	04/19/06	<10*	<21	<5.1	<21	<5.1	<5.1	<5	<5
CC SB02 (4-5')	04/19/06	<10*	<21	<5.2	<21	<5.2	<5.2	<5	<5
CC SB03 (4-5')	04/19/06	<10*	<21	<5.2	<21	<5.2	<5.2	<5	<5
ME SB01 (4-5')	04/20/06	<10	<21*	<5.2	<21	<5.2	7.4	<5	<5
VW SB01 (4-5')	04/18/06	<10*	71 JD	<5.2	<21	<5.2	<5.2	<5	<5
VW SB04 (4-5')	04/18/06	<13*	220	<6.3	18 J	<6.3	<6.3	<5	<5
VW SB02 (4-5')	04/18/06	<11*	<21	<5.3	<21	<5.3	9.9	<5	<5
MB SB01 (4-5')	04/19/06	<10*	48	<5.2	<21	<5.2	<5.2	<5	<5
MB SB04 (4-5')	04/19/06	<11*	24	<5.3	<21	<5.3	<5.3	<5	<5
MB SB02 (4-5')	04/19/06	<10*	6.4 J	<5.0	<20	<5.0	<5.0	<5	<5
PS SB01 (4-5')	04/19/06	<11*	<22	<5.4	<22	<5.4	<5.4	<5	<5
PS SB04 (4-5')	04/19/06	<10*	26	<5.2	<21	<5.2	<5.2	<5	<5
PS SB02 (4-5')	04/20/06	<9.9	<20*	<5.0	<20	<5.0	7.2	<5	<5

[a] Criterion for trans-1,2-dichloroethene used.
"<13": Not detected, reporting limit = 13 ug/kg
*Quality control data were outside criteria.
J: Estimated; R: Rejected by data validator
Field duplicate of preceding sample

Table 7-1(b). Polychlorinated Biphenyls (PCBs) analysis of soil samples from the Maintenance Building compared against ecological screening values.

Sample Numbers & Depth	Sampling Date	Aroclor 1016 (ug/kg)	Aroclor 1221 (ug/kg)	Aroclor 1232 (ug/kg)	Aroclor 1242 (ug/kg)	Aroclor 1248 (ug/kg)	Aroclor 1254 (ug/kg)	Aroclor 1260 (ug/kg)
	Ecological Screening Level	371	371	371	371	371	371	371
	Source [a]	ORNL-PRG	ORNL-PRG	ORNL-PRG	ORNL-PRG	ORNL-PRG	ORNL-PRG	ORNL-PRG
MB 01 (0-0.5')	07/8-15/96	<550	<550	<550	<550	<550	<550	<550
MB SS01 (0-0.5')	4/19/2006	<100	<100	<100	<100	<100	<100	<100
MB SS03 (0-0.5')	4/19/2006	<220	<220	<220	<220	<220	<220	<220
MB SS02 (0-0.5')	4/19/2006	<42	<42	<42	<42	<42	<42	<42
MB SB01 (4-5')	4/19/2006	<21	<21	<21	<21	<21	<21	<21
MB SB04 (4-5')	4/19/2006	<21	<21	<21	<21	<21	<21	<21
MB SB02 (4-5')	4/19/2006	<21	<21	<21	<21	<21	<21	<21
MB 02 (4-5')	07/8-15/96	<550	<550	<550	<550	<550	<550	<550

[a] Source: ORNL-PRG (Efroymson et al. 1997a)

Table 7-1(c). Polynuclear Aromatic Hydrocarbons (PAH) analysis of soil samples from AOPCs at the former HCAFS compared against ecological screening values. (see Table 4-7 to 4-11(a) and (b), and Table 7-1(d) for complete dataset))

		Surface Soil (0-0.5 ft)				Subsurface Soil (0.5-5 ft)					
Chemical	**Number of rings:**	**Number of Data Points**	**Number of Detects**	**Minimum (ug/kg) [a]**	**Maximum (ug/kg) [a]**	**Number of data points**	**Number of Detects**	**Minimum (ug/kg) [a]**	**Maximum (ug/kg) [a]**	**Ecological Screening Value (ug/kg) [b]**	**Source [c]**
Naphthalene	2	68	53	2.6	10000	21	1	2.8	21.5	99.4	EPA Reg 5
Acenaphthylene	3	68	38	1.7	1200	21	0	3	21.5	682000	EPA Reg 5
Acenaphthene	3	68	66	2.1	6900	21	1	3	30	20000	ORNL-PRG
Fluorene	3	68	65	1.8	5600	21	1	3.45	30	30000	ORNL-BM
Phenanthrene	3	68	68	6.6	27000	21	3	3.45	570	45700	EPA Reg 5
Anthracene	3	68	64	1.5	6100	21	2	3.45	112	1480000	EPA Reg 5
Fluoranthene	4	68	68	30	52000	21	7	3.1	1300	122000	EPA Reg 5
Pyrene	4	68	68	23	39000	21	5	2.8	1105	78500	EPA Reg 5
Benzo(a)anthracene	4	68	68	14	18000	21	4	3	455	5210	EPA Reg 5
Chrysene	4	68	68	17	21000	21	4	3.45	575	4730	EPA Reg 5
Benzo(b)fluoranthene	5	68	68	16	31000	21	5	3	650	59800	EPA Reg 5
Benzo(k)fluoranthene	5	68	68	7.4	9750	21	4	2.6	440	148000	EPA Reg 5
Benzo(a)pyrene	5	68	68	13	19000	21	15	4.6	560	1520	EPA Reg 5
Indeno(1,2,3-cd)pyrene	5	68	68	9.8	14000	21	6	3	400	109000	EPA Reg 5
Dibenzo(a,h)anthracene	5	68	67	2.6	3600	21	4	3	160	18400	EPA Reg 5
2-Methylnaphthalene	2	57	50	0	740	12	9	2.95	3.05	3240	EPA Reg 5
Benzo(g,h,i)perylene	6	68	66	2.8	14500	21	9	3	480	119000	EPA Reg 5

[a] Non-detects were substituted with 1/2 x reporting limit before minima and maxima were calculated.

[b] Ecological Screening Values (ESV) were the lowest of screening criteria from ORNL benchmarks, EPA Region 5 SSL, and EPA Eco-SSL.

[c] Sources: EPA Reg 5 (EPA Region 5 SSL, EPA 2003a); ORNL-PRG (Efroymson et al. 1997a); ORNL-BM (Efroymson et al. 1997b or 1997c)

Exceeded ESV

Table 7-1d. PAH measured in subsurface soil samples collected during the 1996 SI and the 2006 SSI (TtEC 2008) from the Tile Field, Main Entrance, Maintenance Building, and Paint Shop (Subsurface soil samples from Vehicle Wash Rack are in Table 4-11b.)

Sample Numbers & Depth	Sampling Date	Naphthalene (ug/kg)	Acenaphthylene (ug/kg)	Acenaphthene (ug/kg)	Fluorene (ug/kg)	Phenanthrene (ug/kg)	Anthracene (ug/kg)	Fluoranthene (ug/kg)	Pyrene (ug/kg)
TF SB01 (4-5')	04/20/06	40 U	40 U	40 U	40 U	81 U	40 U	40 U	81 U
TF SB02 (4-5')	04/20/06	42 U	42 U	42 U	42 U	85 U	42 U	42 U	85 U
ME SB01 (4-5')	04/20/06	40 U	40 U	40 U	40 U	55 U	40 U	130	87 U
MB SB01 (4-5')	04/19/06	43 U	43 U	43 U	43 U	87 U	43 U	43 U	87 U
MB SB04 (4-5')	04/19/06	42 U	42 U	42 U	42 U	85 U	42 U	42 U	85 U
MB SB02 (4-5')	04/19/06	42 U	42 U	42 U	42 U	84 U	42 U	42 U	84 U
PS SB01 (4-5')	04/19/06	42 U	42 U	42 U	42 U	85 U	42 U	9.4 J	85 U
PS SB04 (4-5')	04/19/06	41 U	41 U	41 U	41 U	83 U	41 U	41 U	83 U
PS SB02 (4-5')	04/20/06	42 U	42 U	42 U	42 U	83 U	42 U	14 J	10 J

U: Not detected; J: Concentration is below reporting limit.

Field duplicate of preceding sample.

Table 7-1d. PAH measured in subsurface soil samples collected during the 1996 SI and the 2006 SSI (TtEC 2008) from the Tile Field, Main Entrance, Maintenance Building, and Paint Shop (Subsurface soil samples from Vehicle Wash Rack are in Table 4-11b)

Sample Numbers & Depth	Sampling Date	Benzo(a)an-thracene (ug/kg)	Chrysene (ug/kg)	Benzo(b)fluor-anthene (ug/kg)	Benzo(k)fluor-anthene (ug/kg)	Benzo(a)py-rene (ug/kg)	Indeno(1,2,3-cd)pyrene (ug/kg)	Dibenzo(a,h)-anthracene (ug/kg)	2-Methyl-naphthalene (ug/kg)	Benzo(g,h,i)-perylene (ug/kg)
TF SB01 (4-5')	04/20/06	40 U	40 U	40 U	40 U	40 U	40 U	40 U	NA	20 Ja
TF SB02 (4-5')	04/20/06	42 U	42 U	42 U	42 U	42 U	42 U	42 U	NA	42 U
ME SB01 (4-5')	04/20/06	55	66	85 M	75 M	89	57	23 Ja	NA	68
MB SB01 (4-5')	04/19/06	43 U	43 U	43 U	43 U	43 U	43 U	43 U		43 U
MB SB04 (4-5')	04/19/06	42 U	42 U	42 U	42 U	42 U	42 U	42 U		42 U
MB SB02 (4-5')	04/19/06	42 U	42 U	42 U	42 U	42 U	42 U	42 U	NA	42 U
PS SB01 (4-5')	04/19/06	42 U	42 U	42 U	42 U	42 U	16 Ja	42 U	NA	18 Ja
PS SB04 (4-5')	04/19/06	41 U	41 U	41 U	41 U	41 U	41 U	41 U	NA	41 U
PS SB02 (4-5')	04/20/06	42 U	42 U	17 Ja	42 U	19 Ja	23 Ja	23 Ja	NA	30 Ja

U: Not detected; J: Concentration is below reporting limit.

Field duplicate of preceding sample.

Table 7-1(e). Metals analysis of soil samples from AOPCs at the former HCAFS compared against ecological screening values and background data.
(see Table 7-1(f) for complete metals surface soil dataset; Table 7-1(g) and Table 4-6 for complete metals in subsurface soil dataset)

	Surface Soil (0-0.5 ft)				Subsurface Soil (0.5-5 ft)							Summary Statistics for IL soil data from Shacklette and Boerngen (1984) [f]	
Chemical	**Number of Data Points**	**Number of Detects**	**Minimum (mg/kg) [a]**	**Maximum (mg/kg) [a]**	**Number of Data Points**	**Number of Detects**	**Minimum (mg/kg) [a]**	**Maximum (mg/kg) [a]**	**TACO Metro Background (mg/kg) [b]**	**Ecological Screening Value (mg/kg) [c]**	**Source [d]**	**Arithmetic mean**	**Std. Dev.**
Mercury	13	9	0.008	0.140	9	9	0.02	0.07	0.06	0.00051	ORNL-PRG	0.11	0.086
Aluminum	13	13	1600	17000	9	9	8800	15000	9500	50	ORNL-Plants	48714.29	22106.883
Antimony	13	7	0.115	1.2	9	8	0.51	1	4	0.1423	EPA Reg 5	1.07	0.123
Arsenic	13	13	4.8	11	53	53	7	18	13	5.7	EPA Reg 5	7.06	2.462
Barium	13	13	12	182	9	9	96	170	110	1.04	EPA Reg 5	551.36	174.964
Beryllium	13	13	0.17	0.83	9	9	0.54	1.1	0.59	1.06	EPA Reg 5	0.71	0.373
Cadmium	13	6	0.095	1.7	9	2	0.093	0.245	0.6	0.00222	EPA Reg 5	None	
Calcium	13	13	3350	80000	9	9	2300	20000	9300	No Screening Value		5958.29	2362.406
Chromium	13	13	6.2	20	9	9	14	20	16.2	0.4	EPA Reg 5	48.41	16.860
Cobalt	13	13	3	10.7	9	9	6.7	16	8.9	0.14	EPA Reg 5	9.75	4.309
Copper	13	13	12	32	9	9	18	36	19.6	5.4	EPA Reg 5	24.41	11.935
Iron	13	13	7300	23000	9	9	19000	37000	15900	200	EPA Reg 5	19159.09	8385.626
Lead	17	17	11	93	11	11	8.4	58.5	36	0.0537	EPA Reg 5	38.64	59.924
Magnesium	13	13	2950	34000	9	9	2700	13000	4820	No Screening Value		4168.18	2564.109
Manganese	13	13	240	1110	9	9	265	1100	636	100	ORNL-BM	646.14	336.324
Nickel	13	13	8.1	22	9	9	18.5	39	18	13.6	EPA Reg 5	18.61	8.403
Potassium	13	13	480	1890	9	9	610	1100	1268	No Screening Value		15705.68	3725.752
Selenium	13	9	0.47	1	9	5	0.49	0.96	0.48	0.0276	EPA Reg 5	0.54	0.388
Silver	13	4	0.12	0.42	9	0	0.255 [e]	0.31 [e]	0.55	2	ORNL-PRG	None	
Sodium	13	8	47	160	9	5	120	230	130	No Screening Value		7705.88	1311.712
Thallium	13	1	0.14	0.14	9	0	1.3 [e]	1.3 [e]	0.32	0.0569	EPA Reg 5	10.30	0.361
Vanadium	13	13	13	37.6	9	9	27	45	25.2	1.59	EPA Reg 5	61.82	21.742
Zinc	13	13	29	330	9	9	45	104	95	6.62	EPA Reg 5	242.27	96.260

[a] Non-detects were substituted with 1/2 x reporting limit before minima and maxima were calculated.
[b] TACO background for Metropolitan Statistical Areas, Table A, Appendix G (Illinois Administrative Code Title 35, Section 742)
[c] Ecological Screening Values (ESV) were the lowest of screening criteria from ORNL benchmarks, EPA Region 5 SSL, and EPA Eco-SSL.
[d] ORNL-PRG: Efroymson et al. (1997a); ORNL-Plants: Efroymson et al. (1997c); ORNL-BM: Efroymson et al. (1997b)
[e] Chemical was not detected; this value is 1/2 x reporting limit.
[f] Arithmetic means and standard deviations of Shacklette and Boerngen's IL dataset was obtained from EPA's database (USEPA 2007c)
Values that exceed ESVs and TACO background.

Table 7-1(f). Metals measured in surface soil samples collected during the SI and SSI (TtEC 2008)

Sample Numbers & Depth	Sampling Date	Mercury (mg/kg)	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)
CA SS01 (0-0.5')	04/18/06	0.061	9,500.00	1.20 B	9.30	170.00	0.72	0.57	15,000.00	17.00	10.00	32.00	19,000.00
CA SS02 (0-0.5')	04/18/06	0.140	8,600.00	0.84 B	10.00	120.00	0.45	0.21 U	31,000.00	12.00	9.40	15.00	18,000.00
CA02 (0-0.5')	07/8-15/96	0.050 U	14,400.00	0.42 U	8.10	176.00	0.74	0.46	5,780.00	18.80	9.80	16.80	18,400.00
CB SS01 (0-0.5')	04/20/06	0.036	13000	0.58 B	8	150	0.66	0.24 U	6200	16	5.5	23	17000
CB SS03 (0-0.5')	04/20/06	0.027 B	14,000.00	2.30 U	7.60	210.00	0.72	0.23 U	6,000.00	17.00	7.30	21.00	17,000.00
CB SS02 (0-0.5')	04/20/06	0.030 B	12,000.00	0.57 B	7.40	130.00	0.57	0.23 U	15,000.00	14.00	5.70	14.00	17,000.00
CA04 (0-0.5')	07/8-15/96	0.040 U	7,980.00	0.23 U	5.80	94.90	0.46	0.38	15,400.00	11.30	4.50	13.30	12,700.00
CC SS01 (0-0.5')	04/19/06	0.008 B	1,600.00	1.90 U	4.80	12.00	0.17 B	0.19 U	80,000.00	6.20	3.00	12.00	7,300.00
CC SS02 (0-0.5')	04/19/06	0.034 B	7,300.00	0.88 B	7.40	150.00	0.76	1.70	47,000.00	13.00	6.80	23.00	15,000.00
CA05 (0-0.5')	07/8-15/96	0.050 U	13000	0.25 U	8.3	182	0.79	0.7	15100	19.2	10.7	23.7	18500
CC SB03 (0-0.5')	04/19/06	0.042	17,000.00	0.95 B	10.00	170.00	0.83	0.25 U	4,200.00	20.00	10.00	20.00	23,000.00
VW SS01 (0-0.5')	04/18/06	0.100	11000	0.23 U	8.7	150	0.59	0.23 U	3300	17	7.8	20	20000
VW SS03 (0-0.5')	04/18/06	0.059	12,000.00	2.30 U	8.60	150.00	0.61	0.23 U	3,400.00	16.00	8.40	19.00	20,000.00
WR01 (0-0.5')	07/8-15/96	0.050 U	15,200.00	0.25 U	8.20	167.00	0.70	0.66	4,090.00	19.40	6.60	19.00	18,900.00
VW SS02 (0-0.5')	04/18/06	0.036 B	13,000.00	0.63 B	11.00	160.00	0.71	0.23 U	7,700.00	19.00	9.30	18.00	20,000.00
PS01 (0-0.5')	07/8-15/96	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS01 (0-0.5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS03 (0-0.5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS02 (0-0.5')	04/20/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BA01 (0-0.5') [a]	7/13/1996	.06 U	13200	.26 N	10.1	243	0.59	0.42	NA	16.4	9	14.3	17600

B: Estimated; U: Not detected

[a] Collected from location along northern boundary of property representing conditions unimpacted by HCAFS activities.

Field duplicate of preceding sample

Table 7-1(f) Metals measured in surface soil samples collected during the SI and SSI (TtEC 2008) continued

Sample Numbers & Depth	Sampling Date	Lead (mg/kg)	Magnesium (mg/kg)	Manganese (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
CA SS01 (0-0.5')	04/18/06	81.00	8000	930.00	22.00	1,100.00	0.75 B	0.26 B	300.00 U	2.90 U	28.00	330.00
CA SS02 (0-0.5')	04/18/06	32.00	10000	950.00	12.00	780.00	1.50 U	0.14 B	270.00 U	2.60 U	26.00	59.00
CA02 (0-0.5')	07/8-15/96	38.00	3640	964.00	15.80	1,580.00	0.53	0.29 U	51.50	0.14	36.10	111.00
CB SS01 (0-0.5')	04/20/06	20	3800	380	14	1400	0.55 B	0.6 U	310 U	3 U	30	71
CB SS03 (0-0.5')	04/20/06	17.00	3300	690.00	14.00	1,100.00	1.00 B	0.58 U	95.00 B	2.90 U	32.00	56.00
CB SS02 (0-0.5')	04/20/06	11.00	7500	380.00	13.00	690.00	0.59 B	0.58 U	300.00 U	2.90 U	27.00	46.00
CA04 (0-0.5')	07/8-15/96	28.20	7760	424.00	10.90	1,340.00	0.70 U	0.27 U	47.00	0.18 U	20.90	80.60
CC SS01 (0-0.5')	04/19/06	15.00	34000	240.00	8.10 B	480.00	1.40 U	0.42 B	130.00 B	2.40 U	13.00	29.00
CC SS02 (0-0.5')	04/19/06	93.00	12000	480.00	15.00	800.00	0.67 B	0.56 U	150.00 B	2.80 U	21.00	220.00
CA05 (0-0.5')	07/8-15/96	64.4	6340	1110	17.1	1890	0.61	0.28 U	82	0.13 U	35.9	135
CC SB03 (0-0.5')	04/19/06	14.00	3900	320.00	22.00	970.00	1.90 U	0.62 U	320.00 U	3.10 U	34.00	57.00
VW SS01 (0-0.5')	04/18/06	17	2900	470	22	820	1.7 U	0.57 U	99 B	2.8 U	27	61
VW SS03 (0-0.5')	04/18/06	17.00	3000	600.00	21.00	720.00	0.60 B	0.57 U	110.00 B	2.80 U	26.00	54.00
WR01 (0-0.5')	07/8-15/96	58.50	2990	631.00	16.50	1,520.00	0.47	0.19 U	62.50	0.19 U	37.60	78.90
VW SS02 (0-0.5')	04/18/06	38.00	4600	770.00	21.00	1,200.00	1.00 B	0.12 B	300.00 U	2.90 U	31.00	68.00
PS01 (0-0.5')	07/8-15/96	27.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS01 (0-0.5')	04/19/06	20	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS03 (0-0.5')	04/19/06	17	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SS02 (0-0.5')	04/20/06	26	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BA01 (0-0.5')	7/13/1996	32.6	2370	1070	14.8	1820	0.61	0.28 U	40.4	0.2	35.8	184

B: Estimated; U: Not detected

NS: Not sampled

Field duplicate of preceding sample

Table 7-1(g). Metals (excluding arsenic) measured in subsurface soil samples collected during the SI and SSI (TtEC 2008).
(see Table 4-6 for arsenic in subsurface soil dataset)

Sample Numbers & Depth	Sampling Date	Mercury (mg/kg)	Aluminum (mg/kg)	Antimony (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)
CA SB01 (4-5')	04/18/06	0.03 B	15,000.00	0.81 B	140.00	0.91	0.24	2,800.00	19.00	9.30	28.00	29,000.00	12.00
CA SB02 (4-5')	04/18/06	0.05	8,800.00	2.00 U	130.00	0.54	0.20 U	5,800.00	15.00	12.00	19.00	20,000.00	14.00
CB SB01 (4-5')	04/20/06	0.05	13,000.00	0.51 B	140.00	0.57	0.23 U	3,200.00	19.00	9.30	16.00	16,000.00	13.00
CB SB04 (4-5')	04/20/06	0.05	17,000.00	0.85 B	160.00	0.91	0.47 U	3,500.00	21.00	5.20	22.00	25,000.00	7.80
CB SB02 (4-5')	04/20/06	0.05	13,000.00	0.95 B	140.00	1.10	0.49 U	2,800.00	18.00	10.00	36.00	37,000.00	15.00
CC SB01 (4-5')	04/19/06	0.02 B	9,900.00	0.72	96.00	0.55	0.23 U	20,000.00	16.00	6.70	19.00	19,000.00	11.00
CC SB02 (4-5')	04/19/06	0.04	9,700.00	0.71 B	170.00	0.58	0.21 U	2,700.00	14.00	11.00	21.00	20,000.00	13.00
CC SB03 (4-5')	04/19/06	0.04	12,000.00	0.51 B	140.00	0.68	0.22 U	2,500.00	17.00	8.60	18.00	21,000.00	8.90
VW SB01 (4-5')	04/18/06	0.06	12,000.00	0.86 B	180.00	0.71	0.08 B	4,600.00	22.00	11.00	20.00	22,000.00	69.00
VW SB04 (4-5')	04/18/06	0.08	11,000.00	0.72 B	160.00	0.68	0.11 B	5,200.00	18.00	10.00	20.00	19,000.00	48.00
VW SB02 (4-5')	04/18/06	0.05	12,000.00	0.88 B	160.00	0.67	0.25 U	2,300.00	16.00	16.00	20.00	21,000.00	15.00
PS SB01 (4-5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	12
PS SB04 (4-5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	9.6
PS SB02 (4-5')	04/20/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	8.4
BA01 (5-8') [a]	7/10/1996	0.05 U	15100	0.24 U	169	0.63	0.25	NA	22.3	12	21.4	24500	16.3

B: Estimated; U: Not detected

[a] Collected from location along northern boundary of property representing conditions unimpacted by HCAFS activities.

Field duplicate of preceding sample

Table 7-1(g) Metals measured in subsurface soil samples collected during the SI and SSI (TtEC 2008) continued

Sample Numbers & Depth	Sampling Date	Magnesium (mg/kg)	Manganese (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Thallium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
CA SB01 (4-5')	04/18/06	3200	650.00	25.00	850.00	0.58 B	0.60 U	310.00 U	3.00 U	40.00	69.00
CA SB02 (4-5')	04/18/06	4800	960.00	27.00	700.00	0.49 B	0.51 U	270.00 U	2.60 U	27.00	50.00
CB SB01 (4-5')	04/20/06	3400	360.00	19.00	760.00	1.70 U	0.58 U	120.00 B	2.90 U	28.00	48.00
CB SB04 (4-5')	04/20/06	3700	170.00	18.00	790.00	1.80 U	0.58 U	140.00 B	2.90 U	43.00	62.00
CB SB02 (4-5')	04/20/06	3000	750.00	32.00	640.00	0.90 B	0.62 U	120.00 B	3.10 U	45.00	55.00
CC SB01 (4-5')	04/19/06	13000	520.00	19.00	1,000.00	1.70 U	0.58 U	130.00 B	2.90 U	31.00	45.00
CC SB02 (4-5')	04/19/06	2700	1,000.00	39.00	610.00	0.64 B	0.54 U	230.00 B	2.70 U	27.00	50.00
CC SB03 (4-5')	04/19/06	3100	390.00	31.00	690.00	1.70 U	0.56 U	290.00 U	2.80 U	28.00	52.00
VW SB01 (4-5')	04/18/06	3400	760.00	23.00	1,000.00	1.00 B	0.62 U	130.00 B	3.10 U	31.00	110.00
VW SB04 (4-5')	04/18/06	3400	770.00	19.00	1,200.00	0.92 B	0.57 U	110.00 B	2.80 U	30.00	98.00
VW SB02 (4-5')	04/18/06	3000	1,100.00	26.00	710.00	1.90 U	0.62 U	320.00 U	3.10 U	28.00	50.00
PS SB01 (4-5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SB04 (4-5')	04/19/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PS SB02 (4-5')	04/20/06	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BA01 (5-8') [a]	7/10/1996	4500	961	35	1370	0.18	0.3 U	83.4	0.27	39.4	58.9

B: Estimated; U: Not detected

[a] Collected from location along northern boundary of property representing conditions unimpacted by HCAFS activities.

Field duplicate of preceding sample

Table 7-2(a) Ecological soil screening levels and risk characterization from exposure to PAHs in surface soil for terrestrial receptors.

Chemical Class	Exposure Concentration (ug/kg) [a]	Eco-SSLs (ug/kg) [b]				Hazard Quotient [c]			
		Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife	Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife
Low-molecular weight PAHs	8146	NA	29000	NA	100000	NA	0.28	NA	0.08
High-molecular weight PAHs	28865	NA	18000	NA	1100	NA	1.60	NA	26.24

[a] Exposure concentration: 95% UCL calculated from PAH surface soil (0-0.5 ft) and subsurface soil (0.5-5 ft) data set (combined data from all AOPCs).
[b] Source: EPA (2007); NA: Not available because of insufficient toxicity data.
[c] Hazard Quotient = Exposure concentration/Eco-SSL

Table 7-2(b) Ecological soil screening levels and risk characterization from exposure to PAHs in surface soil for mammalian receptors.

Chemical Class	Exposure Concentration (ug/kg) [a]	Soil Screening Levels (ug/kg) [b]			Hazard Quotient [c]		
		Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)	Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)
Low-molecular weight PAHs	8146	350000	100000	1200000	0.02	0.08	0.01
High-molecular weight PAHs	28865	39000	1100	110000	0.74	26.24	0.26

[a] Exposure concentration: 95% UCL calculated from PAH surface soil (0-0.5 ft) and subsurface soil (0.5-5 ft) data set (combined data from all AOPCs).
[b] Source: Table 6.3 and 6.4 in EPA (2007); the Soil Screening Level for the mammalian insectivore was the lowest and selected by EPA as the Eco-SSL (Table 7-2(a)).
[c] Hazard Quotient = Exposure concentration/Eco-SSL

Table 7-3. Comparison of site data against EPA Eco-SSLs and regional EPA ecological screening levels for tentative metal COPECs (i.e., metals that exceeded minimum of ecological screening levels and TACO metropolitan statistical area background)

	Site Data		EPA Eco-SSLs				Regional EPA Ecological Screening Levels				
Chemical	**Maximum in surface (0 to 0.5 ft bgs) soil (mg/kg) (mg/kg)**	**Maximum in subsurface (> 0.5 ft bgs) soil (mg/kg) (mg/kg)**	**Plants (mg/kg)**	**Invertebrates (mg/kg)**	**Avian (mg/kg)**	**Mammalian (mg/kg)**	**EPA Region 6 Earthworms Surface Soil (mg/kg)**	**EPA Region 6 Plants Surface Soil (mg/kg)**	**EPA Region 4 Soil (mg/kg)**	**EPA Region 5 ESL Soil (mg/kg)**	**Retain as COPEC for ecological risk characterization? (Justification)**
Mercury	0.140	0.07					0.1	0.3	0.1	0.1	No (Only one measurement exceeded EPA regional screening levels; see Table 7.1(f) and (g) for data)
Aluminum	17000	15000		pH < 5.5				50	50		No (Aluminum is only toxic at pH < 5.5 (USEPA, 2003f); soil pH at HCAFS > 6)
Arsenic	11	18	18		43	46	60	37	10	5.7	Yes (For subsurface soil, maximum is equal to Plant Eco-SSL)
Barium	182	170		330		2000		500	165	1.04	No (Maxima are below Eco-SSLs)
Beryllium	0.83	1.1		40		21		10	1.1	1.06	No (Below Eco-SSLs and Regional EPA screening levels (other than Region 5))
Cadmium	1.7	0.245	32	140	0.77	0.36	110	29	1.6	0.00222	Yes (for surface soil; exceeds avian and mammalian ECO-SSLs)
Chromium	20	20			26	34	0.4	5	0.4	0.4	No (Maxima are below Eco-SSLs)
Cobalt	10.7	16	13		120	230		20	20	0.14	Yes (for subsurface soil, maximum is above Plant Eco_SSL)
Copper	32	36	70	80	28	51	61	100	40	5.4	Yes (Maximum values are above avian Eco-SSL)
Iron	23000	37000	Not toxic						200		No (Not toxic to plants; naturally occuring and widely distributed at concentrations ranging from 20,000 to 550,000 mg/kg (USEPA 2003g))
Lead	93	58.5	120	1700	11	56	500	50	50	0.0537	Yes (Maxima exceed avian and mammalian Eco-SSLs)
Manganese	1110	1100	220	450	4300	4000		500	100		Yes (Maxima exceed plant and invertebrate Eco-SSLs)
Nickel	22	39	38	280	210	130	200	30	30	13.6	No (Below invertebrate, avian and mammilian Eco-SSLs, only slightly higher than Plants Eco-SSL)
Selenium	1	0.96	0.52	4.1	1.2	0.63	70	1	0.81	0.0276	Yes (Above plant and mammalian Eco-SSLs)
Thallium	0.14	1.3 [a]						1	1	0.0569	No (Thallium in surface soil was below EPA Region 4 and 6 screening levels; thallium was not detected in subsurface soils)
Vanadium	37.6	45			7.8	280		2	2	1.59	Yes (Maxima above avian Eco-SSL)
Zinc	330	104	160	120	46	79	120	190	50	6.62	Yes (Maxima above Eco-SSLs)

[a] Thallium was not detected; this value is 1/2 x reporting limit.

Table 7-4(a) Ecological soil screening levels and risk characterization from exposure to metal COPECs in surface soil at the former HCAFS for terrestrial receptors.

Chemical	Exposure Concentration (mg/kg) [a]	Eco-SSLs for Receptor Groups (mg/kg) [b]				Hazard Quotient for Receptor Groups [c]			
		Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife	Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife
Cadmium	1.7	32	140	0.77	0.36	0.05	0.01	2.21	4.72
Copper	32	70	80	28	51	0.46	0.40	1.14	0.63
Lead	93	120	1700	11	56	0.78	0.05	8.45	1.66
Manganese	1110	220	450	4300	4000	5.05	2.47	0.26	0.28
Selenium	1	0.52	4.1	1.2	0.63	1.92	0.24	0.83	1.59
Vanadium	37.6	NA	NA	7.8	280	NA	NA	4.82	0.13
Zinc	330	160	120	46	79	2.06	2.75	7.17	4.18

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs; NA: Not available
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

Table 7-4(b) Ecological soil screening levels and risk characterization for avian receptors from exposure to metal COPECs in surface soil

Chemical Class	Exposure Concentration (mg/kg) [a]	Soil Screening Levels (mg/kg) [b]			Hazard Quotient [c]		
		Avian herbivore (dove)	Avian ground insectivore (woodchuck)	Avian carnivore (hawk)	Avian herbivore (dove)	Avian ground insectivore (woodchuck)	Avian carnivore (hawk)
Cadmium	1.7	28	0.77	630	0.06	2.21	0.00
Copper	32	76	28	1600	0.42	1.14	0.02
Lead	93	46	11	510	2.02	8.45	0.18
Manganese	1110	4300	4300	65000	0.26	0.26	0.02
Selenium	1	2.2	1.2	83	0.45	0.83	0.01
Vanadium	37.6	13	7.8	140	2.89	4.82	0.27
Zinc	330	950	46	30000	0.35	7.17	0.01

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

Table 7-4(c) Ecological soil screening levels and risk characterization for mammalian receptors from exposure to metals with highest hazard quotients in surface soil

Chemical Class	Exposure Concentration (mg/kg) [a]	Soil Screening Levels (mg/kg) [b]			Hazard Quotient [c]		
		Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)	Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)
Cadmium	1.7	73	0.36	84	0.02	4.72	0.02
Copper	32	1100	49	560	0.03	0.65	0.06
Lead	93	1200	56	460	0.08	1.66	0.20
Manganese	1110	5300	4000	6200	0.21	0.28	0.18
Selenium	1	2.7	0.63	2.8	0.37	1.59	0.36
Vanadium	37.6	1300	280	580	0.03	0.13	0.06
Zinc	330	39000	56	460	0.01	5.89	0.72

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

Table 7-5(a) Ecological soil screening levels and risk characterization from exposure to metal COPCs in subsurface soil at the former HCAFS for terrestrial receptors.

Chemical	Exposure Concentration (mg/kg) [a]	Eco-SSLs for Receptor Groups (mg/kg) [b]				Hazard Quotient for Receptor Groups [c]			
		Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife	Plants	Soil Invertebrates	Avian Wildlife	Mammalian Wildlife
Arsenic	18	18	NA	43	46	1.00	NA	0.42	0.39
Cobalt	16	13	NA	120	230	1.23	NA	0.13	0.07
Copper	36	70	80	28	51	0.51	0.45	1.29	0.71
Lead	58.5	120	1700	11	56	0.49	0.03	5.32	1.04
Manganese	1100	220	450	4300	4000	5.00	2.44	0.26	0.28
Selenium	0.96	0.52	4.1	1.2	0.63	1.85	0.23	0.80	1.52
Vanadium	45	NA	NA	7.8	280	NA	NA	5.77	0.16
Zinc	104	160	120	46	79	0.65	0.87	2.26	1.32

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs; NA: Not available
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

Table 7-5(b) Ecological soil screening levels and risk characterization for avian receptors from exposure to metal COPECs in subsurface soil

Chemical Class	Exposure Concentration (mg/kg) [a]	Soil Screening Levels (mg/kg) [b]			Hazard Quotient [c]		
		Avian herbivore (dove)	Avian ground insectivore (woodchuck)	Avian carnivore (hawk)	Avian herbivore (dove)	Avian ground insectivore (woodchuck)	Avian carnivore (hawk)
Arsenic	18	67	43	1100	0.27	0.42	0.02
Cobalt	16	270	120	1300	0.06	0.13	0.01
Copper	36	76	28	1600	0.47	1.29	0.02
Lead	58.5	46	11	510	1.27	5.32	0.11
Manganese	1100	4300	4300	65000	0.26	0.26	0.02
Selenium	0.96	2.2	1.2	83	0.44	0.80	0.01
Vanadium	45	13	7.8	140	3.46	5.77	0.32
Zinc	104	950	46	30000	0.11	2.26	0.00

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

Table 7-5(c) Ecological soil screening levels and risk characterization for mammalian receptors from exposure to metal COPECs in subsurface soil

Chemical Class	Exposure Concentration (mg/kg) [a]	Soil Screening Levels (mg/kg) [b]			Hazard Quotient [c]		
		Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)	Mammalian herbivore (vole)	Mammalian ground insectivore (shrew)	Mammalian carnivore (weasel)
Arsenic	18	170	46	170	0.11	0.39	0.11
Cobalt	16	2100	230	470	0.01	0.07	0.03
Copper	36	1100	49	560	0.03	0.73	0.06
Lead	58.5	1200	56	460	0.05	1.04	0.13
Manganese	1100	5300	4000	6200	0.21	0.28	0.18
Selenium	0.96	2.7	0.63	2.8	0.36	1.52	0.34
Vanadium	45	1300	280	580	0.03	0.16	0.08
Zinc	104	39000	56	460	0.00	1.86	0.23

[a] Exposure concentration: Maximum detected concentration
[b] Source: EPA Eco-SSLs
[c] Hazard Quotient = Exposure concentration/Eco-SSL
Hazard Quotient greater then 1

APPENDIX C

BORING LOGS FROM REMEDIAL INVESTIGATION AND WELL DRILLING LOGS FOR WELLS WITHIN 0.5 MILES OF THE HCAFS

ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
s.s. #29100	0	0
till, st, ylsh-buff, ox, leached	0	20
sh,st,gry/brnsh-gry,tough/brit,lamd	20	40
ls,lgt gry,vy f,xln,very fosf	40	42
coal	42	45
shale, light gray, weak	45	53
ls, very st, gry/lgt gry, vy f, fosf	53	57
shale,st,lgt gry/grysh-buff,weak/brit	57	65
shale, st,mic, gry/grysh-brn,tough/brit	65	110
coal	110	111
sh,lgt grnsh gry/gry,brit/wk,slgtly sy	111	123
shale,st,redish-brn,weak/brit,ltl tough	123	130
sh,sty,gry,wk/brit,mic;sh,sty,wk/brit	130	145
shale,silty,mic,gray,brit to weak	145	155
ss,calc,mic,sty,vy f/f,ang,cmpt	155	160
sh,sty,gry,brit/wk	160	168
ls,st,grysh-buff/lgt buff, very fine	168	173
coal	173	175
shale, lgt gray/grysh-buff, weak/brit	175	185
sh,sty,mic,lgt gry lgt blsh gry,wk/brit	185	210
sh,sty,wk/brit,ltl tough,lamd,gry/brnsh	210	243
coal	243	245
shale,sty,gry/blk,weak to brittle	245	253
ls, very sty, grysh-brn, very fine	253	255

Permit Date: **Permit #:**

COMPANY owner
FARM Hanna City Radar Base
DATE DRILLED January 1, 1957 **NO.** 1
ELEVATION 739TM **COUNTY NO.** 00474
LOCATION 350'N 2000'W SE/c
LATITUDE 40.698236 **LONGITUDE** -89.821303
COUNTY **Peoria** **API** **121430047400** **4 - 8N - 6E**

shale,silty,lgt gry/gry,weak/brittle	255	271
ss,calc,vy mic,lgt gry,vy f/f,compact	271	275
sh,sty,lgt bfsh gry/grysh bf,weak/brit	275	305
shale,gray to brownish gray, weak/brit	305	315
shale,black to gray,tough/weak,lamd	315	330
sh,sty,mic,lgt bfsh-gry,weak/brit,pyrc	330	360
sh,sty,mic,slgtly lamd,pyrc,ltl ss,c bot	360	375
sh,sty,mic,lgt gry/brnsh gry weak/brit	375	415
Total Depth		1864

Casing: 22" CASING from 0' to 59'
18" CASING W/ SHOES from 0' to 465'
12" from 0' to 980'

Driller's Log filed
Survey Sample Study filed
Sample set # 29100 (0' - 1865')

Location source: Location from the driller

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
top soil	0	2
yellow clay	2	16
blue clay	16	19
sand	19	21
blue clay	21	30
rock	30	30
Total Depth		30

Casing: 24" CONCRETE from 11' to 30'
Size hole below casing: 0"

Water from sand at 19' to 21'.
Static level 15' below casing top which is 1' above GL

Location source: Location from permit

Permit Date: June 8, 1979 **Permit #:** 86468

COMPANY Scherf Robert William
FARM Melz, Russell
DATE DRILLED June 8, 1979 **NO.** 2
ELEVATION 0 **COUNTY NO.** 23024
LOCATION SE SW SE
LATITUDE 40.698184 **LONGITUDE** -89.819972
COUNTY **Peoria** **API** **121432302400** **4 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
clay	0	34
shale	34	87
coal	87	89
shale	89	125
Total Depth		125

Casing: 6" STEEL from 0' to 38'
Size hole below casing: 0"

Water from shale at 0' to 0'.
Pumping level 0' when pumping at 1 gpm for 0 hours

Location source: Location from permit

Permit Date: December 21, 1979 **Permit #:** 92147

COMPANY Cole, Raymond J.
FARM Melz, Russell
DATE DRILLED January 11, 1980 **NO.**
ELEVATION 0 **COUNTY NO.** 23025
LOCATION SE SW SE
LATITUDE 40.698184 **LONGITUDE** -89.819972
COUNTY **Peoria** **API** **121432302500** **4 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
black topsoil	0	3
brown silty clay	3	8
brown silty sandy clay (H2o)	8	17
dark brown clay	17	20
brown till	20	30
multi color clay	30	34
gray shale	34	53
Total Depth		53

Casing: 6" PVC SDR 21 from -1' to 10'
36" CONCRETE from 10' to 53'

Grout: BENTONITE CHIPS from 8 to 9.
Grout: BUCKSHOT from 10 to 53.
Water from brown silty sandy cl at 8' to 17'.

Address of well: 14720 Farmington Rd.

Location source: Location from permit

Permit Date: September 17, 2001 **Permit #:**

COMPANY Wiesenhofer, Andrew
FARM Danley, Dan
DATE DRILLED October 23, 2001 **NO.**
ELEVATION 0 **COUNTY NO.** 34458
LOCATION NW NE NW
LATITUDE 40.696347 **LONGITUDE** -89.82709
COUNTY **Peoria** **API** **121433445800** **9 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
hard yellow clay	0	18
soft yellow clay	18	25
coarse yellow sand & gravel	25	26
soft blue clay	26	30
soft blue shale	30	45
hard blue shale	45	61
light hard gray shale	61	71
Total Depth		71

Casing: 6" SDR 21 from -2' to 11'
36" CONCRETE from 11' to 71'

Grout: HOLE PLUG from 0 to 0.
Water from crs yl sand & gvl at 25' to 26'.
Static level 25' below casing top which is 2' above GL
Pumping level 35' when pumping at 16 gpm for 4 hours

Address of well: same as above

Location source: Location from permit

Permit Date: September 21, 2004 **Permit #:**

COMPANY Kuntz, John E.
FARM Rosenbohm, John
DATE DRILLED September 24, 2004 **NO.** 1
ELEVATION 0 **COUNTY NO.** 34822
LOCATION NE NW NW
LATITUDE 40.696343 **LONGITUDE** -89.82946
COUNTY **Peoria** **API** **121433482200** **9 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
hard yellow clay	0	19
soft yellow clay	19	25
coarse yellow sand	25	26
hard blue clay	26	30
soft blue shale	30	45
hard blue shale	45	51
soft limerock	51	60
hard blue shale	60	71
Total Depth		71

Casing: 6" SDR 21 PLASTIC from -2' to 11'
36" CONCRETE from 11' to 71'

Grout: HOLE PLUG from 0 to 0.
Water from coarse yellow sand at 25' to 26'.
Static level 22' below casing top which is 2' above GL
Pumping level 35' when pumping at 10 gpm for 4 hours

Address of well: 528 N. Eden Rd.

Location source: Location from permit

Permit Date: September 14, 2004 **Permit #:**

COMPANY Kuntz, John E.
FARM Rosenbohm, John
DATE DRILLED September 18, 2004 **NO.** 1
ELEVATION 0 **COUNTY NO.** 34821
LOCATION NW NW NW
LATITUDE 40.696339 **LONGITUDE** -89.831827
COUNTY **Peoria** **API** **121433482100** **9 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Livestock Watering Well	Top	Bottom
yellow clay	0	14
blue clay	14	25
gravel	25	26
shale & rock	26	40
Total Depth		40

Casing: 24" CONCRETE from 10' to 40'
Size hole below casing: 0"

Water from gravel at 25' to 26'.
Static level 12' below casing top which is 1' above GL
Permanent pump installed at 38' on September 28, 1987, with a capacity of 10 gpm

Location source: Location from permit

Permit Date: August 18, 1987 **Permit #:** 134567

COMPANY Scherf Robert William
FARM Copple, Leroy
DATE DRILLED September 22, 1987 **NO.** 2
ELEVATION 0 **COUNTY NO.** 23554
LOCATION SE SE SE
LATITUDE 40.698165 **LONGITUDE** -89.834167
COUNTY **Peoria** **API** **121432355400** **5 - 8N - 6E**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
yellow clay	0	18
sandstone	18	20
gray shale	20	27
Total Depth		27

Casing: 6" ID PVC 21 200# from -2' to 11'
24" ID CONC TILE 375# from 11' to 27'

Water from sandstone at 18' to 20'.
Static level 13' below casing top which is 2' above GL
Pumping level 10' when pumping at 10 gpm for 4 hours

Location source: Location from permit

Permit Date: August 17, 1988 **Permit #:** 004856

COMPANY Kuntz, Peter William
FARM Duley, Don
DATE DRILLED September 6, 1988 **NO.**
ELEVATION 0 **COUNTY NO.** 23637
LOCATION SE NE SE
LATITUDE 40.701806 **LONGITUDE** -89.834137
COUNTY **Peoria** **API** **121432363700** **5 - 8N - 6E**

Boring: HCCASB01

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469137.496
Date Finished:	11/18/08	Easting:	2390531.228
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
	1.7'					SILTY CLAY: brown, damp, plastic, stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCCASB0123010811 & HCCASB0123030811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCASB0145010811 (4.0' - 5.0')		
-5						BOH @ 5 ft.
-6						

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Kevil, KY

U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB01
Sheet:	1 of 1

Boring: HCCASB02

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469132.556
Date Finished:	11/18/08	Easting:	2390578.768
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.1	4.0/4.0	No readings exceeded background levels			
	2.4					SILTY CLAY: brown, damp, plastic, stiff
				HCCASB0223010811 (2.0' - 3.0')		SILTY CLAY: dark brown, damp, plastic, stiff
-3						
	3.9					
-4						SILTY CLAY: brown, damp, plastic, stiff, with iron and manganese nodules
		1.0/1.0		HCCASB0245010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB02
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469125.514
Date Finished:	11/18/08	Easting:	2390660.973
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCASB03

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, stiff, plastic
-1	1.2		Background readings less than 2.0 ppm			SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels	HCCASB0323010811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCCASB0345010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469094.922
Date Finished:	11/18/08	Easting:	2390558.676
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCASB04

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.1	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, damp, plastic, stiff, with iron and manganese nodules
				HCCASB0423010811 & HCCASB0423020811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCCASB0445010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Kevil, KY

U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB04
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469043.102
Date Finished:	11/18/08	Easting:	2390523.780
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCASB05

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.0	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, damp to moist, plastic, soft to medium, with iron and manganese nodules
				HCCASB0523010811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCCASB0545010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB05
Sheet:	1 of 1

Boring: HCCASB06

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469041.016
Date Finished:	11/18/08	Easting:	2390593.142
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.0	4.0/4.0	No readings exceeded background levels	HCCASB0623010811 & MS/MSD (2.0' - 3.0')		SILTY CLAY: brown, damp to moist, plastic, soft to medium, with iron and manganese nodules
-3						
-4		1.0/1.0		HCCASB0645010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB06
Sheet:	1 of 1

Boring: HCCASB07

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469037.842
Date Finished:	11/18/08	Easting:	2390644.951
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown, damp, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.1	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, damp to moist, plastic, soft to medium, with iron and manganese nodules
-3				HCCASB0723010811 (2.0' - 3.0')		
-4		1.0/1.0		HCCASB0745010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCASB07
Sheet:	1 of 1

Boring: HCCBSB01

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468332.450
Date Finished:	11/18/08	Easting:	2391516.420
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
-2	2.2	4.0/4.0	No readings exceeded background levels			
				HCCBSB0123010811 & HCCBSB0123020811 (2.0' - 3.0')		SILTY CLAY: brown, plastic, moist to damp, stiff, with iron and manganese nodules
-3						
-4		1.0/1.0		HCCBSB0145010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB01
Sheet:	1 of 1

Boring: HCCBSB02

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468334.379
Date Finished:	11/18/08	Easting:	2391538.709
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0				No samples collected		SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
-2		4.0/4.0	No readings exceeded background levels			
	2.3					SILTY CLAY: brown, plastic, moist to damp, stiff, with iron and manganese nodules
-3						
-4		1.0/1.0				
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB02
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468304.788
Date Finished:	11/18/08	Easting:	2391495.688
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCBSB03

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
-2	2.0	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, plastic, moist, stiff, with iron and manganese nodules
				HCCBSB0323010811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCCBSB0345010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB03
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468286.554
Date Finished:	11/18/08	Easting:	2391516.806
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCBSB04

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
	1.8					SILTY CLAY: brown, plastic, moist, stiff, with iron and manganese nodules
-2		4.0/4.0	No Readings exceeded background levels			
				HCCBSB0423010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCBSB0445010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB04
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468289.052
Date Finished:	11/18/08	Easting:	2391539.354
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCBSB05

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
	1.9					
-2		4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, plastic, moist, stiff, with iron and manganese nodules
				HCCBSB0523010811 & HCCBSB0523030811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCBSB0545010811		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB05
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468248.640
Date Finished:	11/18/08	Easting:	2391495.237
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCBSB06

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
	1.5					SILTY CLAY: brown, plastic, moist, stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCCBSB0623010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCBSB0645010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB06
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468241.088
Date Finished:	11/18/08	Easting:	2391468.168
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCBSB09

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, plastic, moist, stiff
-1			Background readings less than 2.0 ppm			
-2	2.0	4.0/4.0	No readings exceeded background levels	HCCBSB0923010811 (2.0' - 3.0')		SILTY CLAY: brown, plastic, moist, stiff, with iron and manganese nodules
-3						
-4		1.0/1.0		HCCBSB0945010811 & MS/MSD (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCBSB09
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468676.377
Date Finished:	11/18/08	Easting:	2391356.864
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCCSB01

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, stiff, plastic
-1			Background readings less than 2.0 ppm			
	1.8					SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCCCSB0123010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCCSB0145010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCCSB01
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468683.095
Date Finished:	11/18/08	Easting:	2391397.406
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCCSB02

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, stiff, plastic
-1			Background readings less than 2.0 ppm			
	1.5					SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCCCSB0223010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCCCSB0245010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCCSB02
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468650.987
Date Finished:	11/18/08	Easting:	2391376.223
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCCCSB06

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, stiff, plastic
-1			Background readings less than 2.0 ppm			
-2	2.1	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, moist, plastic, stiff to medium stiff, mottled gray with iron and manganese nodules
				HCCCSB0623010811 & HCCCSB0623020811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCCCSB0645010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCCSB06
Sheet:	1 of 1

Boring: HCCCSB07

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468647.221
Date Finished:	11/18/08	Easting:	2391411.126
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0				No samples collected		SILTY CLAY: dark brown to black, damp to moist, plastic, medium to stiff
-1			Background readings less than 2.0 ppm			
	1.4					SILTY CLAY: brown, moist, plastic, stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
-3						
-4		1.0/1.0				
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCCCSB07
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468602.729
Date Finished:	11/18/08	Easting:	2391439.591
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCPSSB03

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, medium to stiff
-1			Background readings less than 2.0 ppm			
	1.7					SILTY CLAY: brown, moist, plastic, stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCPSSB0323010811 (2.0' - 3.0')		
-3						
				HCPSSB0334010811 (3.0' - 4.0')		
-4						
		1.0/1.0		HCPSSB0345010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCPSSB03
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468544.245
Date Finished:	11/18/08	Easting:	2391437.530
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCPSSB05

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, medium to stiff
-1			Background readings less than 2.0 ppm			
	1.7					SILTY CLAY: brown, moist, plastic, stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCPSSB0523010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCPSSB0545010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCPSSB05
Sheet:	1 of 1

Boring: HCPSSB06

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1468613.284
Date Finished:	11/18/08	Easting:	2391385.029
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, medium to stiff
-1			Background readings less than 2.0 ppm			
	1.9					
-2		4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, moist, plastic, stiff, with iron and manganese nodules
				HCPSSB0623010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCPSSB0645010811 & HCPSSB0645030811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCPSSB06
Sheet:	1 of 1

Boring: HCVWSB01

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469184.602
Date Finished:	11/18/08	Easting:	2390849.439
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1			Background readings less than 2.0 ppm			
	1.7					SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCVWSB0123010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCVWSB0145010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB01
Sheet:	1 of 1

Boring: HCVWSB02

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469179.251
Date Finished:	11/18/08	Easting:	2390895.035
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1			Background readings less than 2.0 ppm			
	1.6					SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCVWSB0223010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCVWSB0245010811 & HCVWSB0245020811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB02
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469132.646
Date Finished:	11/18/08	Easting:	2390915.894
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCVWSB04

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1			Background readings less than 2.0 ppm			
	1.5					SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels			
				HCVWSB0423010811 (2.0' - 3.0')		
-3						
-4						
		1.0/1.0		HCVWSB0445010811& MS/MSD (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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A Geological Engineering and Environmental Services Company
Kevil, KY

U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB04
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	827236.00
Date Finished:	11/18/08	Easting:	865343.00
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCVWSB05

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1	1.2		Background readings less than 2.0 ppm			SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels	HCVWSB0523010811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCVWSB0545010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB05
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469069.981
Date Finished:	11/18/08	Easting:	2391014.694
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCVWSB06

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1			Background readings less than 2.0 ppm			
	1.6					SILTY CLAY: brown, moist, plastic, medium stiff, with iron and manganese nodules
-2		4.0/4.0	No readings exceeded background levels	HCVWSB0623010811 & HCVWSB0623030811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCVWSB0645010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB06
Sheet:	1 of 1

Client	USACE - Louisville District	Drilling Contractor:	IPS
Location:	Hanna City, IL	Drilling Method:	Direct Push
Project:	Hanna City Remedial Investigation	Surf. Elev:	0
Date Started:	11/18/08	Northing:	1469022.918
Date Finished:	11/18/08	Easting:	2390938.028
Geologist:	T. Calhoun	Total Depth of Boring:	5.0 feet

Boring: HCVWSB07

Elevation (ft)	Depth (ft) Lithologic Change	Core Recovery (Pen/Rec)	PID Reading	Sample ID	Lithology	Lithology Description
0						SILTY CLAY: dark brown to black, damp to moist, plastic, stiff
-1			Background readings less than 2.0 ppm			
-2	2.1	4.0/4.0	No readings exceeded background levels			SILTY CLAY: brown, moist, plastic, stiff to medium stiff, with iron and manganese nodules
				HCVWSB0723010811 (2.0' - 3.0')		
-3						
-4		1.0/1.0		HCVWSB0745010811 (4.0' - 5.0')		
-5						BOH @ 5 ft
-6						

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Kevil, KY

U.S. Army Corps of Engineers
Louisville District

Client:	USACE - Louisville District
Project:	Hanna City RI
Location:	Hanna City, IL
Borehole:	HCVWSB07
Sheet:	1 of 1

APPENDIX D

LABORATORY DATA REPORTS

APPENDIX E

REMEDIAL INVESTIGATION WELL SAMPLING LOGS

MONITORING WELL DATA SHEET

WELL NUMBER:	HCVWGW04	FREQUENCY:	Single	SAMPLE NUMBER:	HCVWGW04020811 HCVWGW04010811
DATE:	11/20/08	ARRIVAL TIME:	0745	DEPARTURE TIME:	0815
PURGE AMOUNT:	280 mL	PURGE START:	0758	PURGE STOP:	0759
WELL DEPTH:	20.00	WATER DEPTH:	6.60	POINT DATUM:	TOC (0.2 ft ags)
BAROMETER:	30.30	SAMPLE TIME:	0803	COC NUMBER:	-

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
0800	0.703	4.55	12.52	6.75	-25	2000
0803	0.721	3.43	12.40	6.79	-36	2000

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:

Collected filtered and unfiltered metals, TSS. Primary sample and field duplicate.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER:	HCVWGW05	FREQUENCY:	Single	SAMPLE NUMBER:	HCVWGW05010811
DATE:	11/20/08	ARRIVAL TIME:	0816	DEPARTURE TIME:	0841
PURGE AMOUNT:	200 mL	PURGE START:	0824	PURGE STOP:	0826
WELL DEPTH:	20.00	WATER DEPTH:	10.40	POINT DATUM:	TOC (1.0 ft ags)
BAROMETER:	30.30	SAMPLE TIME:	0830	COC NUMBER:	-

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
0826	0.627	4.42	11.56	7.27	68	110
0829	0.625	4.32	11.92	7.19	63	98.8

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during collection of TSS. Collected filtered and unfiltered metals and partial TSS. Primary sample.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCCAGW06 FREQUENCY: Single SAMPLE NUMBER: HCCAGW06010811

DATE: 11/20/08 ARRIVAL TIME: 0842 DEPARTURE TIME: 0905

PURGE AMOUNT: 211 mL PURGE START: 0847 PURGE STOP: 0852

WELL DEPTH: 20.00 WATER DEPTH: 9.91 POINT DATUM: TOC (0.88 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 0856 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
0852	0.531	5.03	11.30	7.43	111	67.9
0855	0.521	4.83	12.06	7.73	97	53.1

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during collection of TSS, approximately 100 mL collected. Collected filtered and unfiltered metals, partial TSS. Primary sample.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCVWGW07 FREQUENCY: Single SAMPLE NUMBER: HCVWGW07010811

DATE: 11/20/08 ARRIVAL TIME: 0907 DEPARTURE TIME: 0925

PURGE AMOUNT: 142 mL PURGE START: 0913 PURGE STOP: 0915

WELL DEPTH: 20.00 WATER DEPTH: 12.85 POINT DATUM: TOC (0.6 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 0918 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
0915	1.084	4.34	10.77	7.15	67	151

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:

Well pumped dry during collection of TSS. Collected filtered and unfiltered metals, partial TSS. Primary sample.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCCBGW09 FREQUENCY: Single SAMPLE NUMBER: HCCBGW09010811

DATE: 11/20/08 ARRIVAL TIME: 0745 DEPARTURE TIME: 0815

PURGE AMOUNT: 237 mL PURGE START: 0955 PURGE STOP: 1009

WELL DEPTH: 20.00 WATER DEPTH: 8.15 POINT DATUM: TOC (0.8 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 1000 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
0957	0.771	4.03	13.75	7.51	-60	171
1000	0.768	2.58	14.62	7.25	-60	106

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during collection of filtered metals. Collected filtered and unfiltered metals, no TSS. Primary sample, MS/MSD.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER:	HCPSGW05	FREQUENCY:	Single	SAMPLE NUMBER:	HCPSGW05030811 HCPSGW05010811
DATE:	11/20/08	ARRIVAL TIME:	1010	DEPARTURE TIME:	1039
PURGE AMOUNT:	186 mL	PURGE START:	1020	PURGE STOP:	1022
WELL DEPTH:	20.00	WATER DEPTH:	10.70	POINT DATUM:	TOC (0.65 ft ags)
BAROMETER:	30.30	SAMPLE TIME:	1026	COC NUMBER:	-

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
1022	0.671	4.07	11.63	7.29	19	123
1025	0.662	3.81	12.55	7.28	10	133

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during sample collection. Collected filtered lead for primary lab and filtered/unfiltered lead for QA lab, no TSS collected. Primary sample and QA split duplicate.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCPSGW04 FREQUENCY: Single SAMPLE NUMBER: HCPSGW04010811

DATE: 11/20/08 ARRIVAL TIME: 1040 DEPARTURE TIME: 1055

PURGE AMOUNT: 200 mL PURGE START: 1046 PURGE STOP: 1048

WELL DEPTH: 20.00 WATER DEPTH: 8.98 POINT DATUM: TOC (0.65 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 1050 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
1048	0.612	3.49	12.21	7.39	-9	65.9

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:

Well pumped dry during collection of TSS. Collected filtered/unfiltered lead, partial TSS collected. Primary sample.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) **CLOUDY** RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCPSGW02 FREQUENCY: Single SAMPLE NUMBER: HCPSGW02030811 HCPSGW02010811

DATE: 11/20/08 ARRIVAL TIME: 1100 DEPARTURE TIME: 1106

PURGE AMOUNT: 280 mL PURGE START: 1104 PURGE STOP: 1106

WELL DEPTH: 20.00 WATER DEPTH: 5.03 POINT DATUM: TOC (0.75 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 1026 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
1106	0.627	3.71	12.92	7.21	56	6.81

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during sample collection. Collected filtered/unfiltered lead, TSS for primary lab, partial TSS for QA lab.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) CLOUDY RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER:	HCPSGW03	FREQUENCY:	Single	SAMPLE NUMBER:	HCPSGW03010811
DATE:	11/20/08	ARRIVAL TIME:	1121	DEPARTURE TIME:	1132
PURGE AMOUNT:	280 mL	PURGE START:	1125	PURGE STOP:	1126
WELL DEPTH:	20.00	WATER DEPTH:	5.56	POINT DATUM:	TOC (0.79 ft ags)
BAROMETER:	30.30	SAMPLE TIME:	1127	COC NUMBER:	-

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
11126	0.608	3.52	12.55	7.19	58	152

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:

Well pumped dry during sample collection. Collected unfiltered lead and TSS for primary lab plus MS/MSD pair.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) CLOUDY RAINY SUNNY SNOWY

SIGNATURE:

MONITORING WELL DATA SHEET

WELL NUMBER: HCCCGW06 FREQUENCY: Single SAMPLE NUMBER: HCCCGW06010811

DATE: 11/20/08 ARRIVAL TIME: 1135 DEPARTURE TIME: 1142

PURGE AMOUNT: 250 mL PURGE START: 1139 PURGE STOP: 1140

WELL DEPTH: 20.00 WATER DEPTH: 7.57 POINT DATUM: TOC (1.3 ft ags)

BAROMETER: 30.30 SAMPLE TIME: 1140 COC NUMBER: -

PROJECT: HCAFS RI/FS CONTRACT NO./DELIVERY ORDER: W912QR-04-D-0030/0018

SAMPLED BY: JT/TC

FIELD PARAMETERS

Time	Cond. (µmhos/cm)	D.O. (mg/L)	Temp (°C)	pH (SU)	ORP (mv)	Turbidity (NTU)
1140	0.695	4.53	12.11	6.49	112	512

EQUIPMENT DECON

DESCRIPTION: NA TIME: -

COMMENTS AND OBSERVATIONS:
Well pumped dry during sample collection. Collected filtered/unfiltered metals for primary lab, and unfiltered metals for QA split sample.

REQUIRED ANALYSES: Metals (filtered/unfiltered), TSS

FIELD CONDITIONS: Normal TEMPERATURE: 33ºF

WEATHER CONDITIONS: (circle one) CLOUDY RAINY SUNNY SNOWY

SIGNATURE:

APPENDIX F

GROUNDWATER FIELD PARAMETERS FROM REMEDIAL INVESTIGATION

Well ID	Date/Time	Conductivitiy (umhos/cm)	Dissolved Oxygen (mg/L)	Temperature C	pH	Oxidation Reduction Potential mV	Turbidity NTU	Remarks (a)
HCCAGW06	11/20/08 8:55	0.521	4.83	12.06	7.37	97	53.1	well pumped dry towards the end of sampling
HCCBGW09	11/20/08 10:00	0.768	2.58	14.62	7.25	-60	106	well pumped dry towards the end of sampling
HCCCGW06	11/19/08 11:40	0.695	4.53	12.11	6.49	112	512	well pumped dry towards the end of sampling
HCPSGW02	11/20/08 11:06	0.627	3.71	12.92	7.21	56	6.81	well pumped dry towards the end of sampling
HCPSGW03	11/20/08 11:26	0.608	3.52	12.55	7.19	58	152	well pumped dry towards the end of sampling
HCPSGW04	11/20/08 10:48	0.612	3.49	12.21	7.39	-9	65.9	well pumped dry towards the end of sampling
HCPSGW05	11/20/08 10:25	0.662	3.81	12.55	7.28	10	133	well pumped dry towards the end of sampling
HCVWGW04	11/20/08 8:03	0.721	3.43	12.4	6.79	-36	2000	only well that did not pump dry
HCVWGW05	11/20/08 8:29	0.625	4.32	11.92	7.19	63	98.8	well pumped dry towards the end of sampling
HCVWGW07	11/20/08 9:15	1.084	4.34	10.77	7.15	67	151	well pumped dry towards the end of sampling

(a) primary groundwater samples were collected from all wells. Well pumped dry during the collection of the TSS (last one collected) sample

APPENDIX G

ECOLOGICAL RECONNAISSANCE REPORT

29 April 2009

Mr. Todd Calhoun, P.G.
GEO Consultants, LLC
199 Kentucky Avenue
P.O Box 95
Kevil, KY 42053
Phone: (270) 462-3882
Fax: (270) 519-4051

Re: *Baseline Risk Assessment, former Hanna City Air Force Station, Peoria County, Illinois*
ES Project Number 1203-2653

Dear Mr. Calhoun:

An EnviroScience biologist visited the former Hanna City Air Force Station on November 18, 2008 to determine if any significant ecological resources exist onsite and to complete the U.S. Army Corps of Engineers ecological checklist provided by GEO Consultants (attached). Maps, aerial photographs, and photographs taken onsite are also included.

The site was used as a minimum security prison (Hanna City Work Camp) and by the Federal Aviation Administration (FAA) as a navigation facility; the Hanna City Work Camp was closed in the 1990's and the FAA facility is still in use. The FAA facility is located in the center of the site; several buildings are present and surrounded by mowed lawn and landscaped shrubs. The closed Hanna City Work Camp consists mainly of new field habitat with landscaped trees and shrubs throughout. Buildings are located throughout the site, and paved roads and parking lots provide access to these buildings. A running track is located in the southwest corner of the site and two large waste water treatment ponds are located along the east side of the site. Two settling basins are located in the southeast corner of the site. An additional small water treatment pond is located in the south-central portion of the study area. The three water treatment ponds contain wetland habitat. Non-jurisdictional ditches are located along both sides of the paved road running north-south through the center of the site. These ditches carry site runoff during times of precipitation.

Wildlife observed included dark-eyed juncos, northern cardinals, mourning doves, house sparrows, field sparrows and an eastern cottontail rabbit. Trees located onsite do not contain suitable habitat for the federally endangered Indiana bat (*Myotis sodalis*). Furthermore, a search was conducted for the federally threatened eastern prairie fringed orchid (*Platanthera leucophaea*), the federally threatened decurrent false aster (*Boltonia decurrens*), and the federally threatened prairie bush clover (*Lespedeza leptostachya*) and none of these species or their habitat were identified.

Potential contaminants based on historic uses include VOC's, PAH's and metals. If you wish to discuss the findings of this ecological assessment, I can be reached by phone (330) 688-0111 or by email at bharrison@enviroscienceinc.com.

Respectfully,

Brooke Harrison

Brooke Harrison
Senior Wetland Scientist

enc: Ecological Checklists
Maps
Site Photographs

ATTACHMENT A
ECOLOGICAL SCOPING CHECKLIST

ECOLOGICAL ASSESSMENT CHECKLIST

The evaluation associated with the checklist is intended to be a screening-level survey of the developed and undeveloped/ecological portions of the site. The checklist is patterned after ERAGS Appendix A - Checklist for Ecological Assessment/Sampling, June 1997 and consists of five major sections: 1 - Site Description, 2 - Terrestrial Habitat Checklist, 3 - Aquatic Habitat Checklist (non-flowing systems), 4 - Aquatic Habitat Checklist (flowing systems), and 5 - Wetlands Habitat Checklist. Answers to the checklist should reflect existing conditions and should not consider future remedial actions at the site.

In general, the checklist is designed for applicability to all sites, however, there may be unusual circumstances which require professional judgment in order to determine the need for further ecological evaluation. Sources and general information available for the identification of ecological receptors and habitats may include: the U.S. Fish and Wildlife Service (http://www.fws.gov), State Game and Fish Conservation Services, United States Geological Service (USGS), National Wetland Inventory Maps (http://nwi.fws.gov) National Audubon Society, National Biological Survey, national and local wildlife clubs, National and State Heritage Programs, State and National Parks System, and tribal organizations.

Section 1. Site Description

1. Site Name: Hanna City Air Force Station

Location: Ten miles west of the City of Peoria in Peoria County, Illinois
Route 116 (North Farmington Rd), between N Conn Rd and N Eden Rd

County/Parish: Peoria City: Hanna City

State: Illinois

Type of Facility:

Former USAF radar tracking and navigation facility; now a closed minimum security prison, and active navigation facility (FAA)

2. Latitude: N 40.699038° Longitude: W 89.825595°

3. What is the approximate area of the site?

42.89-acres

4. Is this the first site visit? Yes X No _____. If no, attach trip report of previous site visit(s), if available. Date(s) of previous site visit(s):_____

5. Please attach to the checklist USGS topographic map(s) of the site, if available.

6. Are aerial or other site photographs available? Yes X No ____. If yes, please attach any available photo(s) to the site map at the conclusion of this section.

7. The land use on the site is: The area surrounding the site is:

0.5 mile radius

100 % Urban 0 % Urban

0 % Rural 0 % Rural

0 % Residential 0 % Residential

0 % Industrial __ light __ heavy 0 % Industrial __ light __ heavy

0 % Agriculture 100 % Agriculture

(Crops: _____) (Crops: Corn)

0 % Recreational 0 % Recreational

(Describe; note if it is a park, etc.) (Describe; note if it is a park, etc.)

0 % Undisturbed 0 % Undisturbed

0 % Other 0 % Other

8. Has any movement of soil taken place at the site? Yes X No ___. If yes, please identify the most likely cause of this disturbance:

_____ Agricultural Use X Heavy Equipment _____ Mining

_____ Natural Events _____ Erosion _____ Other

Please describe: Site used as a prison facility and navigation facility; surrounding area agricultural

9. Do any potentially sensitive environmental areas exist adjacent to or in proximity to the site, e.g., Federal and State parks, National and State Monuments, wetlands, prairie potholes? *Remember, flood plains and wetlands are not always obvious; do not answer "no" without confirming information.*

No sensitive areas within 0.5 miles of site.

10. What type of facility is located at the site?

_____ Chemical_____ Manufacturing _____ Mixing _____ Waste Disposal

__X__ Other (specify) Minimum security prison (IDOC), and navigation facility (FAA)

11. What are the suspected contaminants of concern at the site? If known, what are their maximum concentration levels?

VOCs, PAHs and metals (specifically Arsenic).

12. Check any potential routes of off-site migration of contaminants observed at the site:

_____ Swales _____ Depressions __X__ Drainage ditches

_____ Runoff _____ Windblown particulate __X__ Vehicular traffic

_____ Other (specify) _____

13. If known, what is the approximate depth to the water table? Unknown

14. Is the direction of surface runoff apparent from site observations? Yes _X_ No ___. If yes, to which of the following does the surface runoff discharge? Indicate all that apply.

_____ Surface water _____ Groundwater _____ Sewer __X__ Collection impoundment

15. Is there a navigable waterbody or tributary to a navigable waterbody? Yes ___ No _X_.

16. Is there a waterbody anywhere on or in the vicinity of the site? If yes, also complete Section 3: Aquatic Habitat Checklist - non-flowing systems and /or Section 4: Aquatic Habitat Checklist - flowing systems.

Yes _X__ (approximate distance 2 ponds-0.29AC, 0.15AC)) No _____.

17. Is there evidence of flooding? Yes _X___ No _____. *Wetlands and flood plains are not always obvious; do not answer "no" without confirming information.* If yes, complete Section 5: Wetland Habitat Checklist.

Ponded areas include wetland vegetation. Section 5 completed by Brooke Harrison, Senior Wetland Scientist.

18. If a field guide was used to aid any of the identifications, please provide a reference. Also, estimate the time spent identifying the fauna. (Use a blank sheet if additional space is needed for text).

Braun, E.L. 1989. Woody Plants of Ohio. Ohio State University Press, Columbus, OH.

Fauna identified by scat or visual observation during site visit (est. time of observation:4h)

19. Are any threatened and/or endangered species (plant or animal) known to inhabit the area of the site? Yes _____ No __X__. *If yes, you are required to verify this information with the U.S. Fish and Wildlife Service.*

If species identities are known, please list them in the text.

Illinois Dept of Natural Resources, Natural Heritage Database has no records of listed species within the site. See attached letter.

20. Record weather conditions at the time this checklist was prepared:

Date: November 18, 2008

____40_____ Temperature (^{0}C /^{0}F) ____35_____ Normal daily high temperature

_NE 4mph___ Wind (direction/speed) _None_____ Precipitation (rain,snow)

____5%_____ Cloud cover

Section 1A. Summary of Observations and Site Setting

The study area consists of an closed minimum security prison facility and a Federal Aviation Administration (FAA) facility. The FAA facility is located in the center of the site and is currently in use. Buildings are located throughout the site, paved roads and parking lots provide access to these buildings. A track is located in the southwest corner of the site and two large waste water treatment ponds are located along the east side of the site. Two settling basins are located in the southeast corner of the site. An additional small water treatment pond is located in the south-central portion of the study area. Terrestrial habitat consists of new fallow field with landscaped trees and shrubs throughout.

Completed by Brooke Harrison Affiliation EnviroScience, Inc.

Additional Preparers Jeffrey Niehaus

Site Manager _____

Date 18 November 2008

Section 2. Terrestrial Habitat Checklist

Section 2A. Wooded

1. Are there any wooded areas on the site? Yes _____ No X. If no, go to Section IIB: Shrub/Scrub.

2. What percentage of the area of the site is wooded? (_____ % _____ acres). Indicate the wooded area on the site map which is attached to a copy of this checklist. Please identify what information was used to determine the wooded area of the site.

_____

_____

3. What is the dominant type of vegetation in the wooded area?
(Circle one: Evergreen/Deciduous/Mixed) Provide a photograph if available.
Dominant plant, if known: _____

4. What is the predominant size of the trees at the site? Use diameter at breast height.
_____ 0-6 inches _____ 6-12 inches _____ > 12 inches

5. Specify type of understory present, if known. Provide a photograph, if available. _____

_____

_____

Section 2B. Shrub/scrub

1. Is shrub/scrub vegetation present at the site? Yes _____ No X. If no, go to Section IIC: Open Field.

2. What percentage of the site is covered by shrub/scrub vegetation? (_____ % _____ acres). Indicate the acres of shrub/scrub on the site map. Please identify what information was used to determine this area.

_____

_____

3. What is the dominant type of shrub/scrub vegetation, if known? Provide a photograph if available.

_____

4. What is the approximate average height of the shrub/scrub vegetation?
_____ 0-2 feet _____ 2-5 feet _____ > 5 feet

5. Based on site observations, how dense is the shrub/scrub vegetation?
_____ Dense _____ patchy _____ Sparse

Section 2C. Open Field

1. Are there open (bare, barren) field areas present at the site? Yes X No _____. If yes, please indicate the type below:
_____ Prairie/plains _____ Savannah _____ Old field _____ Other (specify) New fallow field

_____

2. What percentage of the site is open field? (85 % 36.46 acres). Indicate the open field areas on the site map.

3. What is/are the dominant plant plants? Provide a photograph if available. Kentucky bluegrass, goldenrod, dandelion, aster

4. What is the approximate average height of the dominant plant? 1ft

5. Describe the vegetation cover: _X__ Dense _____ Sparse _____ Patchy

Section 2D. Miscellaneous

1. Are other types of terrestrial habitats present at the site, other than woods, shrub/scrub, and open field?

Yes _X__ No _____. If yes, identify and describe below. Mowed grass on the FAA facility.

2. Describe the terrestrial miscellaneous habitat(s) and identify these areas on the site map.

3. What observations, if any, were made at the site regarding the presence and/or absence of insects, fish, birds, mammals, etc?

Present throughout the site at the site visit: dark-eyed juncos, field sparrows, black-capped chickadees, northern cardinals, mourning doves, house sparrows, eastern cottontail rabbit.

4. Review the questions in Section I to determine if any additional habitat checklists should be completed for this site.

Section 3. Aquatic Habitat Checklist – Non-flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section 5, Wetland Habitat Checklist.

1. What type of open-water, non-flowing system is present at the site?

_____ Natural (pond or lake)

_X__ Artificially created (lagoon, reservoir, canal, impoundment)

2. If known, what is the name(s) of the waterbody(ies) on or adjacent to the site?

Unknown

3. If a waterbody is present, what are its known uses (e.g., recreation, navigation, etc.)?

Waste water treatment ponds(2)

4. What is the approximate size of the waterbody(ies)? 0.29Ac and 0.15Ac acre(s).

5. Is any aquatic vegetation present? Yes _X__ No _____. If yes, please identify the type of vegetation present, if known.

_X__ Emergent _____ Submergent _X__ Floating

6. If known, what is the depth of the water? Unknown

7. What is the general composition of the substrate? Check all that apply.

_____ Bedrock _____ Sand _____ Muck (fine/black)

_____ Boulder (>10 in.) _____ Silt (fine) _____ Debris

_____ Cobble (2.5-10 in.) _____ Marl (shells) _____ Detritus

_____ Gravel (0.1-2.5 in.) _____ Clay (slick) _____ Concrete

_X__ Other (specify) Unknown

8. What is the source of water in the waterbody?

_____ River/Stream/Creek _____ Groundwater _X__ Other (specify) Waste water discharge

_____ Industrial discharge _____ Surface runoff

9. Is there a discharge from the site to the waterbody? Yes _X__ No _____. If yes, please describe this discharge and its path.

Discharge no longer occurs, but before the facility was shut down waste water was discharged to these ponds for treatment.

10. Is there a discharge from the waterbody? Yes _____ No _X___. If yes, and the information is available, identify from the list below the environment into which the waterbody discharges.
_____ River/Stream/Creek _____ onsite offsite _____ Distance _____
_____ Groundwater _____ onsite offsite _____
_____ Wetland _____ onsite offsite _____ Distance _____
_____ Impoundment _____ onsite offsite _____
11. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected provide the measurement and the units of measure below:
_____ Area
_____ Depth (average)
_____ pH
_____ Dissolved oxygen
_____ Salinity
_____ Turbidity (clear, slightly turbid, turbid, opaque) (Secchi disk depth _____)
_____ Other (specify)

NONE TAKEN

12. Describe observed color and area of coloration. _____
Water appears to be light brown in color; iced over.
13. Mark the open-water, non-flowing system on the site map attached to this checklist.
14. What observations, if any were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds mammals, etc.?_____
Birds observed using the emergent vegetation; no other wildlife observed. Ponds were only visually examined, no formal sampling for fish or macroinvertebrates conducted.

Section 4. Aquatic Habitat Checklist – Flowing Systems

Note: Aquatic systems are often associated with wetland habitats. Please refer to Section 5, wetland Habitat Checklist.

1. What type(s) of flowing water system(s) is (are) present at the site?
_____ River _____ Stream _____ Creek
_____ Dry wash _____ Arroyo _____ Brook
_____ Artificially created _____ Intermittent stream _X__ Channeling (ditch, etc,) _____ Other (specify) _____
2. If known, what is the name of the waterbody? No name; vegetated upland ditches.
3. For natural systems, are there any indicators of physical alteration (e.g., channeling, debris, etc.)? Yes _____ No _____. If yes, please describe indicators that were observed.
N/A
4. What is the general composition of the substrate? Check all that apply.
_____ Bedrock _____ Sand _____ Muck (fine/black)
_____ Boulder (>10 in.) _____ Silt (fine) _____ Debris
_____ Cobble (2.5-10 in.) _____ Marl (shells) _____ Detritus
_____ Gravel (0.1-2.5 in.) _____ Clay (slick) _____ Concrete
_X__ Other (specify) upland ditches vegetated
5. What is the condition of the bank (e.g., height, slope, extent of vegetative cover)? _____
Banks vegetated.
6. Is the system influenced by tides? Yes _____ No _X__. What information was used to make this determination?_____

7. Is the flow intermittent? Yes __X__ No _____. If yes, please note the information that was used in making this determination. Upland ditches drain site only during times of precipitation.

8. Is there a discharge from the site to the waterbody? Yes _____ No __X__. If yes, please describe the discharge and its path. _____

9. Is there a discharge from the waterbody? Yes _____ No __X__. If yes, and the information is available, please identify what the waterbody discharges to and whether the discharge in onsite or off site._____

10. Identify any field measurements and observations of water quality that were made. For those parameters for which data were collected, provide the measurement and the units of measure in the appropriate space below:

_____ Width (feet)
_____ Depth (feet)
_____ Velocity (specify units)
_____ Temperature (depth of the water at which the temperature was taken)
_____ pH
_____ Dissolved oxygen
_____ Salinity
_____ Turbidity (clear, slightly turbid, turbid, opaque)
(Secchi disk depth _____)
_____ Other (specify) _____

NONE TAKEN

11. Described observed color and area of coloration. N/A

12. Is any aquatic vegetation present? Yes _____ No __X__. If yes, please identify the type of vegetation present, if known.

_____ Emergent _____ Submergent _____ Floating

13. Mark the flowing water system on the attached site map.

14. What observations were made at the waterbody regarding the presence and/or absence of benthic macroinvertebrates, fish, birds, mammals, etc.? No species observed.

Section 5. Wetland Habitat Checklist

1. Based on observations and/or available information, are designated or know wetlands definitely present at the site? Yes __X__ No _____.

Please note the sources of observations and information used (e.g., USGS Topographic maps, National Wetland Inventory, Federal or State Agency, etc.) to make this determination.

Site observations.

2. Based on the location of the site (e.g., along a waterbody, in a floodplain) and site conditions (e.g., standing water; dark, wet soils; mud cracks; debris line; water marks), are wetland habitats suspected? Yes __X__ No _____. If yes, proceed with the remainder of the wetland habitat identification checklist.

3. What type(s) of vegetation are present in the wetland?
_____ Submergement __X__ Emergent
_____ Shrub/scrub _____ Wooded
_X__ Other (specify) _Floating_____

4. Provide a general description of the vegetation present in and around the wetland (height, color, etc.). Provide a photograph of the known or suspected wetlands, if available.
Emergent vegetation consists of cattail and floating vegetation consists of duck weed.

5. Is standing water present. Yes _X_ No ____. If yes, is this water: Fresh _X__ Brackish _____
What is the approximate area of the water (sq. ft.)? 12575.8 sq. ft. and 6603.6 sq. ft.
Please complete questions 4, 11, 12 in Checklist 3 - Aquatic Habitat -- Non-Flowing Systems.

6. Is there evidence of flooding at the site? What observations were noted?
_____ Buttressing _____ Water marks _____ Mud cracks
_____ Debris line _____ Other (describe below)

7. If known, what is the source of water in the wetland?
_____ Stream/River/Creek/Lake/Pond _____ Groundwater
_____ Flooding _____ Surface runoff

8. Is there a discharge from the site to a known or suspected wetland? Yes _X__ No _____. If yes, please describe.
Discharge no longer occurs, but when the facility was in use waste water was discharged into these waste water treatment ponds.

9. Is there a discharge from the wetland? Yes _____ No _X__. If yes, to what water body is the discharge released?
_____ Surface stream/River _____ Groundwater _____ Lake/pond _____ Marine

10. If a soil sample was collected, describe the appearance of the soil in the wetland area. Circle or write in the best response.
Color (blue/gray, brown, black, mottled) _____
Water content (dry, wet, saturated/unsaturated) _____

11. Mark the observed wetland area(s) on the attached site map.

ATTACHMENT B
SITE MAPS AND AERIAL PHOTOS

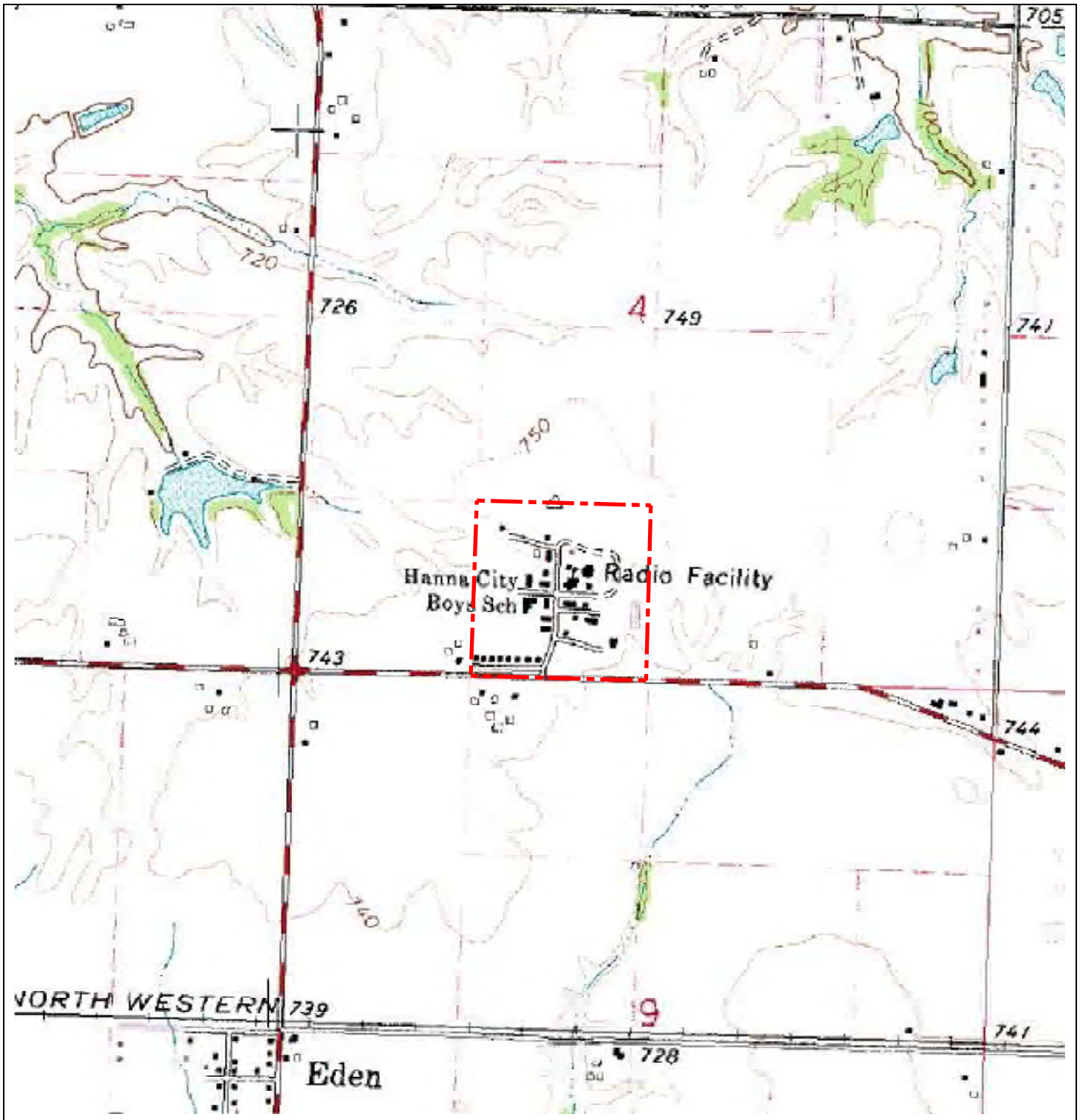

Figure 1. Topographic Map Showing Study Area, Former Hanna City Air Force Station, Hanna City, IL.	1:1070 scale	ES ENVIRO SCIENCE INCORPORATED *Excellence in Ecological Monitoring*

Figure 2. National Wetland Inventory Map showing Study Area, Former Hanna City Air Force Station, Hanna City, IL.	1:600 Scale	ES ENVIRO SCIENCE INCORPORATED *Excellence in Ecological Monitoring*

Figure 3. Aerial Photograph showing Study Area, Ecological Resources, and Photograph Locations, Former Hanna City Air Force Station, Hanna City, Illinois.

ES ENVIRO SCIENCE INCORPORATED

Excellence in Ecological Monitoring

ATTACHMENT C
SITE PHOTOGRAPHS

Photo 1. Facing west, view of roadway and buildings in the southeast corner of the study area.

Photo 2. Facing south, view of track located in southwest corner of the study area.

Photo 3. Facing east, typical view of roadway and buildings.

Photo 4. Facing south, view of dominant new fallow field habitat.

Photo 5. Facing northeast, view of new fallow field habitat and overgrown garden in background.

Photo 6. Facing south, view of new fallow field habitat and buildings.

Photo 7. Facing north, view of overgrown baseball field diamond.

Photo 8. Looking southwest, view of new field habitat and FAA facility in background.

Photo 9. Facing south, view of non-jurisdictional roadside ditch and culverts.

Photo 10. Facing north, view of non-jurisdictional roadside ditch and culverts.

Photo 11. Facing east, view of typical roadway and buildings.

Photo 12. Facing northwest, view of palustrine emergent wetland fringe (Wetland A) in northeast corner of waste water treatment pond.

Photo 13. Facing southwest, view of waste water treatment pond.

Photo 14. Facing southwest, view of palustrine emergent wetland fringe (Wetland B) around waste water treatment pond.

Photo 15. Facing south, view of settling basins.

Photo 16. Facing W, view of new fallow field habitat.

Photo 17. Facing northwest, typical view of Hanna City Work Camp.

Photo 18. Looking northwest, view of palustrine emergent Wetland C.

ATTACHMENT D
AGENCY COMMUNICATIONS
ILLINOIS DEPARTMENT OF NATURAL RESOURCES
U.S. FISH AND WILDLIFE SERVICE

EcoCAT
Ecological Compliance Assessment Tool

Applicant:	Brooke Harrison	*IDNR Project #:*	0904037
Contact:	Brooke Harrison	Alternate #:	2653
Address:	3781 Darrow Road Stow, OH 44224	Date:	11/20/2008

Project: Former Hanna City Air Force Station
Address: 42.89 AC parcel located between Conn Road and Eden Road, 10 miles west of Peoria, IL, Hanna City

Description: Baseline Risk Assessment for the Former Hanna City Air Force Station.

Natural Resource Review Results

This project was submitted for information only. It is not a consultation under Part 1075.

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Peoria

Township, Range, Section:
8N, 6E, 4

IL Department of Natural Resources Contact
Impact Assessment Section
217-785-5500
Division of Ecosystems & Environment

Disclaimer
The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

3. IDNR reserves the right to enhance, modify, alter, or suspend the website at any time without notice, or to terminate or restrict access.

Security

EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

Privacy

EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

Peoria	Indiana bat	*Myotis sodalis*	Endangered	Caves, mines (hibernacula); small stream corridors with well developed riparian woods; upland forests (foraging)
	Eastern prairie fringed orchid	*Platanthera leucophaea*	Threatened	Mesic to wet prairies
	Prairie bush clover	*Lespedeza leptostachya*	Threatened	Dry to mesic prairies with gravelly soil
	Decurrent false aster	*Boltonia decurrens*	Threatened	Disturbed alluvial soils

APPENDIX H

DATA VALIDATION REPORTS FOR THE SITE INPECTION (TtEC) AND REMEDIAL INVESTIGATION (GEO)

LABORATORY DATA CONSULTANTS, INC.
7750 El Camino Real, Suite 2L Carlsbad, CA 92009 Phone: 760/634-0437 Fax: 760/634-0439

Geo Consultants, LLC
199 Kentucky Avenue
Kevil, KY 42053
ATTN: Mr. Todd Calhoun

February 26, 2009

SUBJECT: Hanna City AFS, RI/FS, Data Validation

Dear Mr. Calhoun

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on February 2, 2009. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project # 20223:

SDG #	Fraction
0808247, 0811250, 0811251, 0811280, 0811299, 0811300	Polynuclear Aromatic Hydrocarbons, Metals, Arsenic, Total Suspended Solids, pH

The data validation was performed under Full validation guidelines. The analyses were validated using the following documents, as applicable to each method:

- U.S. Army Corps of Engineers (USACE) Louisville Quality System Manual Supplement (LQSMS), March 2007
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version, January 2006
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; Update IV, February 2007

Please feel free to contact us if you have any questions.

Sincerely,

Stella Cuenco

Stella S. Cuenco
Project Manager/Senior Chemist

V:\LOGIN\GEOCONS\HANNA\20223COV.wpd

Attachment 1

3,500 pages-CD

LDC #20223 (GEO Consultants, LLC - Kevil, KY / Hanna City AFS RI/FS)

Project #20080003.5

LDC	SDG#	DATE REC'D	(3) DATE DUE	PAHs (8270C -SIM)		Metals (SW846)		Diss. Metals (SW846)		As (6010B)		Pb (6010B)		Diss. Pb (6010B)		TSS (2540D)		pH (9045B)																					
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	0808247	02/03/09	02/24/09	1	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-																				
B	0811250	02/03/09	02/24/09	0	13	-	-	-	-	0	9	-	-	-	-	-	-	0	1																				
C	0811251	02/03/09	02/24/09	-	-	-	-	-	-	0	22	-	-	-	-	-	-	0	2																				
D	0811280	02/03/09	02/24/09	0	18	-	-	-	-	2	15	-	-	-	-	-	-	0	1																				
E	0811299	02/03/09	02/24/09	-	-	6	0	8	0	-	-	-	-	-	-	5	0	-	-																				
F	0811300	02/03/09	02/24/09	-	-	1	0	1	0	-	-	5	0	2	0	3	0	-	-																				
Total	T/LR			1	82	7	0	9	0	2	46	5	0	2	0	8	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS/MSD, and DUPs

20223ST.wpd

Hanna City AFS, RI/FS
Data Validation Reports
LDC# 20223

Polynuclear Aromatic Hydrocarbons

LDC

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Hanna City AFS RI/FS

Collection Date: August 25, 2008

LDC Report Date: February 25, 2009

Matrix: Soil/Water

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Full Review

Laboratory: Empirical Laboratories, LLC

Sample Delivery Group (SDG): 0808247

Sample Identification

HCMESS01010808
HCMESS02010808
HCMESS03010808
HCMESS04010808
HCMESS04010808DL
HCMESS05010808
HCMESS06010808
HCMBSS01010808
HCMBSS02010808
HCMBSS03010808
HCMBSS04010808
HCMBSS05010808
HCMBSS06010808
HCVWSS01010808
HCVWSS02010808
HCVWSS02020808
HCVWSS03010808
HCVWSS04010808
HCVWSS05010808
HCVWSS06010808
HCVWSS06010808DL
HCPSSS01010808
HCPSSS02010808
HCPSSS03010808
HCPSSS04010808
HCPSSS05010808
HCCASS01010808
HCCASS02010808
HCCASS03010808
HCCASS04010808
HCCASS04020808
HCCASS05010808
HCCASS06010808
HCCASS07010808
HCCCSS01010808
HCCCSS02010808
HCCCSS03010808
HCCCSS04010808
HCCCSS05010808
HCCCSS05020808
HCCCSS05020808DL
HCCCSS06010808
HCCCSS07010808
HCCBSS01010808
HCCBSS02010808
HCCBSS02020808
HCCBSS03010808
HCCBSS04010808
HCCBSS05010808
HCCBSS06010808
HCCBSS07010808
HCEB01020808
HCPSS04010808MS
HCPSS04010808MSD
HCCASS06010808MS
HCCASS06010808MSD

Introduction

This data review covers 55 soil samples and one water sample listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8270C using Selected Ion Monitoring (SIM) for Polynuclear Aromatic Hydrocarbons.

The review follows the U.S. Army Corps of Engineers (USACE) Louisville Quality System Manual Supplement (LQSMS), March 2007, and the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version (January 2006).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

B The compound or analyte was found in an associated blank as well as in the sample.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals. All ion abundance requirements were met with the following exceptions:

Sample	Compound	Total Time From DFTPP Tuning Until Analysis	Required Analysis Time From DFTPP Tuning Until Analysis	Flag	A or P
HCCCSS05020808	All TCL compounds	12 hours 2 minutes	12 hours	None	P

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for all calibration check compounds and less than or equal to 30.0% for all other compounds.

A curve fit, based on the initial calibration, was established for quantitation for selected compounds. The coefficient of determination (r^2) was greater than or equal to 0.990 .

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were less than or equal to 20.0% for all compounds.

The percent difference (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polynuclear aromatic hydrocarbon contaminants were found in the method blanks with the following exceptions:

Method Blank ID	Extraction Date	Compound TIC (RT in minutes)	Concentration	Associated Samples
SBLK0829BW1	8/29/08	Benzo(a)anthracene Benzo(a)pyrene Chrysene Fluoranthene Fluorene 2-Methylnaphthalene Naphthalene Phenanthrene Pyrene	0.021 ug/L 0.0072 ug/L 0.016 ug/L 0.034 ug/L 0.014 ug/L 0.012 ug/L 0.019 ug/L 0.042 ug/L 0.028 ug/L	HCEB01020808

Sample concentrations were compared to concentrations detected in the method blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated method blanks with the following exceptions:

Sample	Compound TIC (RT in minutes)	Reported Concentration	Modified Final Concentration
HCEB01020808	2-Methylnaphthalene Naphthalene Phenanthrene	0.0074 ug/L 0.016 ug/L 0.016 ug/L	0.0074B ug/L 0.016B ug/L 0.016B ug/L

Sample HCEB01020808 was identified as an equipment blank. No polynuclear aromatic hydrocarbon contaminants were found in this blank with the following exceptions:

Equipment Blank ID	Sampling Date	Compound	Concentration	Associated Samples
HCEB01020808	8/25/08	Fluoranthene	0.015 ug/L	HCMESS01010808
		2-Methylnaphthalene	0.0074 ug/L	HCMESS02010808
		Naphthalene	0.016 ug/L	HCMESS03010808
		Phenanthrene	0.016 ug/L	HCMESS04010808
				HCMESS04010808DL
				HCMESS05010808
				HCMESS06010808
				HCMBSS01010808
				HCMBSS02010808
				HCMBSS03010808
				HCMBSS04010808
				HCMBSS05010808
				HCMBSS06010808
				HCVWSS01010808
				HCVWSS02010808
				HCVWSS02020808
				HCVWSS03010808
				HCVWSS04010808
				HCVWSS05010808
				HCVWSS06010808
				HCVWSS06010808DL
				HCPSSS01010808
				HCPSSS02010808
				HCPSSS03010808
				HCPSSS04010808
				HCPSSS05010808
				HCCASS01010808
				HCCASS02010808
				HCCASS03010808
				HCCASS04010808
				HCCASS04020808
				HCCASS05010808
				HCCASS06010808
				HCCASS07010808
				HCCCSS01010808
				HCCCSS02010808
				HCCCSS03010808
				HCCCSS04010808
				HCCCSS05010808
				HCCCSS05020808
				HCCCSS05020808DL
				HCCCSS06010808
				HCCCSS07010808
				HCCBSS01010808
				HCCBSS02010808
				HCCBSS02020808
				HCCBSS03010808
				HCCBSS04010808
				HCCBSS05010808
				HCCBSS06010808
				HCCBSS07010808

Sample concentrations were compared to concentrations detected in the field blanks. The sample concentrations were either not detected or were significantly greater (>10X for common contaminants, >5X for other contaminants) than the concentrations found in the associated field blanks.

VI. Surrogate Spikes

Surrogates were added to all samples and blanks as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Compound	Flag	A or P
HCCASS02010808	2-Fluorobiphenyl Terphenyl-d14	26 (45-105) 38 (30-125)	All TCL compounds	J (all detects) UJ (all non-detects)	P
HCCASS03010808	2-Fluorobiphenyl Terphenyl-d14	13 (45-105) 21 (30-125)	All TCL compounds	J (all detects) UJ (all non-detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	RPD (Limits)	Flag	A or P
HCCASS06010808MS/MSD (HCCASS06010808)	Benzo(a)anthracene Acenaphthylene	113 (50-110) -	118 (50-110) 106 (45-105)	- -	J (all detects) J (all detects)	A
HCPSS04010808MS/MSD (HCPSSS04010808)	Acenaphthylene	111 (45-105)	110 (45-105)	-	J (all detects)	A
HCPSS04010808MS/MSD (HCPSSS04010808)	Benzo(a)anthracene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Indeno(1,2,3-cd)pyrene	0 (50-110) 24 (45-125) 0 (40-125) 0 (50-110) 0 (55-110) 0 (40-120)	0 (50-110) 14 (45-125) 0 (40-125) 0 (50-110) 0 (55-110) 0 (40-120)	- - - - - -	J (all detects) UJ (all non-detects)	A

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits.

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

All internal standard areas and retention times were within QC limits.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
HCMESS04010808	Fluoranthene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
HCVWSS06010808	Fluoranthene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
HCMESS04010808	Fluoranthene Pyrene	R R	A
HCMESS04010808DL	All TCL compounds except Fluoranthene Pyrene	R	A
HCVWSS06010808	Fluoranthene	R	A
HCVWSS06010808DL	All TCL compounds except Fluoranthene	R	A

Sample	Compound	Flag	A or P
HCCCSS05020808DL	All TCL compounds	R	A

Manual integrations were reviewed for all samples, when applicable. The integrations were considered acceptable. The laboratory provided before and after integration printouts.

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples HCVWSS02010808 and HCVWSS02020808, samples HCCASS04010808 and HCCASS04020808, samples HCCCSS05010808 and HCCCSS05020808, samples HCCCSS05010808 and HCCCSS05020808DL, samples HCCBSS02010808 and HCCBSS02020808 were identified as field duplicates. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSS02010808		HCVWSS02020808			
	Dilution: 1.0 Prep Date: 9/11/8 Analysis date: 9/16/08		Dilution: 1 Prep Date: 9/11/08 Analysis date: 9/17/08			
Acenaphthene	5.5	5.8U	4.8	5.7U	1	-
Acenaphthylene	3.3	5.8U	2.9	5.7U	1	-
Anthracene	27	6.6U	20	6.6U	1	-
Benzo(a)anthracene	220	5.8U	240	5.7U	1	-
Benzo(b)fluoranthene	550	5.8U	470	5.7U	1	-
Benzo(k)fluoranthene	160	5.8U	140	5.7U	1	-
Benzo(g,h,i)perylene	360	5.8U	260	5.7U	1	-
Benzo(a)pyrene	320	5.8U	260	5.7U	1	-
Chrysene	320	6.6U	340	6.6U	1	-
Dibenz(a,h)anthracene	70	5.8U	50	5.7U	1	-
Fluoranthene	580	6.6U	420	6.6U	1	-
Fluorene	5.9	6.6U	4.6	6.6U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSS02010808		HCVWSS02020808			
	Dilution: 1.0 Prep Date: 9/11/8 Analysis date: 9/16/08		Dilution: 1 Prep Date: 9/11/08 Analysis date: 9/17/08			
Indeno(1,2,3-cd)pyrene	290	5.8U	210	5.7U	1	-
2-Methylnaphthalene	2.6	5.7U	2.2	5.6U	1	-
Naphthalene	4.2	5.4U	3.8	5.3U	1	-
Phenanthrene	160	6.6U	120	6.6U	1	-
Pyrene	460	5.8U	330	5.7U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCASS04010808		HCCASS04020808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1 Prep Date: 9/11/08 Analysis date: 9/17/08			
Acenaphthene	3.1	7.1U	4.9	7.1U	2	-
Anthracene	7.5	8.1U	8.9	8.1U	1	-
Benzo(a)anthracene	53	7.1U	64	7.1U	1	-
Benzo(b)fluoranthene	89	7.1U	110	7.1U	1	-
Benzo(k)fluoranthene	28	7.1U	30	7.1U	1	-
Benzo(g,h,i)perylene	51	7.1U	60	7.1U	1	-
Benzo(a)pyrene	55	7.1U	63	7.1U	1	-
Chrysene	56	8.1U	68	8.1U	1	-
Dibenz(a,h)anthracene	11	7.1U	13	7.1U	1	-
Fluoranthene	140	8.1U	150	8.1U	1	-
Fluorene	2.3	8.1U	3.3	8.1U	1	-
Indeno(1,2,3-cd)pyrene	42	7.1U	48	7.1U	1	-
2-Methylnaphthalene	4.9	7.0U	12	7.0U	2	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCASS04010808		HCCASS04020808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1 Prep Date: 9/11/08 Analysis date: 9/17/08			
Naphthalene	7.8	6.6U	6.4	6.6U	1	-
Phenanthrene	63	8.1U	75	8.1U	1	-
Pyrene	110	7.1U	110	7.1U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS05010808		HCCCSS05020808			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/188			
Acenaphthene	1500	550U	1700	370U	1	-
Anthracene	3500	620U	5100	420U	1	-
Benzo(a)anthracene	15000	550U	14000	370U	1	-
Benzo(b)fluoranthene	24000	550U	20000	370U	1	-
Benzo(k)fluoranthene	8500	550U	11000	370U	1	-
Benzo(g,h,i)perylene	14000	550U	15000	370U	1	-
Benzo(a)pyrene	16000	550U	15000	370U	1	-
Chrysene	13000	620U	18000	420U	1	-
Dibenz(a,h)anthracene	3300	550U	3300	370U	1	-
Fluoranthene	42000	620U	41000	420U	1	-
Fluorene	1200	620U	1300	420U	1	-
Indeno(1,2,3-cd)pyrene	12000	550U	12000	370U	1	-
2-Methylnaphthalene	340	540U	320	370U	1	-
Naphthalene	510U	51U	260	340U	Not calculable	-
Phenanthrene	21000	620U	21000	420U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS05010808		HCCCSS05020808			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/188			
Pyrene	32000	550U	31000	370U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS05010808		HCCCSS05020808DL			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08			
Acenaphthene	1500	550U	1800	740U	1	-
Anthracene	3500	620U	4000	850U	1	-
Benzo(a)anthracene	15000	550U	17000	740U	1	-
Benzo(b)fluoranthene	24000	550U	26000	740U	1	-
Benzo(k)fluoranthene	8500	550U	9300	740U	1	-
Benzo(g,h,i)perylene	14000	550U	14000	740U	1	-
Benzo(a)pyrene	16000	550U	17000	740U	1	-
Chrysene	13000	620U	20000	850U	2	-
Dibenz(a,h)anthracene	3300	550U	3300	740U	1	-
Fluoranthene	42000	620U	45000	850U	1	-
Fluorene	1200	620U	1400	850U	1	-
Indeno(1,2,3-cd)pyrene	12000	550U	12000	740U	1	-
2-Methylnaphthalene	340	540U	380	730U	1	-
Phenanthrene	21000	620U	24000	850U	1	-
Pyrene	32000	550U	34000	740U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCBSS02010808		HCCBSS02020808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1 Prep Date: 9/11/08 Analysis date: 9/17/08			
Acenaphthene	860	71U	15	5.7U	57	MD
Acenaphthylene	71U	71U	3.0	5.7U	Not calculable	-
Anthracene	870	81U	35	6.6U	25	MD
Benzo(a)anthracene	3100	71U	220	5.7U	14	MD
Benzo(b)fluoranthene	3800	71U	290	5.7U	13	MD
Benzo(k)fluoranthene	1900	71U	110	5.7U	17	MD
Benzo(g,h,i)perylene	2000	71U	170	5.7U	12	MD
Benzo(a)pyrene	2800	71U	200	5.7U	14	MD
Chrysene	3500	81U	210	6.6U	17	MD
Dibenz(a,h)anthracene	530	71U	39	5.7U	14	MD
Fluoranthene	10000	81U	400	6.6U	25	MD
Fluorene	740	81U	11	6.6U	67	MD
Indeno(1,2,3-cd)pyrene	1900	71U	150	5.7U	13	MD
2-Methylnaphthalene	150	70U	4.9	5.6U	31	MD
Naphthalene	330	66U	6.3	5.3U	52	MD
Phenanthrene	9400	81U	160	6.6U	59	MD
Pyrene	7300	71U	310	5.7U	24	MD

Samples HCMESS04010808 (primary) and HCMESS04030808 (QA split from CTL SDG 68673), samples HCMESS04010808DL (primary) and HCMESS04030808DL (QA split from CTL SDG 68673), samples HCMBSS05010808 (primary) and HCMBSS05030808 (QA split from CTL SDG 68673), and samples HCMBSS05010808 (primary) and HCMBSS05030808DL (QA split from CTL SDG 68673) were compared. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCMESS04010808		HCMESS04030808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 8/29/08 Analysis date: 9/8/08			
Acenaphthene	25	5.8U	23	4.7U	1	-
Acenaphthylene	4.7	5.8U	2.4	4.6U	2	-
Anthracene	64	6.6U	85	5.0U	1	-
Dibenz(a,h)anthracene	92	5.8U	82	4.9U	1	-
Fluorene	20	6.6U	21	5.2U	1	-
2-Methylnaphthalene	11	5.7U	8.0	4.6U	1	-
Naphthalene	9.4	5.4U	6.5	4.3U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCMESS04010808DL		HCMESS04030808			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/10/08		Dilution: 10.0 Prep Date: 8/29/08 Analysis date: 9/11/08			
Benzo(a)anthracene	410	12U	430	18U	1	-
Benzo(b)fluoranthene	690	12U	660	18U	1	-
Benzo(k)fluoranthene	240	12U	230	18U	1	-
Benzo(g,h,i)perylene	350	12U	350	18U	1	-
Benzo(a)pyrene	410	12U	470	17U	1	-
Chrysene	520	13	520	19U	1	-
Fluoranthene	990	13U	1200	19U	1	-
Indeno(1,2,3-cd)pyrene	280	12U	310	17U	1	-
Phenanthrene	420	13U	460	20U	1	-
Pyrene	760	12U	610	18U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCMBSS05010808		HCMBSS05030808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 8/29/08 Analysis date: 9/8/08			
Acenaphthene	13	5.8U	9.5	4.7U	1	-
Acenaphthylene	19	5.8U	11	4.6U	2	-
Anthracene	35	6.6U	33	5.0U	1	-
Benzo(k)fluoranthene	140	5.8U	120	5.0U	1	-
Benzo(g,h,i)perylene	220	5.8U	190	4.8U	1	-
Dibenz(a,h)anthracene	48	5.8U	50	4.9U	1	-
Fluorene	9.2	6.6U	8.2	5.2U	1	-
Indeno(1,2,3-cd)pyrene	190	5.8U	180	4.6U	1	-
2-Methylnaphthalene	24	5.7U	16	4.6U	2	-
Naphthalene	12	5.4U	7.8	4.3U	2	-
Phenanthrene	250	6.6U	220	5.3U	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCMBSS05010808		HCMBSS05030808DL			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 10.0 Prep Date: 8/29/08 Analysis date: 9/11/08			
Benzo(a)anthracene	320	5.8U	270	18U	1	-
Benzo(b)fluoranthene	450	5.8U	410	18U	1	-
Benzo(a)pyrene	260	5.8U	310	17U	1	-
Chrysene	350	6.6U	300	19U	1	-
Fluoranthene	600	6.6U	680	20U	1	-
Pyrene	450	5.8U	520	19U	1	-

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 0808247

SDG	Sample	Compound	Flag	A or P	Reason
0808247	HCCCSS05020808	All TCL compounds	None	P	GC/MS instrument performance check
0808247	HCCASS02010808 HCCASS03010808	All TCL compounds	J (all detects) UJ (all non-detects)	P	Surrogate recovery (%R)
0808247	HCCASS06010808	Benzo(a)anthracene Acenaphthylene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicates (%R)
0808247	HCPSSS04010808	Acenaphthylene	J (all detects)	A	Matrix spike/Matrix spike duplicates (%R)
0808247	HCPSSS04010808	Benzo(a)anthracene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Indeno(1,2,3-cd)pyrene	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicates (%R)
0808247	HCMESS04010808	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Compound quantitation and CRQLs
0808247	HCVWSS06010808	Fluoranthene	J (all detects)	A	Compound quantitation and CRQLs
0808247	HCMESS04010808	Fluoranthene Pyrene	R R	A	Overall assessment of data
0808247	HCMESS04010808DL	All TCL compounds except Fluoranthene Pyrene	R	A	Overall assessment of data
0808247	HCVWSS06010808	Fluoranthene	R	A	Overall assessment of data
0808247	HCVWSS06010808DL	All TCL compounds except Fluoranthene	R	A	Overall assessment of data
0808247	HCCCSS05020808DL	All TCL compounds	R	A	Overall assessment of data

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 0808247

SDG	Sample	Compound TIC (RT in minutes)	Modified Final Concentration	A or P
0808247	HCEB01020808	2-Methylnaphthalene Naphthalene Phenanthrene	0.0074B ug/L 0.016B ug/L 0.016B ug/L	A

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 0808247

No Sample Data Qualified in this SDG

LDC #: 20223A2b

SDG #: 0808247

Laboratory: Empirical Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET

Level IV

Date: 2/5/09

Page: 1 of 2

Reviewer:

2nd Reviewer:

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 8/25/08
II.	GC/MS Instrument performance check	SW	
III.	Initial calibration	A	% RSD ≤ 15/30, r² ≥ 0.990 no SPCC RRF
IV.	Continuing calibration/ICV	A	ICV ≤ 25 CCV ≤ 20
V.	Blanks	SW	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS/D
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	
XI.	Target compound identification	A	
XII.	Compound quantitation/CRQLs	SW	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	A	
XV.	Overall assessment of data	SW	manual integration acceptable
XVI.	Field duplicates	SW	D = 15 + 16, 30 + 31, 39 + 40, 39 + 41, 45 + 46
XVII.	Field blanks	SW	EB = 52

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

= 4/5 + HCMESS04030808 DL (CTL SDG 68673)

= 12 + HCMBSS05030808/DL

Validated Samples:

1 2	HCMESS01010808	11	HCMBSS04010808	21	HCVWSS06010808DL	31	HCCASS04020808
2	HCMESS02010808 2x	12	HCMBSS05010808	22	HCPSSS01010808	32	HCCASS05010808
3	HCMESS03010808	13	HCMBSS06010808	23	HCPSSS02010808	33	HCCASS06010808
4	HCMESS04010808	14	HCVWSS01010808	24	HCPSSS03010808	34	HCCASS07010808
5	HCMESS04010808DL 2x	15	HCVWSS02010808	25	HCPSSS04010808	35	HCCCSS01010808
6	HCMESS05010808 2x	16	HCVWSS02020808	26	HCPSSS05010808	36	HCCCSS02010808
7	HCMESS06010808	17	HCVWSS03010808	27	HCCASS01010808	37	HCCCSS03010808
8	HCMBSS01010808 2x	18	HCVWSS04010808	28	HCCASS02010808	38	HCCCSS04010808
9	HCMBSS02010808	19	HCVWSS05010808	29	HCCASS03010808	39	HCCCSS05010808
10	HCMBSS03010808	20	HCVWSS06010808	30	HCCASS04010808	40	HCCCSS05020808

LDC #: 20223A2b **VALIDATION COMPLETENESS WORKSHEET** Date: 2/5/09
SDG #: 0808247 Level IV Page: 2 of 2
Laboratory: Empirical Laboratories, LLC Reviewer: FD
2nd Reviewer: M

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times		Sampling dates:
II.	GC/MS Instrument performance check		
III.	Initial calibration		
IV.	Continuing calibration/ICV		
V.	Blanks		
VI.	Surrogate spikes		
VII.	Matrix spike/Matrix spike duplicates		
VIII.	Laboratory control samples		
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards		
XI.	Target compound identification		
XII.	Compound quantitation/CRQLs		
XIII.	Tentatively identified compounds (TICs)		
XIV.	System performance		
XV.	Overall assessment of data		
XVI.	Field duplicates		
XVII.	Field blanks		

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

41	HCCCSS05020808DL	51	HCCBSS07010808	61 1	SBLK0829BW1	71	
42	HCCCSS06010808	52 1	HCEB01020808 EB	62 2	SBLK0903BS1	72	
43	HCCCSS07010808	53	HCPSS04010808MS	63 3	SBLK0904BS1	73	
44	HCCBSS01010808	54	HCPSS04010808MSD	64 4	SBLK0905BS1	74	
45	HCCBSS02010808	55	HCCASS06010808MS	65		75	
46	HCCBSS02020808	56	HCCASS06010808MSD	66		76	
47	HCCBSS03010808	57		67		77	
48	HCCBSS04010808	58		68		78	
49	HCCBSS05010808	59		69		79	
50	HCCBSS06010808	60		70		80	

LDC #: 20223A06
SDG #: pu cover

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270C)

Validation Area	Yes	No	NA	Findings/Comments
[illegible]				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
[illegible]				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
[illegible]				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation?	✓			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30% and relative response factors (RRF) > 0.05?	✓			
[illegible]				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 25% and relative response factors (RRF) ≥ 0.05?	✓			
[illegible]				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
[illegible]				
Were all surrogate %R within QC limits?		✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?		✓		
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?	✓			
[illegible]				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
[illegible]				
Was an LCS analyzed for this SDG?	✓			

LDC #: 20223A06
SDG #: [illegible]

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
IX. Reagent/Chain Assessment/Organics				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
X. Internal Standards				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds from the associated calibration standard?	✓			
XI. Target Compound Identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XII. Quantitation/Calculations				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Tentatively Identified Compounds (TICs)				
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?			✓	
Were relative intensities of the major ions within ± 20% between the sample and the reference spectra?			✓	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?			✓	
XIV. Overall Assessment of Data				
System performance was found to be acceptable.	✓			
XV. Overall Assessment of Data				
Overall assessment of data was found to be acceptable.	✓			
XVI. Field Duplicates				
Field duplicate pairs were identified in this SDG.		✓		
Target compounds were detected in the field duplicates.			✓	
XVII. Field Blanks				
Field blanks were identified in this SDG.	✓			
Target compounds were detected in the field blanks.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

A. Phenol**	P. Bis(2-chloroethoxy)methane	EE. 2,6-Dinitrotoluene	TT. Pentachlorophenol**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	Q. 2,4-Dichlorophenol**	FF. 3-Nitroaniline	UU. Phenanthrene	JJJ. Indeno(1,2,3-cd)pyrene
C. 2-Chlorophenol	R. 1,2,4-Trichlorobenzene	GG. Acenaphthene**	VV. Anthracene	KKK. Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S. Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL. Benzo(g,h,i)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nitrophenol*	XX. Di-n-butylphthalate	MMM. Bis(2-Chloroisopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachlorobutadiene**	JJ. Dibenzofuran	YY. Fluoranthene**	NNN. Aniline
G. 2-Methylphenol	V. 4-Chloro-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP. Benzoic Acid
I. 4-Methylphenol	X. Hexachlorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ. Benzyl alcohol
J. N-Nitroso-di-n-propylamine*	Y. 2,4,6-Trichlorophenol**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachloroethane	Z. 2,4,5-Trichlorophenol	OO. 4-Nitroaniline	DDD. Chrysene	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chloronaphthalene	PP. 4,6-Dinitro-2-methylphenol	EEE. Bis(2-ethylhexyl)phthalate	TTT.
M. Isophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	UUU
N. 2-Nitrophenol**	CC. Dimethylphthalate	RR. 4-Bromophenyl-phenylether	GGG. Benzo(b)fluoranthene	VVV.
O. 2,4-Dimethylphenol	DD. Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	WWW.

Notes: * = System performance check compound (SPCC) for RRF; ** = Calibration check compound (CCC) for %RSD.

LDC #: 20223008
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
GC/MS Performance Check

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the DFTPP performance results reviewed and found to be within the EPA Functional Guideline criteria?

Y N N/A Were all samples analyzed within the 12 hour clock criteria?

#	Laboratory ID	12 Hour Clock (Time/date)	Finding	Associated Samples Client ID	Qualifications
	40	9/18/08 @ 2310	outside 12Hrs		none / P
			clock by 2minutes		

m/z	ION ABUNDANCE CRITERIA	m/z	ION ABUNDANCE CRITERIA
51	30.0 - 60.0% of m/z 198	199	5.0 - 9.0% of m/z 198
68	Less than 2.0% of m/z 69	275	10.0 - 30.0% of m/z 198
69	Present	365	Greater than 1.0% of m/z 198
70	Less than 2.0% of 69	441	Present, but less than m/z 443
127	40.0 - 60.0% of m/z 198	442	Greater than 40.0% of m/z 198
197	Less than 1.0% of m/z 198	443	17.0 - 23.0% of m/z 442
198	Base peak, 100% relative abundance		

LDC #: 20223A2b
SDG #: per coney

VALIDATION FINDINGS WORKSHEET
Blanks

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a method blank analyzed for each matrix?
Y N N/A Was a method blank analyzed for each concentration preparation level?
Y N N/A Was a method blank associated with every sample?
Y N N/A Was the blank contaminated? If yes, please see qualification below.

Blank extraction date: 8/29/08 **Blank analysis date:** 9/8/08
Conc. units: ug/l Associated Samples: 52

Compound	Blank ID	Sample Identification								
	SBLK0829BW1	52								
E	0.016		~~0.015~~ / ~~0.0464~~							
CCC	0.021		–							
III	0.0072		–							
DDD	0.016		–							
YY	0.034		–							
NN	0.014		–							
W	0.012		0.0074 / ~~0.0464~~ B							

Blank extraction date: ↓ **Blank analysis date:** ↓
Conc. units: ug/L Associated Samples: 52

Compound	Blank ID	Sample Identification								
	↓		52							
S	0.019		0.016 / ~~0.0464~~ B							
UU	0.042		0.016 / ~~0.0464~~ B							
ZZ	0.028		–							

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated method blank concentration were qualified as not detected, "U". Other contaminants within five times the method blank concentration were also qualified as not detected, "U".

LDC #: 20223A26
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Field Blanks

Page: 1 of 1
Reviewer: B
2nd Reviewer: M

METHOD: GC/MS BNA (EPA SW 846 Method 8270)
Y N N/A Were field blanks identified in this SDG?
Y N N/A Were target compounds detected in the field blanks?
Blank units: ug/L **Associated sample units:** ug/kg
Sampling date: 8/25/08
Field blank type: (circle one) Field Blank / Rinsate / Other: EB Associated Samples: 1 → 51 (> 5x)

Compound	Blank ID	Sample Identification								
	52									
~~Diethylphthalate~~ YY	0.015									
Di-n-butylphthalate W	0.0074									
~~Bis(2-ethylhexyl)phthalate~~ S	0.016									
UU	0.016									
CRQL										

Blank units: _____ **Associated sample units:** _____
Sampling date: _____
Field blank type: (circle one) Field Blank / Rinsate / Other: _____ Associated Samples: _____

Compound	Blank ID	Sample Identification								
Diethylphthalate										
Di-n-butylphthalate										
Bis(2-ethylhexyl)phthalate										
CRQL										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
Common contaminants such as the phthalates and TICs noted above that were detected in samples within ten times the associated field blank concentration were qualified as not detected, "U". Other contaminants within five times the field blank concentration were also qualified as not detected, "U".

FBLKASC2.2S

LDC #: 20223A26
SDG #: all cases

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer:
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N N/A If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N N/A If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)		Qualifications
		23	TPH	150	(30-125)	no qual
					( )	
		27		137	( )	
					( )	
		32		141	( )	
					( )	
		34		162	( )	
					( )	
		37		136	( )	
					( )	
		2		128	( )	
					( )	
		8		161	( )	
					( )	
		20		133	( )	
					( )	
		39		126	( )	
					( )	
		40		131	( )	
					( )	
✓		47 (50X)	FBP	0	(45-105)	~~J/UJ/P~~ * no qual (50X)
			TPH	0	(30-125)	
					( )	
		* matrix	interference		( )	

* QC limits are advisory	QC Limits (Soil)	QC Limits (Water)
S1 (NBZ) = Nitrobenzene-d5	23-120	35-114
S2 (FBP) = 2-Fluorobiphenyl	30-115	43-116
S3 (TPH) = Terphenyl-d14	18-137	33-141
S4 (PHL) = Phenol-d5	24-113	10-94

	QC Limits (Soil)	QC Limits (Water)
S5 (2FP) = 2-Fluorophenol	25-121	21-100
S6 (TBP) = 2,4,6-Tribromophenol	19-122	10-123
S7 (2CP) = 2-Chlorophenol-d4	20-130*	33-110*
S8 (DCB) = 1,2-Dichlorobenzene-d4	20-130*	16-110*

SUR.2S

LDC #: 20223A06
SDG #: all cases

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer:
2nd Reviewer:

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N N/A If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N N/A If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		28	FBP	26 (45-105)	J/UJ/P All TCL
			TPH	38 (30-125)	↓ ↓
				( )	
		29	↓	13 (↓)	↓ ↓
				21 ( )	
				( )	
		35	TPH	138 (30-125)	no qual
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

* QC limits are advisory	QC Limits (Soil)	QC Limits (Water)		QC Limits (Soil)	QC Limits (Water)
S1 (NBZ) = Nitrobenzene-d5	23-120	35-114	S5 (2FP) = 2-Fluorophenol	25-121	21-100
S2 (FBP) = 2-Fluorobiphenyl	30-115	43-116	S6 (TBP) = 2,4,6-Tribromophenol	19-122	10-123
S3 (TPH) = Terphenyl-d14	18-137	33-141	S7 (2CP) = 2-Chlorophenol-d4	20-130*	33-110*
S4 (PHL) = Phenol-d5	24-113	10-94	S8 (DCB) = 1,2-Dichlorobenzene-d4	20-130*	16-110*

LDC #: 20223A26
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y (N) N/A Were percent recoveries (%R) for surrogates within QC limits?
Y (N) N/A If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y (N) N/A If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		7	TPH	127 (30 - 125)	no qual
				( )	
		3		149 ( )	
				( )	
		4		150 ( )	
				( )	
		10		154 ( )	
				( )	
		12		161 ( )	
				( )	
		13		155 ( )	
				( )	
		18		148 ( )	
				( )	
		20		179 ( )	
				( )	
		19		146 ( )	
				( )	
		16		167 ( )	
				( )	
		17		161 ( )	
				( )	
		22	✓	149 (✓)	✓
				( )	

* QC limits are advisory	QC Limits (Soil)	QC Limits (Water)
S1 (NBZ) = Nitrobenzene-d5	23-120	35-114
S2 (FBP) = 2-Fluorobiphenyl	30-115	43-116
S3 (TPH) = Terphenyl-d14	18-137	33-141
S4 (PHL) = Phenol-d5	24-113	10-94
S5 (2FP) = 2-Fluorophenol	25-121	21-100
S6 (TBP) = 2,4,6-Tribromophenol	19-122	10-123
S7 (2CP) = 2-Chlorophenol-d4	20-130*	33-110*
S8 (DCB) = 1,2-Dichlorobenzene-d4	20-130*	16-110*

SUR.2S

LDC #: 20223A26
SDG #: All cases

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		55 + 56	CCC	113 (50-110)	118 (50-110)	( )	3 3	J/A dit
			DD	( )	106 (45-105)	( )	↓	↓
				( )	( )	( )		
				( )	( )	( )	— — —	—
		53 + 54	DD	111 (45-105)	110 (45-105)	( )	25	J/Adit
			CCC	0 (50-110)	0 (50-110)	( )	↓	J/UJ/A
✓			GGG	0 (45-115)	0 (45-115)	( )		
			HHH	24 (45-125)	14 (45-125)	( )		no qual parent 74X
			LLL	0 (40-125)	0 (40-125)	( )		J/UJ/A
			III	0 (50-110)	0 (50-110)	( )		↓
			DDD	0 (55-110)	0 (55-110)	( )		
✓			YY	0 (55-115)	0 (55-115)	( )		
			JJJ	0 (40-120)	0 (40-120)	( )		no qual parent 74X
✓			UU	0 (50-110)	0 (50-110)	( )		J/UJ/A
✓			ZZ	0 (45-125)	0 (45-125)	( )		no qual parent 74X
				( )	( )	( )	↓	↓
		note 53+54 parent sample highly contaminated						

	Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)		Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)
A.	Phenol	26-90%	≤ 35%	12-110%	≤ 42%	GG.	Acenaphthene	31-137%	≤ 19%	46-118%	≤ 31%
C.	2-Chlorophenol	25-102%	≤ 50%	27-123%	≤ 40%	II.	4-Nitrophenol	11-114%	≤ 50%	10-80%	≤ 50%
E.	1,4-Dichlorobenzene	28-104%	≤ 27%	36-97%	≤ 28%	KK.	2,4-Dinitrotoluene	28-89%	≤ 47%	24-96%	≤ 38%
J.	N-Nitroso-di-n-propylamine	41-126%	≤ 38%	41-116%	≤ 38%	TT.	Pentachlorophenol	17-109%	≤ 47%	9-103%	≤ 50%
R.	1,2,4-Trichlorobenzene	38-107%	≤ 23%	39-98%	≤ 28%	ZZ.	Pyrene	35-142%	≤ 36%	26-127%	≤ 31%
V.	4-Chloro-3-methylphenol	26-103%	≤ 33%	23-97%	≤ 42%						

LDC #: [illegible]
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?

Y N N/A Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?

#	Date	compd ~~Sample ID~~	Finding	Associated Samples	Qualifications
		YY, ZZ	x'd cal range	4	J/A det
		YY	↓	20	↓

Comments: See sample calculation verification worksheet for recalculations

COMQUA.2S

LDC #: 20223A26
SDG #: Su Corr

VALIDATION FINDINGS WORKSHEET
Overall Assessment of Data

Page: 1 of 1
Reviewer: R
2nd Reviewer: X

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

All available information pertaining to the data were reviewed using professional judgement to compliment the determination of the overall quality of the data.

Y N N/A Was the overall quality and usability of the data acceptable?

#	Date	Sample ID	Finding	Associated Samples	Qualifications
		4	YY, ZZ		R/X
		5	All except YY, ZZ		
		20	YY		
		21	All except YY		
		41	All cpds		

Comments:

OVR.2S

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	15		16			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/17/08			
GG	5.5	5.8	4.8	5.7	1	-
DD	3.3	5.8	2.9	5.7	1	-
VV	27	6.6	20	6.6	1	-
CCC	220	5.8	240	5.7	1	-
GGG	550	5.8	470	5.7	1	-
HHH	160	5.8	140	5.7	1	-
LLL	360	5.8	260	5.7	1	-
III	320	5.8	260	5.7	1	-
DDD	320	6.6	340	6.6	1	-
KKK	70	5.8	50	5.7	1	-
YY	580	6.6	420	6.6	1	-
NN	5.9	6.6	4.6	6.6	1	-
JJJ	290	5.8	210	5.7	1	-
W	2.6	5.7	2.2	5.6	1	-
S	4.2	5.4	3.8	5.3	1	-
UU	160	6.6	120	6.6	1	-
ZZ	460	5.8	330	5.7	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	30		31			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/17/08			
GG	3.1	7.1	4.9	7.1	2	-
VV	7.5	8.1	8.9	8.1	1	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	30		31			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/17/08			
CCC	53	7.1	64	7.1	1	-
GGG	89	7.1	110	7.1	1	-
HHH	28	7.1	30	7.1	1	-
LLL	51	7.1	60	7.1	1	-
III	55	7.1	63	7.1	1	-
DDD	56	8.1	68	8.1	1	-
KKK	11	7.1	13	7.1	1	-
YY	140	8.1	150	8.1	1	-
NN	2.3	8.1	3.3	8.1	1	-
JJJ	42	7.1	48	7.1	1	-
W	4.9	7.0	12	7.0	2	-
S	7.8	6.6	6.4	6.6	1	-
UU	63	8.1	75	8.1	1	-
ZZ	110	7.1	110	7.1	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	39		40			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08			
GG	1500	550	1700	370	1	-
VV	3500	620	5100	420	1	-
CCC	15000	550	14000	370	1	-
GGG	24000	550	20000	370	1	-
HHH	8500	550	11000	370	1	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	39		40			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08			
LLL	14000	550	15000	370	1	-
III	16000	550	15000	370	1	-
DDD	13000	620	18000	420	1	-
KKK	3300	550	3300	370	1	-
YY	42000	620	41000	420	1	-
NN	1200	620	1300	420	1	-
JJJ	12000	550	12000	370	1	-
W	340	540	320	370	1	-
S	510U	51	260	340	NC	-
UU	21000	620	21000	420	1	-
ZZ	32000	550	31000	370	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	39		41			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08			
GG	1500	550	1800	740	1	-
VV	3500	620	4000	850	1	-
CCC	15000	550	17000	740	1	-
GGG	24000	550	26000	740	1	-
HHH	8500	550	9300	740	1	-
LLL	14000	550	14000	740	1	-
III	16000	550	17000	740	1	-
DDD	13000	620	20000	850	2	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	39		41			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/18/08			
KKK	3300	550	3300	740	1	-
YY	42000	620	45000	850	1	-
NN	1200	620	1400	850	1	-
JJJ	12000	550	12000	740	1	-
W	340	540	380	730	1	-
UU	21000	620	24000	850	1	-
ZZ	32000	550	34000	740	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	45		46			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/17/08			
GG	860	71	15	5.7	57	MD
DD	71U	71	3.0	5.7	NC	-
VV	870	81	35	6.6	25	MD
CCC	3100	71	220	5.7	14	MD
GGG	3800	71	290	5.7	13	MD
HHH	1900	71	110	5.7	17	MD
LLL	2000	71	170	5.7	12	MD
III	2800	71	200	5.7	14	MD
DDD	3500	81	210	6.6	17	MD
KKK	530	71	39	5.7	14	MD
YY	10000	81	400	6.6	25	MD
NN	740	81	11	6.6	67	MD

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	45		46			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/18/08		Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/17/08			
JJJ	1900	71	150	5.7	13	MD
W	150	70	4.9	5.6	31	MD
S	330	66	6.3	5.3	52	MD
UU	9400	81	160	6.6	59	MD
ZZ	7300	71	310	5.7	24	MD

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	4		HCMESS04030808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 8/29/08 Analysis date: 9/8/08			
GG	25	5.8	23	4.7	1	-
DD	4.7	5.8	2.4	4.6	2	-
VV	64	6.6	85	5.0	1	-
~~CCC~~	~~560~~	~~5.8~~	~~NR~~		~~NA~~	
GGG	890	5.8	NR		NA	
HHH	310	5.8	NR		NA	
LLL	450	5.8	NR		NA	
III	530	5.8	NR		NA	
~~DDD~~	~~730~~	~~6.6~~	~~NR~~		~~NA~~	
KKK	92	5.8	82	4.9	1	-
~~YY~~	~~1200~~	~~6.6~~	~~NR~~		~~NA~~	
NN	20	6.6	21	5.2	1	-
~~JJJ~~	~~370~~	~~5.8~~	~~NR~~		~~NA~~	
W	11	5.7	8.0	4.6	1	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	4		HCMESS04030808			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 8/29/08 Analysis date: 9/8/08			
S	9.4	5.4	6.5	4.3	1	-
~~UU~~	~~510~~	~~6.6~~	NR		NA	
ZZ	910	5.8	NR		NA	

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	5		HCMESS04030808DL			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/22/08		Dilution: 10.0 Prep Date: 8/29/08 Analysis date: 9/11/08			
GG	20	12	NR		NA	
DD	4.1	12	NR		NA	
~~VV~~	~~48~~	~~13~~	~~NR~~		~~NA~~	
CCC	410	12	430	18	1	-
GGG	690	12	660	18	1	-
HHH	240	12	230	18	1	-
LLL	350	12	350	18	1	-
III	410	12	470	17	1	-
DDD	520	13	520	19	1	-
~~KKK~~	~~72~~	~~12~~	~~NR~~		~~NA~~	
YY	990	13	1200	19	1	-
~~NN~~	~~16~~	~~13~~	~~NR~~		~~NA~~	
JJJ	280	12	310	17	1	-
~~W~~	~~8.7~~	~~11~~	~~NR~~		~~NA~~	
~~S~~	~~7.9~~	~~11~~	~~NR~~		~~NA~~	
UU	420	13	460	20	1	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	5		HCMESS04030808DL			
	Dilution: 2.0 Prep Date: 9/11/08 Analysis date: 9/22/08		Dilution: 10.0 Prep Date: 8/29/08 Analysis date: 9/11/08			
ZZ	760	12	610	18	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	12		HCMBSS05030808			
	Dilution: 1.0 Prep Date: 9/11/08_ Analysis date: 9/16/08		Dilution: 1.0 Prep Date: 8/29/08 Analysis date: 9/08/08			
GG	13	5.8	9.5	4.7	1	-
DD	19	5.8	11	4.6	2	-
VV	35	6.6	33	5.0	1	-
HHH	140	5.8	120	5.0	1	-
LLL	220	5.8	190	4.8	1	-
KKK	48	5.8	50	4.9	1	-
NN	9.2	6.6	8.2	5.2	1	-
JJJ	190	5.8	180	4.6	1	-
W	24	5.7	16	4.6	2	-
S	12	5.4	7.8	4.3	2	-
UU	250	6.6	220	5.3	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	12		HCMBSS05030808DL			
	Dilution: 1.0 Prep Date: 9/11/08_ Analysis date: 9/16/08		Dilution: ~~1.0~~ 10 Prep Date: 8/29/08 Analysis date: 9/11/08			
CCC	320	5.8	270	18	1	-
GGG	450	5.8	410	18	1	-

LDC#: 20223A2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH (EPA SW 846 Method 8270C-SIM)
Y Were field duplicate pairs identified in this SDG?
Y Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	12		HCMBSS05030808DL			
	Dilution: 1.0 Prep Date: 9/11/08 Analysis date: 9/16/08		Dilution: ~~10~~ 10 Prep Date: 8/29/08 Analysis date: 9/11/08			
III	260	5.8	310	17	1	-
DDD	350	6.6	300	19	1	-
YY	600	6.6	680	20	1	-
ZZ	450	5.8	520	19	1	-

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LDC #: 20223A2b
SDG #: See cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: F7
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (0.5 std)	Recalculated RRF (0.5 std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	ICAL	9/15/08	~~Phenol~~ (1st internal standard) Acenaphthene	0.530	0.530	0.52771	0.52771	7.3	7.3
			Naphthalene (2nd internal standard) Chrysene	1.177	1.177	1.2733	1.2733	11.0	11.0
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						
2	ICAL	9/4/08	Phenol (1st internal standard)	See summary					
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						
3			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC # 20223A2b
SDG# recovery

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GCMS PAH 8270C sim

Parameter: Chrysene

Date	Column	Compound	X	Y	
09/04/2008	GCMS4	Chrysene	0.005	0.014	
			0.010	0.025	
			0.050	0.085	
			0.100	0.186	
			0.250	4.56E-001	
			0.500	9.13E-001	
			1.000	1.80E+000	
			5.000	7.945	
			10.000	14.999	

Regression Output:		Regression Output:	Reported	
Constant		0.00000		
Std Err of Y Est		0.18231		
R Squared		0.99876		0.99900
No. of Observations		9.00000		
Degrees of Freedom		8.00000		
X Coefficient(s)	1.521E+000		1.52206	
Std Err of Coef.	0.016220	0.00		

LDC # 20223A26
SDG# per cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: JS
2nd Reviewer: K

METHOD: GCMS PAH 8270C sim

Parameter: Acenaphthene

Date	Column	Compound	X	Y	
09/04/2008	GCMS4	Acenaphthene	0.005	0.003	
			0.010	0.006	
			0.050	0.025	
			0.100	0.050	
			0.250	1.38E-001	
			0.500	2.86E-001	
			1.000	6.11E-001	
			5.000	3.174	
			10.000	6.213	

Regression Output:	Regression Output:	Reported	
Constant	0.00000		
Std Err of Y Est	0.02494		
R Squared	0.99987		1.00000
No. of Observations	9.00000		
Degrees of Freedom	8.00000		
X Coefficient(s)	6.237E-001	0.62379	
Std Err of Coef.	0.002219	0.00	

LDC #: 20223A2b
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	PAHCCV1W	9/8/08	~~Phenol~~ (1st internal standard) Acenaphthene	5.0	4.840	4.840	3.2	3.2
			~~Naphthalene~~ (2nd internal standard) Chrysene	↓	5.167	5.167	3.3	3.3
			~~Fluorene (3rd internal standard)~~					
			~~Pentachlorophenol (4th internal standard)~~					
	PAHCCV1	9/16/08	~~Bis(2-ethylhexyl)phthalate (5th internal standard)~~	0.527	0.569	0.569	7.9	7.9
			~~Benzo(a)pyrene (6th internal standard)~~	1.273	1.246	1.246	2.2	2.2
2			~~Phenol (1st internal standard)~~					
	PAHCCV1	9/17/08	~~Naphthalene~~ (2nd internal standard)		0.566	0.566	7.3	7.3
			~~Fluorene~~ (3rd internal standard)		1.316	1.316	3.4	3.4
			~~Pentachlorophenol (4th internal standard)~~					
	PAHCCV1	9/18/08	Bis(2-ethylhexyl)phthalate (5th internal standard)		0.559	0.559	5.9	5.9
			Benzo(a)pyrene (6th internal standard)		1.027	1.027	19.4	19.4
3	~~PAH~~		~~Phenol (1st internal standard)~~					
	PAHCCV1S	9/19/08	~~Naphthalene (2nd internal standard)~~		0.580	0.580	10.0	10.0
			Fluorene (3rd internal standard)		1.211	1.211	4.9	4.9
			Pentachlorophenol (4th internal standard)					
	PAHCCV1S	9/22/08	Bis(2-ethylhexyl)phthalate (5th internal standard)		0.603	0.603	14.2	14.2
			~~Benzo(a)pyrene~~ (6th internal standard)		1.228	1.228	3.6	3.6

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 20223A2b
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: B
2nd reviewer: h

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270C)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl	1.0	0.98044	98	98	0
Terphenyl-d14	1.0	1.00647	101	101	0
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 20223A26
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: A
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MS - MSD I * 2/(MS + MSD) MS = Matrix spike percent recovery MSD = Matrix spike duplicate percent recovery

MS/MSD samples: 55 + 52

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene	80.03	80.03	ND	78.75	81.87	98	98	102	102	4	4
Pentachlorophenol											
Pyrene	80.03	80.03	23.44	84.32	83.26	76	76	75	75	1	1

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

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LDC #: 20223A2b
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1 of 1
Reviewer: A
2nd Reviewer: C

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA Where: SSC = Spike concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD) LCS = Laboratory control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: ~~SBLK0829BW1L~~ SBLK0903BS1

Compound	Spike Added (ug/kg)		Spike Concentration (ug/kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol										
N-Nitroso-di-n-propylamine										
4-Chloro-3-methylphenol										
Acenaphthene	66.67	NA	52.07	NA	78	78				
Pentachlorophenol										
Pyrene	66.67	NA	58.28	NA	87	87	NA			

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 20223A2b
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x = Area of the characteristic ion (EICP) for the compound to be measured

A_{is} = Area of the characteristic ion (EICP) for the specific internal standard

I_s = Amount of internal standard added in nanograms (ng)

V_o = Volume or weight of sample extract in milliliters (ml) or grams (g).

V_i = Volume of extract injected in microliters (ul)

V_t = Volume of the concentrated extract in microliters (ul)

Df = Dilution Factor.

%S = Percent solids, applicable to soil and solid matrices only.

2.0 = Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, chrysene

Conc. = $\frac{(64902)(1.0)(1000)(\quad)(\quad)}{(119908)(1.2733)(15.0)(0.668)(\quad)}$

= 42 ug/kg

#	Sample ID	Compound	Reported Concentration ( )	Calculated Concentration ( )	Qualification

RECALC.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Hanna City AFS RI/FS

Collection Date: November 18, 2008

LDC Report Date: February 12, 2009

Matrix: Soil

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Full Review

Laboratory: Empirical Laboratories, LLC

Sample Delivery Group (SDG): 0811250

Sample Identification

HCVWSB0123010811
HCVWSB0145010811
HCVWSB0223010811
HCVWSB0245010811
HCVWSB0245020811
HCVWSB0423010811
HCVWSB0445010811
HCVWSB0523010811
HCVWSB0545010811
HCVWSB0623010811
HCVWSB0645010811
HCVWSB0723010811
HCVWSB0745010811
HCVWSB0445010811MS-1
HCVWSB0445010811MS-3

Introduction

This data review covers 15 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8270C using Selected Ion Monitoring (SIM) for Polynuclear Aromatic Hydrocarbons.

The review follows the U.S. Army Corps of Engineers (USACE) Louisville Quality System Manual Supplement (LQSMS), March 2007, and the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version (January 2006).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

B The compound or analyte was found in an associated blank as well as in the sample.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
HCVWSB0645010811 HCVWSB0445010811MS-3	All TCL compounds	16	14	J (all detects) UJ (all non-detects)	A

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals. All ion abundance requirements were met.

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for all calibration check compounds and less than or equal to 30.0% for all other compounds.

A curve fit, based on the initial calibration, was established for quantitation for selected compounds. The coefficient of determination (r^2) was greater than or equal to 0.990 .

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
12/1/08	Acenaphthylene Benzo(g,h,i)perylene	21.9 22.4	HCVWSB0123010811 HCVWSB0145010811 HCVWSB0223010811 HCVWSB0245010811 HCVWSB0245020811 HCVWSB0423010811 HCVWSB0445010811 HCVWSB0523010811 HCVWSB0545010811 HCVWSB0623010811 HCVWSB0445010811MS-1 SBLK1121BS1	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A
12/4/08	Benzo(b)fluoranthene	26.9	HCVWSB0723010811 HCVWSB0745010811 SBLK1121BS2	J (all detects) UJ (all non-detects)	A
12/16/08	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(g,h,i)perylene	32.1 23.8 23.6	HCVWSB0645010811	J (all detects) UJ (all non-detects)	A

The percent difference (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polynuclear aromatic hydrocarbon contaminants were found in the method blanks.

No field blanks were identified in this SDG.

VI. Surrogate Spikes

Surrogates were added to all samples and blanks as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) analyses were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	%R (Limits)	Flag	A or P
HCVWSB0445010811MS-1 (HCVWSB0445010811)	Acenaphthylene Anthracene	112 (45-105) 109 (55-105)	J (all detects) J (all detects)	A

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
SBLK1121BS1L	Acenaphthylene	110 (45-105)	HCVWSB0123010811 HCVWSB0145010811 HCVWSB0223010811 HCVWSB0245010811 HCVWSB0245020811 HCVWSB0423010811 HCVWSB0445010811 HCVWSB0523010811 HCVWSB0545010811 HCVWSB0623010811 SBLK1121BS1	J (all detects)	P

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

All internal standard areas and retention times were within QC limits.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria.

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment

Manual integrations were reviewed for all samples, when applicable. The integrations were considered acceptable. The laboratory provided before and after integration printouts.

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples HCVWSB0245010811 and HCVWSB0245020811 were identified as field duplicates. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSB0245010811		HCVWSB0245020811			
	Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/1/08		Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/1/08			
Benzo(a)pyrene	5.6	6.0U	8.1	6.1U	1	-

Samples HCVWSB0623010811 (primary) and HCVWSB0623030811 (QA split from CTL SDG 70393) were compared. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSB0623010811		HCVWSB0623030811			
	Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/1/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/11/08			
Benzo(a)pyrene	7.2	6.0U	6.1U	6.1U	1	-
Benzo(b)fluoranthene	6.0U	6.9U	2.0	6.4U	Not calculable	-
Fluoranthene	5.6U	6.9U	2.2	6.9U	Not calculable	-

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 0811250

SDG	Sample	Compound	Flag	A or P	Reason
0811250	HCVWSB0645010811	All TCL compounds	J (all detects) UJ (all non-detects)	A	Technical holding times
0811250	HCVWSB0123010811 HCVWSB0145010811 HCVWSB0223010811 HCVWSB0245010811 HCVWSB0245020811 HCVWSB0423010811 HCVWSB0445010811 HCVWSB0523010811 HCVWSB0545010811 HCVWSB0623010811	Acenaphthylene Benzo(g,h,i)perylene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
0811250	HCVWSB0723010811 HCVWSB0745010811	Benzo(b)fluoranthene	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
0811250	HCVWSB0645010811	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(g,h,i)perylene	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
0811250	HCVWSB0445010811	Acenaphthylene Anthracene	J (all detects) J (all detects)	A	Matrix spike analysis (%R)
0811250	HCVWSB0123010811 HCVWSB0145010811 HCVWSB0223010811 HCVWSB0245010811 HCVWSB0245020811 HCVWSB0423010811 HCVWSB0445010811 HCVWSB0523010811 HCVWSB0545010811 HCVWSB0623010811	Acenaphthylene	J (all detects)	P	Laboratory control samples (%R)

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 0811250

No Sample Data Qualified in this SDG

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 0811250

No Sample Data Qualified in this SDG

LDC #: 20223B2b
SDG #: 0811250
Laboratory: Empirical Laboratories, LLC

VALIDATION COMPLETENESS WORKSHEET
Level IV

Date: 2/5/09
Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	SW	Sampling dates: 11/18/08
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	A	% RSD ≤ 15/30, r² ≥ 0.990 no SPCC RRF
IV.	Continuing calibration/ICV	SW	ICV ≤ 25, CCV ≤ 20
V.	Blanks	A	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	MS only
VIII.	Laboratory control samples	SW	LCS
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	
XI.	Target compound identification	A	
XII.	Compound quantitation/CRQLs	A	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	A	
XV.	Overall assessment of data	A	manual integration acceptable
XVI.	Field duplicates	SW	D = 4+5, 10+ HCVWSB0623030811 (CTL SDG 70393)
XVII.	Field blanks	N	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:
SOIL

1 1	HCVWSB0123010811	11 3	HCVWSB0645010811	21 1	SBLK1121BS1	31	12/1
2 1	HCVWSB0145010811	12 2	HCVWSB0723010811	22 2	SBLK1121BS2	32	12/4
3 1	HCVWSB0223010811	13 2	HCVWSB0745010811	23 3	SBLK1204BS3	33	12/16
4 1	HCVWSB0245010811	14 1	HCVWSB0445010811MS -1	24		34	
5 1	HCVWSB0245020811	15 3	HCVWSB0445010811MSD -3	25		35	
6 1	HCVWSB0423010811	16		26		36	
7 1	HCVWSB0445010811	17		27		37	
8 1	HCVWSB0523010811	18		28		38	
9 1	HCVWSB0545010811	19		29		39	
10 1	HCVWSB0623010811	20		30		40	

LDC #: 20223B2b
SDG #: pesticides

VALIDATION FINDINGS CHECKLIST

Page: 1 of 2
Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270C)

Validation Area	Yes	No	NA	Findings/Comments
Technical holding times				
All technical holding times were met.		✓		
Cooler temperature criteria was met.	✓			
GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation?	✓			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~30%~~ 15 and relative response factors (RRF) > 0.05?	✓			
Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ ~~25%~~ 20 and relative response factors (RRF) ≥ 0.05?		✓		
Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
Surrogates				
Were all surrogate %R within QC limits?		✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?	✓			
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Matrix spike/matrix spike duplicate				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			

LDC #: 20223B26
SDG #: See cover

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
[illegible]				
Were performance evaluation (PE) samples performed?			✓	
Were the performance evaluation (PE) samples within the acceptance limits?			✓	
[illegible]				
Were internal standard area counts within -50% or +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds from the associated calibration standard?	✓			
[illegible]				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
[illegible]				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and CRQLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
[illegible]				
Were the major ions (> 10 percent relative intensity) in the reference spectrum evaluated in sample spectrum?			✓	
Were relative intensities of the major ions within ± 20% between the sample and the reference spectra?			✓	
Did the raw data indicate that the laboratory performed a library search for all required peaks in the chromatograms (samples and blanks)?			✓	
[illegible]				
System performance was found to be acceptable.	✓			
[illegible]				
Overall assessment of data was found to be acceptable.	✓			
[illegible]				
Field duplicate pairs were identified in this SDG.	✓	N		
Target compounds were detected in the field duplicates.	✓		N	
[illegible]				
Field blanks were identified in this SDG.		✓		
Target compounds were detected in the field blanks.			✓	

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

A. Phenol**	P. Bis(2-chloroethoxy)methane	EE. 2,6-Dinitrotoluene	TT. Pentachlorophenol**	III. Benzo(a)pyrene**
B. Bis (2-chloroethyl) ether	Q. 2,4-Dichlorophenol**	FF. 3-Nitroaniline	UU. Phenanthrene	JJJ. Indeno(1,2,3-cd)pyrene
C. 2-Chlorophenol	R. 1,2,4-Trichlorobenzene	GG. Acenaphthene**	VV. Anthracene	KKK. Dibenz(a,h)anthracene
D. 1,3-Dichlorobenzene	S. Naphthalene	HH. 2,4-Dinitrophenol*	WW. Carbazole	LLL. Benzo(g,h,i)perylene
E. 1,4-Dichlorobenzene**	T. 4-Chloroaniline	II. 4-Nitrophenol*	XX. Di-n-butylphthalate	MMM. Bis(2-Chloroisopropyl)ether
F. 1,2-Dichlorobenzene	U. Hexachlorobutadiene**	JJ. Dibenzofuran	YY. Fluoranthene**	NNN. Aniline
G. 2-Methylphenol	V. 4-Chloro-3-methylphenol**	KK. 2,4-Dinitrotoluene	ZZ. Pyrene	OOO. N-Nitrosodimethylamine
H. 2,2'-Oxybis(1-chloropropane)	W. 2-Methylnaphthalene	LL. Diethylphthalate	AAA. Butylbenzylphthalate	PPP. Benzoic Acid
I. 4-Methylphenol	X. Hexachlorocyclopentadiene*	MM. 4-Chlorophenyl-phenyl ether	BBB. 3,3'-Dichlorobenzidine	QQQ. Benzyl alcohol
J. N-Nitroso-di-n-propylamine*	Y. 2,4,6-Trichlorophenol**	NN. Fluorene	CCC. Benzo(a)anthracene	RRR. Pyridine
K. Hexachloroethane	Z. 2,4,5-Trichlorophenol	OO. 4-Nitroaniline	DDD. Chrysene	SSS. Benzidine
L. Nitrobenzene	AA. 2-Chloronaphthalene	PP. 4,6-Dinitro-2-methylphenol	EEE. Bis(2-ethylhexyl)phthalate	TTT.
M. Isophorone	BB. 2-Nitroaniline	QQ. N-Nitrosodiphenylamine (1)**	FFF. Di-n-octylphthalate**	UUU
N. 2-Nitrophenol**	CC. Dimethylphthalate	RR. 4-Bromophenyl-phenylether	GGG. Benzo(b)fluoranthene	VVV.
O. 2,4-Dimethylphenol	DD. Acenaphthylene	SS. Hexachlorobenzene	HHH. Benzo(k)fluoranthene	WWW.

Notes: * = System performance check compound (SPCC) for RRF; ** = Calibration check compound (CCC) for %RSD.

COMPNDL

LDC #: 20223B26
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Page: 1 of 1
Reviewer: B
2nd Reviewer: A

All circled dates have exceeded the technical holding times.
Y N N/A Were all cooler temperatures within validation criteria?

METHOD : GC/MS BNA (EPA SW 846 Method 8270)

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
11,15	soil		11/18/08	12/4/08	12/16/08	16	J/UJ/A

TECHNICAL HOLDING TIME CRITERIA

Water: Extracted within 7 days, analyzed within 40 days.
Soil: Extracted within 14 days, analyzed within 40 days.

LDC #: 20223B26
SDG #: pu cover

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: A
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours of sample analysis for each instrument?
Y N N/A Were percent differences (%D) and relative response factors (RRF) within method criteria for all CCC's and SPCC's ?
Y N N/A Were all %D and RRFs within the validation criteria of ≤25 %D and ≥0.05 RRF ?

#	Date	Standard ID	Compound	Finding %D (Limit: ≤25.0%)	Finding RRF (Limit: ≥0.05)	Associated Samples	Qualifications
	12/1/08	PAHccV1	DD	21.9		SBLK1/2/BS1,	J/UJ/A
			LLL	22.4		1→10, 14	↓
	12/4/08	PAHccV1	GGG	26.9		SBLK1/2/BS2,	↓
						12, 13	
	12/16/08	PAHccV1	CCC	32.1		11	
			GGG	23.8		↓	↓
			LLL	23.6			

CONCAL.2S

LDC #: 20223B26
SDG #: all cases

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: FD
2nd Reviewer: R

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N N/A If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N N/A If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		2	FBP	34 (45-105)	no QUAL
				( )	
		3	↓	36 ( )	
				( )	
		4	↓	38 ( )	
				( )	
		10	↓	39 ( )	
				( )	
		SBLK1121BS2	↓	36 ( )	
				( )	
		12	↓	35 ( )	
				( )	
		13	↓	34 (↓)	
				( )	
		11	TPH	158 (30-125)	↓
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

* QC limits are advisory	QC Limits (Soil)	QC Limits (Water)		QC Limits (Soil)	QC Limits (Water)
S1 (NBZ) = Nitrobenzene-d5	23-120	35-114	S5 (2FP) = 2-Fluorophenol	25-121	21-100
S2 (FBP) = 2-Fluorobiphenyl	30-115	43-116	S6 (TBP) = 2,4,6-Tribromophenol	19-122	10-123
S3 (TPH) = Terphenyl-d14	18-137	33-141	S7 (2CP) = 2-Chlorophenol-d4	20-130*	33-110*
S4 (PHL) = Phenol-d5	24-113	10-94	S8 (DCB) = 1,2-Dichlorobenzene-d4	20-130*	16-110*

SUR.2S

LDC #: 20223B26
SDG #: all cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		~~15~~ 14	DD	112 (45-105)	( )	( )	7	J/A det
			VV	109 (55-105)	( )	( )	↓	↓
				( )	( )	( )		
				( )	( )	( )	— — —	—
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

	Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)		Compound	QC Limits (Soil)	RPD (Soil)	QC Limits (Water)	RPD (Water)
A.	Phenol	26-90%	≤ 35%	12-110%	≤ 42%	GG.	Acenaphthene	31-137%	≤ 19%	46-118%	≤ 31%
C.	2-Chlorophenol	25-102%	≤ 50%	27-123%	≤ 40%	II.	4-Nitrophenol	11-114%	≤ 50%	10-80%	≤ 50%
E.	1,4-Dichlorobenzene	28-104%	≤ 27%	36-97%	≤ 28%	KK.	2,4-Dinitrotoluene	28-89%	≤ 47%	24-96%	≤ 38%
J.	N-Nitroso-di-n-propylamine	41-126%	≤ 38%	41-116%	≤ 38%	TT.	Pentachlorophenol	17-109%	≤ 47%	9-103%	≤ 50%
R.	1,2,4-Trichlorobenzene	38-107%	≤ 23%	39-98%	≤ 28%	ZZ.	Pyrene	35-142%	≤ 36%	26-127%	≤ 31%
V.	4-Chloro-3-methylphenol	26-103%	≤ 33%	23-97%	≤ 42%						

LDC #: 20223B26
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: F7
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?

Y N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		~~SBLK~~		( )	( )	( )		
		SBLK1121BS1L	DD	110 (45-105)	( )	( )	SBLK1121BS1	J/Pdet
				( )	( )	( )	1 → 10	—
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 20223B2b
SDG#: see cover

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: FT
2nd Reviewer: SC

METHOD: GC/MS PAH(EPA SW 846 Method 8270SIM)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	4		5			
	Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/01/08		Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/01/08			
III	5.9	(6.0)	8.1	(6.1)	1	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	10		HCVWSB0623030811			
	Dilution: 1.0 Prep Date: 11/21/08 Analysis date: 12/01/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/11/08			
III	7.2	(6.0)	6.1U	(6.1)	1	-
GGG	6.0U	(6.9)	2.0	(6.4)	NC	-
YY	5.6U	(6.9)	2.2	(6.9)	NC	-

LDC #: 20223B26
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer: F7
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of compound,
C_x = Concentration of compound,
S = Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Reported RRF (0.5 std)	Recalculated RRF (0.5 std)	Reported Average RRF (initial)	Recalculated Average RRF (initial)	Reported %RSD	Recalculated %RSD
1	ICAL	9/15/08	~~Phenol~~ (1st internal standard) Acenaphthene	0.530	0.530	0.52771	0.52771	7.3	7.3
			~~Naphthalene~~ (2nd internal standard) Chrysene	1.177	1.177	1.2733	1.2733	11.0	11.0
			~~Fluorene (3rd internal standard)~~						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			~~Benzo(a)pyrene (6th internal standard)~~						
2	ICAL	12/10/08	~~Phenol~~ (1st internal standard) Acenaphthene	0.672	0.672	0.685728	0.686	11.1	11.1
			~~Naphthalene~~ (2nd internal standard) Chrysene	see curve					
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			~~Benzo(a)pyrene (6th internal standard)~~						
3			Phenol (1st internal standard)						
			Naphthalene (2nd internal standard)						
			Fluorene (3rd internal standard)						
			Pentachlorophenol (4th internal standard)						
			Bis(2-ethylhexyl)phthalate (5th internal standard)						
			Benzo(a)pyrene (6th internal standard)						

Comments: Refer to Initial Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC # 20223B2b
SDG# per cover

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Page: 1 of 1
Reviewer:
2nd Reviewer:

METHOD: GCMS PAH 8270C sim

Parameter: Chrysene

Date	Column	Compound	X	Y	
12/10/2009	GCMS4	Chrysene	0.005	0.010	
			0.010	0.027	
			0.050	0.096	
			0.100	0.161	
			0.250	4.06E-001	
			0.500	7.73E-001	
			1.000	1.46E+000	
			5.000	8.029	
			10.000	14.926	

Regression Output:	Regression Output:	Reported	
Constant	0.00000		
Std Err of Y Est	0.18049		
R Squared	0.99879		0.99900
No. of Observations	9.00000		
Degrees of Freedom	8.00000		
X Coefficient(s)	1.515E+000	1.51637	
Std Err of Coef.	0.00		

LDC #: 20223B2b
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Page: 1 of 1
Reviewer: A
2nd Reviewer: K

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = $(A_x)(C_{is})/(A_{is})(C_x)$

Where: ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
A_x = Area of compound, A_{is} = Area of associated internal standard
C_x = Concentration of compound, C_{is} = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (Reference Internal Standard)	Average RRF (initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported %D	Recalculated %D
1	PAH CCV 1	12/1/08	~~Phenol~~ (1st internal standard) Acenaphthene	0.527	0.609	0.609	15.4	15.4
	0559		~~Naphthalene~~ (2nd internal standard) Chrysene	1.273	1.386	1.386	8.9	8.9
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th internal standard)					
			Bis(2-ethylhexyl)phthalate (5th internal standard)					
			Benzo(a)pyrene (6th internal standard)					
2	PAH CCV 1	12/4/08	~~Phenol~~ (1st internal standard)		0.612	0.612	16.0	16.0
			~~Naphthalene~~ (2nd internal standard)		1.388	1.388	9.0	9.0
			Fluorene (3rd internal standard)					
			Pentachlorophenol (4th internal standard)					
	PAH CCV 1	12/15/08	~~Bis(2-ethylhexyl)phthalate~~ (5th internal standard)	0.686	0.679	0.679	4.951	4.951
			~~Benzo(a)pyrene (6th internal standard)~~	5.0	4.025	4.025	19.5	19.5
3			Phenol (1st internal standard)					
	PAH CCV 1	12/16/08	~~Naphthalene~~ (2nd internal standard)		0.689	0.689	0.5	0.5
			~~Fluorene (3rd internal~~ standard)		5.585	5.585	11.7	11.7
			Pentachlorophenol (4th internal standard)					
			Bis(2-ethylhexyl)phthalate (5th internal standard)					
			Benzo(a)pyrene (6th internal standard)					

Comments: Refer to Continuing Calibration findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 20223B2b
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: B
2nd reviewer: A

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270C)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: #1

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl	1.0	0.44907	45	45	0
Terphenyl-d14	1.0	0.35659	36	36	0
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 20223B26
SDG #: per cover

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Page: 1 of 1
Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA

Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MS - MSD I * 2/(MS + MSD)

MS = Matrix spike percent recovery; MSD = Matrix spike duplicate percent recovery

MS/MSD samples: # 15

Compound	Spike Added (ug/kg)		Sample Concentration (ug/kg)	Spiked Sample Concentration (ug/kg)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol											
N-Nitroso-di-n-propylamine											
4-Chloro-3-methylphenol											
Acenaphthene	88.18	NA	0	93.60	NA	106	106				
Pentachlorophenol											
Pyrene	88.18	NA	0	87.54	NA	84	84	NA			

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

MSDCLC.wpd

LDC #: 20223B2b
SDG #: see cover

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Page: 1 of 1
Reviewer: A
2nd Reviewer: R

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration
SA = Spike added

RPD = I LCS - LCSD I * 2/(LCS + LCSD)

LCS = Laboratory control sample percent recovery LCSD = Laboratory control sample duplicate percent recovery

LCS/LCSD samples: SBLK112/BS/L

Compound	Spike Added (ug/Kg)		Spike Concentration (ug/Kg)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
~~Phenol~~										
~~N-Nitroso-di-n-propylamine~~										
~~4-Chloro-3-methylphenol~~										
Acenaphthene	66.67	NA	66.90	NA	100	100				
~~Pentachlorophenol~~										
Pyrene	66.67	NA	68.63	NA	103	103	NA			

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 20223B26
SDG #: pc cover

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: [illegible]
2nd reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270C)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

$$\text{Concentration} = \frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. #1, Benzo (g, h, i) perylene

final Conc. = $\frac{(0.106315)(1000)}{(15)(0.754)}$

= 9.4 ug/kg

#	Sample ID	Compound	Reported Concentration ( )	Calculated Concentration ( )	Qualification
		$\frac{9571}{11786} = \frac{x}{1}$ (0.76382518)			
		$x = (0.106315)(1000)$			

RECALC.wpd

LDC Report# 20223D2b

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Hanna City AFS RI/FS

Collection Date: November 19, 2008

LDC Report Date: February 25, 2009

Matrix: Soil

Parameters: Polynuclear Aromatic Hydrocarbons

Validation Level: Full Review

Laboratory: Empirical Laboratories, LLC

Sample Delivery Group (SDG): 0811280

Sample Identification

HCVWSS08010811
HCVWSS08010811DL
HCVWSS09010811
HCCASS08010811
HCCASS08010811DL
HCCCSS08010811
HCCCSS08010811DL
HCCCSS08020811
HCCCSS08020811DL
HCCCSS09010811
HCCCSS09010811DL
HCMBSS07010811
HCMBSS07010811DL
HCCBSS11010811
HCCBSS11010811DL
HCCBSS10010811
HCCBSS08010811
HCMESS07010811
HCCBSS11010811MS
HCCBSS11010811MSD

Introduction

This data review covers 20 soil samples listed on the cover sheet including dilutions and reanalysis as applicable. The analyses were per EPA SW 846 Method 8270C using Selected Ion Monitoring (SIM) for Polynuclear Aromatic Hydrocarbons.

The review follows the U.S. Army Corps of Engineers (USACE) Louisville Quality System Manual Supplement (LQSMS), March 2007, and the U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version (January 2006).

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

Blank results are summarized in Section V.

Field duplicates are summarized in Section XVI.

The following are definitions of the data qualifiers:

U Indicates the compound or analyte was analyzed for but not detected at or above the stated limit.

J Indicates an estimated value.

R Quality control indicates the data is not usable.

N Presumptive evidence of presence of the constituent.

UJ Indicates the compound or analyte was analyzed for but not detected. The sample detection limit is an estimated value.

B The compound or analyte was found in an associated blank as well as in the sample.

A Indicates the finding is based upon technical validation criteria.

P Indicates the finding is related to a protocol/contractual deviation.

None Indicates the data was not significantly impacted by the finding, therefore qualification was not required.

I. Technical Holding Times

All technical holding time requirements were met.

The chain-of-custodies were reviewed for documentation of cooler temperatures. All cooler temperatures met validation criteria.

II. GC/MS Instrument Performance Check

Instrument performance was checked at 12 hour intervals. All ion abundance requirements were met.

All ion abundance requirements were met.

III. Initial Calibration

Initial calibration was performed using required standard concentrations.

Percent relative standard deviations (%RSD) were less than or equal to 15.0% for all calibration check compounds and less than or equal to 30.0% for all other compounds.

A curve fit, based on the initial calibration, was established for quantitation for selected compounds. The coefficient of determination (r^2) was greater than or equal to 0.990 .

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

All of the continuing calibration percent differences (%D) between the initial calibration RRF and the continuing calibration RRF were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
12/4/08	Benzo(b)fluoranthene	26.9	SBLK1124BS1	J (all detects) UJ (all non-detects)	A
12/5/08	Benzo(b)fluoranthene Chrysene	30.4 40.3	HCVWSS08010811 HCVWSS09010811 HCCASS08010811 HCCCSS08010811 HCCCSS08020811 HCCCSS09010811 HCMBSS07010811 HCCBSS11010811 HCCBSS10010811 HCCBSS08010811 HCMESS07010811 HCCBSS11010811MS HCCBSS11010811MSD	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A

Date	Compound	%D	Associated Samples	Flag	A or P
12/12/08	Benzo(a)anthracene	28.9	HCVWSS08010811DL HCCASS08010811DL	J (all detects) UJ (all non-detects)	A
	Benzo(b)fluoranthene	24.6	HCCCSS08010811DL HCCCSS08020811DL HCCCSS09010811DL HCMBSS07010811DL HCCBSS11010811DL	J (all detects) UJ (all non-detects)	

The percent difference (%D) of the second source calibration standard were less than or equal to 25.0% for all compounds.

V. Blanks

Method blanks were reviewed for each matrix as applicable. No polynuclear aromatic hydrocarbon contaminants were found in the method blanks.

No field blanks were identified in this SDG.

VI. Surrogate Spikes

Surrogates were added to all samples and blanks as required by the method. All surrogate recoveries (%R) were within QC limits.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) samples were reviewed for each matrix as applicable. Percent recoveries (%R) and relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	RPD (Limits)	Flag	A or P
HCCBSS11010811MS/MSD (HCCBSS11010811 HCCBSS11010811DL)	Acenaphthylene	120 (45-105)	169 (45-105)	32 (≤30)	J (all detects)	A
	Anthracene	22 (55-105)	623 (55-105)	117 (≤30)	UJ (all non-detects)	
	Benzo(a)anthracene	-	-	120 (≤30)		
	Benzo(b)fluoranthene	-	-	130 (≤30)		
	Benzo(k)fluoranthene	0 (45-125)	673 (45-125)	107 (≤30)		
	Benzo(g,h,i)perylene	0 (40-125)	578 (40-125)	110 (≤30)		
	Benzo(a)pyrene	-	-	122 (≤30)		
	Chrysene	-	-	118 (≤30)		
	Fluoranthene	-	-	135 (≤30)		
	Indeno(1,2,3-cd)pyrene	0 (40-120)	604 (40-120)	111 (≤30)		
	Phenanthrene	-	-	135 (≤30)		
	Pyrene	-	-	131 (≤30)		
	Acenaphthene	-	372 (45-110)	95 (≤30)		
	Dibenz(a,h)anthracene	-	335 (40-125)	96 (≤30)		
	Fluorene	-	344 (50-110)	99 (≤30)		
	2-Methylnaphthalene	-	161 (45-105)	44 (≤30)		
	Naphthalene	-	197 (40-105)	56 (≤30)		

VIII. Laboratory Control Samples (LCS)

Laboratory control samples were reviewed for each matrix as applicable. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
SBLK1124BS1L	Acenaphthene Acenaphthylene Anthracene Benzo(a)pyrene Fluoranthene Fluorene Naphthalene	129 (45-110) 130 (45-105) 132 (55-105) 112 (50-110) 117 (55-115) 111 (50-110) 115 (40-105)	All samples in SDG 0811280	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P

IX. Regional Quality Assurance and Quality Control

Not applicable.

X. Internal Standards

All internal standard areas and retention times were within QC limits.

XI. Target Compound Identifications

All target compound identifications were within validation criteria.

XII. Compound Quantitation and CRQLs

All compound quantitation and CRQLs were within validation criteria with the following exceptions:

Sample	Compound	Finding	Criteria	Flag	A or P
HCVWSS08010811 HCCCSS09010811	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A

Sample	Compound	Finding	Criteria	Flag	A or P
HCCASS08010811	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A
HCCCSS08010811 HCMBSS07010811	Fluoranthene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects)	A
HCCCSS08020811	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A
HCCBSS11010811	Fluoranthene	Sample result exceeded calibration range.	Reported result should be within calibration range.	J (all detects)	A

Sample	Compound	Finding	Flag	A or P
HCVWSS09010811	All TCL compounds	The laboratory indicated that since the analysis of this sample followed the analysis of sample HCVWSS08010811, which had high concentrations of target analytes, the detected results are potentially biased high. Detected results were estimated due to possible carryover.	J (all detects)	A

XIII. Tentatively Identified Compounds (TICs)

Tentatively identified compounds were not reported by the laboratory.

XIV. System Performance

The system performance was acceptable.

XV. Overall Assessment

The overall assessment of data was acceptable. In the case where more than one result was reported for an individual sample, the least technically acceptable results were rejected as follows:

Sample	Compound	Flag	A or P
HCVWSS08010811 HCCCSS09010811	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	R R R R R R R R R R R	A
HCVWSS08010811DL HCCCSS09010811DL	All TCL compounds except Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	R	A
HCCASS08010811	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	R R R R R R R	A
HCCASS08010811DL	All TCL compounds except Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	R	A
HCCCSS08010811 HCMBSS07010811	Fluoranthene Pyrene	R R	A
HCCCSS08010811DL HCMBSS07010811DL	All TCL compounds except Fluoranthene Pyrene	R	A
HCCCSS08020811	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	R R R R R	A

Sample	Compound	Flag	A or P
HCCCSS08020811DL	All TCL compounds except Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	R	A
HCCBSS11010811	Fluoranthene	R	A
HCCBSS11010811DL	All TCL compounds except Fluoranthene	R	A

Manual integrations were reviewed for all samples, when applicable. The integrations were considered acceptable. The laboratory provided before and after integration printouts.

Data flags are summarized at the end of this report if data has been qualified.

XVI. Field Duplicates

Samples HCCCSS08010811 and HCCCSS08020811 and samples HCCCSS08010811DL and HCCCSS08020811DL were identified as field duplicates. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS08010811		HCCCSS08020811			
	Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08			
Acenaphthene	43	5.8U	100	5.7U	2	-
Anthracene	140	6.6U	360	6.6U	3	-
Benzo(a)anthracene	820	5.8U	3000	5.7U	4	-
Benzo(b)fluoranthene	870	5.8U	2800	5.7U	3	-
Benzo(k)fluoranthene	400	5.8U	1400	5.7U	4	-
Benzo(g,h,i)perylene	400	5.8U	1300	5.7U	3	-
Benzo(a)pyrene	710	5.8U	2300	5.7U	3	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS08010811		HCCCSS08020811			
	Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08			
Chrysene	1100	6.6U	3900	6.6U	4	-
Dibenz(a,h)anthracene	70	5.8U	360	5.7U	5	D
Fluoranthene	1600	6.6U	3900	6.6U	2	-
Fluorene	33	6.6U	100	6.6U	3	-
Indeno(1,2,3-cd)pyrene	400	5.8U	1300	5.7U	3	-
2-Methylnaphthalene	6.8	5.7U	13	5.6U	2	-
Naphthalene	5.7	5.4U	13	5.3U	2	-
Phenanthrene	640	6.6U	2400	6.6U	4	-
Pyrene	1200	5.8U	3200	5.7U	3	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS08010811DL		HCCCSS08020811DL			
	Dilution: 5.0 Prep Date: 11/24/08 Analysis date: 12/12/08		Dilution: 5.0 Prep Date: 11/24/08 Analysis date: 12/12/08			
Acenaphthene	32	29U	79	29U	2	-
Anthracene	110	33U	440	33U	4	-
Benzo(a)anthracene	570	29U	1700	29U	3	-
Benzo(b)fluoranthene	640	29U	1600	29U	3	-
Benzo(k)fluoranthene	230	29U	770	29U	3	-
Benzo(g,h,i)perylene	390	29U	1000	29U	3	-
Benzo(a)pyrene	600	29U	1700	29U	3	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCCCSS08010811DL		HCCCSS08020811DL			
	Dilution: 5.0 Prep Date: 11/24/08 Analysis date: 12/12/08		Dilution: 5.0 Prep Date: 11/24/08 Analysis date: 12/12/08			
Chrysene	640	33U	1900	33U	3	-
Fluoranthene	1200	29U	3900	29U	3	-
Fluorene	24	33U	96	33U	4	-
Indeno(1,2,3-cd)pyrene	330	29U	870	29U	3	-
Phenanthrene	580	33U	2200	33U	4	-
Pyrene	1000	29U	3100	29U	3	-

Samples HCVWSS09010811 (primary) and HCVWSS09030811 (QA split from CTL SDG 70393) were compared. No polynuclear aromatic hydrocarbons were detected in any of the samples with the following exceptions:

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSS09010811		HCVWSS09030811			
	Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/11/08			
Anthracene	7.3U	7.3U	3.0	6.5U	2	-
Benzo(a)anthracene	17	6.4U	15	6.2U	1	-
Benzo(b)fluoranthene	16	6.4U	25	6.2U	2	-
Benzo(k)fluoranthene	11	6.4U	7.3	6.4U	1	-
Benzo(g,h,i)perylene	6.4U	6.4U	11	6.2U	2	-
Benzo(a)pyrene	17	6.4U	16	5.9U	1	-
Chrysene	23	7.3U	19	6.6U	1	-
Fluoranthene	34	7.3U	41	6.8U	1	-
Indeno(1,2,3-cd)pyrene	9.8	6.4U	11	6.0U	1	-
Phenanthrene	11	7.3U	18	6.8U	2	-

Compound	Concentration (Detection limit) (ug/Kg)				Difference Factor (X)	Disagreement /Major Disagreement (D/MD)
	HCVWSS09010811		HCVWSS09030811			
	Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/5/08		Dilution: 1.0 Prep Date: 11/24/08 Analysis date: 12/11/08			
Pyrene	26	6.4U	30	6.4U	1	-

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Polynuclear Aromatic Hydrocarbons - Data Qualification Summary - SDG 0811280

SDG	Sample	Compound	Flag	A or P	Reason
0811280	HCVWSS08010811 HCVWSS09010811 HCCASS08010811 HCCCSS08010811 HCCCSS08020811 HCCCSS09010811 HCMBSS07010811 HCCBSS11010811 HCCBSS10010811 HCCBSS08010811 HCMESS07010811	Benzo(b)fluoranthene Chrysene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
0811280	HCVWSS08010811DL HCCASS08010811DL HCCCSS08010811DL HCCCSS08020811DL HCCCSS09010811DL HCMBSS07010811DL HCCBSS11010811DL	Benzo(a)anthracene Benzo(b)fluoranthene	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)
0811280	HCCBSS11010811 HCCBSS11010811DL	Acenaphthylene Anthracene Benzo(k)fluoranthene Benzo(g,h,i)perylene Indeno(1,2,3-cd)pyrene Acenaphthene Dibenz(a,h)anthracene Fluorene 2-Methylnaphthalene Naphthalene	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicates (%R)(RPD)
0811280	HCCBSS11010811 HCCBSS11010811DL	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicates (RPD)

SDG	Sample	Compound	Flag	A or P	Reason
0811280	HCVWSS08010811 HCVWSS08010811DL HCVWSS09010811 HCCASS08010811 HCCASS08010811DL HCCCSS08010811 HCCCSS08010811DL HCCCSS08020811 HCCCSS08020811DL HCCCSS09010811 HCCCSS09010811DL HCMBSS07010811 HCMBSS07010811DL HCCBSS11010811 HCCBSS11010811DL HCCBSS10010811 HCCBSS08010811 HCMESS07010811	Acenaphthene Acenaphthylene Anthracene Benzo(a)pyrene Fluoranthene Fluorene Naphthalene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	P	Laboratory control samples (%R)
0811280	HCVWSS08010811 HCCCSS09010811	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation and CRQLs
0811280	HCCASS08010811	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation and CRQLs
0811280	HCCCSS08010811 HCMBSS07010811	Fluoranthene Pyrene	J (all detects) J (all detects)	A	Compound quantitation and CRQLs
0811280	HCCCSS08020811	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	J (all detects) J (all detects) J (all detects) J (all detects) J (all detects)	A	Compound quantitation and CRQLs
0811280	HCCBSS11010811	Fluoranthene	J (all detects)	A	Compound quantitation and CRQLs
0811280	HCVWSS09010811	All TCL compounds	J (all detects)	A	Compound quantitation and CRQLs

SDG	Sample	Compound	Flag	A or P	Reason
0811280	HCVWSS08010811 HCCCSS09010811	Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	R R R R R R R R R R R	A	Overall assessment of data
0811280	HCVWSS08010811DL HCCCSS09010811DL	All TCL compounds except Anthracene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(g,h,i)perylene Benzo(a)pyrene Chrysene Fluoranthene Indeno(1,2,3-cd)pyrene Phenanthrene Pyrene	R	A	Overall assessment of data
0811280	HCCASS08010811	Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	R R R R R R R	A	Overall assessment of data
0811280	HCCASS08010811DL	All TCL compounds except Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Phenanthrene Pyrene	R	A	Overall assessment of data
0811280	HCCCSS08010811 HCMBSS07010811	Fluoranthene Pyrene	R R	A	Overall assessment of data
0811280	HCCCSS08010811DL HCMBSS07010811DL	All TCL compounds except Fluoranthene Pyrene	R	A	Overall assessment of data
0811280	HCCCSS08020811	Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	R R R R R	A	Overall assessment of data

SDG	Sample	Compound	Flag	A or P	Reason
0811280	HCCCSS08020811DL	All TCL compounds except Benzo(a)anthracene Benzo(b)fluoranthene Chrysene Fluoranthene Pyrene	R	A	Overall assessment of data
0811280	HCCBSS11010811	Fluoranthene	R	A	Overall assessment of data
0811280	HCCBSS11010811DL	All TCL compounds except Fluoranthene	R	A	Overall assessment of data

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Polynuclear Aromatic Hydrocarbons - Laboratory Blank Data Qualification Summary - SDG 0811280

No Sample Data Qualified in this SDG

Hanna City AFS RI/FS
Polynuclear Aromatic Hydrocarbons - Field Blank Data Qualification Summary - SDG 0811280

No Sample Data Qualified in this SDG

LDC #: 20223D2b **VALIDATION COMPLETENESS WORKSHEET** Date: 2/4/09
SDG #: 0811280 Level IV Page: 1 of 1
Laboratory: Empirical Laboratories, LLC Reviewer: [illegible]
2nd Reviewer: [illegible]

METHOD: GC/MS Polynuclear Aromatic Hydrocarbons (EPA SW 846 Method 8270C-SIM)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Technical holding times	A	Sampling dates: 11/19/08
II.	GC/MS Instrument performance check	A	
III.	Initial calibration	A	% RSD, ≤ 15/30, r² 20-990 no SPCC RRF
IV.	Continuing calibration/ICV	SW	ICV ≤ 25 CCV ≤ 20
V.	Blanks	A	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	SW	LCS
IX.	Regional Quality Assurance and Quality Control	N	
X.	Internal standards	A	
XI.	Target compound identification	A	
XII.	Compound quantitation/CRQLs	SW	
XIII.	Tentatively identified compounds (TICs)	N	
XIV.	System performance	A	
XV.	Overall assessment of data	SW ~~A~~	manual integration acceptable
XVI.	Field duplicates	SW	D = 6 + 8, 7 + 9,
XVII.	Field blanks	N	3 + HCVWSS09030811 (CTL SDG 70393)

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank

Validated Samples:

SOIL

1	HCVWSS08010811 ✓	11	HCCCSS09010811DL ✓	21	SBLK1124BS1	31	
2	HCVWSS08010811DL 50X	12	HCMBSS07010811 ✓	22		32	
3	HCVWSS09010811 ✓	13	HCMBSS07010811DL ✓	23		33	
4	HCCASS08010811 ✓	14	HCCBSS11010811 ✓	24		34	
5	HCCASS08010811DL 20X	15	HCCBSS11010811DL ✓	25		35	
6	HCCCSS08010811 ✓	16	HCCBSS10010811 ✓	26		36	
7	HCCCSS08010811DL 5X ✓	17	HCCBSS08010811 ✓	27		37	
8	HCCCSS08020811 ✓	18	HCMESS07010811 ✓	28		38	
9	HCCCSS08020811DL 5X	19	HCCBSS11010811MS	29		39	
10	HCCCSS09010811 ✓	20	HCCBSS11010811MSD	30		40	

LDC #: 20223D2b
SDG #: per cover

VALIDATION FINDINGS CHECKLIST

Reviewer: [illegible]
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270C)

Validation Area	Yes	No	NA	Findings/Comments
Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation?	✓			
Did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30% and relative response factors (RRF) > 0.05?	✓			
Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 25% and relative response factors (RRF) ≥ 0.05?			✓	
Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was a method blank analyzed for each matrix and concentration?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
Surrogate spikes				
Were all surrogate %R within QC limits?		✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?	✓			
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
Matrix spike/matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			