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June 9, 1997
WCFS Project No. F96515

Department of the Air Force
Headquarters Oklahoma City Air Logistics Center (AFMC)
OC-ALC/PKOSS
ATTN: Sharon Beatty
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Subject: Submittal of the Draft Second Year Quarterly Monitoring Annual Report
Long-Term Monitoring of Soldier Creek
Contract No. F34650-93-D-0109, Order No. 5014
WCFS Document Control No. F96515.28

Dear Mr. Beatty:

This letter transmits the response to comments on the Internal Draft Quarterly Monitoring Annual Report, and eleven copies of the Draft Quarterly Monitoring Annual Report prepared by Woodward-Clyde Federal Services (WFCS) for the second year of quarterly monitoring of Soldier Creek at Tinker AFB. Ten copies of the report were delivered to James Dawson.

If you have any questions regarding this submittal, please contact the undersigned.

Sincerely,

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Senior Staff Scientist

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Project Manager

tinker/d014/annual.id/transmitr.ltr June 9, 1997

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DRAFT

SECOND YEAR QUARTERLY MONITORING ANNUAL REPORT LONG-TERM MONITORING OF SOLDIER CREEK TINKER AFB OKLAHOMA CITY, OKLAHOMA

CONTRACT NO. F34650-93-D-0109
ORDER 5014

Prepared for
Department of the Air Force
Tinker AFB
Oklahoma City, Oklahoma

June 1997

DRAFT

SECOND YEAR QUARTERLY MONITORING ANNUAL REPORT FOR LONG-TERM MONITORING OF SOLDIER CREEK SEDIMENT AND SURFACE WATER OPERABLE UNIT

Document Prepared for:

Tinker Air Force Base
Environmental Directorate
OC-ALC/EM
Tinker AFB, Oklahoma

405-734-3058

This Draft Quarterly Monitoring Annual Report is intended for review by Tinker and regulatory personnel. The document incorporates sediment and surface water data collected by Woodward-Clyde Federal Services during the second year of quarterly monitoring, the human health risk assessment II (HHRA II), and a summary of groundwater data collected in 1995 and 1996 as it relates to the Soldier Creek Sediment and Surface Water Operable Unit.

Outline of Document

- Introduction
- Background
- Investigation Methods
- Human Health Risk Assessments
- Discussion of Quarterly Monitoring Results
- Review of Groundwater
- Conclusions and References

TABLE OF CONTENTS

Section			Page
EXECUTIVE SUMMARY			0-1
1.0	INTRODUCTION		1-1
	1.1	PURPOSE OF REPORT	1-1
	1.2	REGULATORY BASIS	1-1
	1.3	INVESTIGATION SCOPE AND OBJECTIVES	1-2
	1.4	REPORT ORGANIZATION	1-2
2.0	BACKGROUND		2-1
	2.1	INSTALLATION DESCRIPTION AND HISTORY	2-1
	2.2	SITE DESCRIPTION AND HISTORY	2-3
		2.2.1 East Soldier Creek	2-4
		2.2.2 West Soldier Creek	2-6
		2.2.3 Previous Investigations	2-7
3.0	INVESTIGATION METHODS		3-1
	3.1	SAMPLING LOCATIONS	3-1
		3.1.1 Sediment Sampling	3-2
		3.1.2 Surface Water Sampling	3-3
		3.1.3 Decontamination Procedures	3-3
	3.2	SAMPLE IDENTIFICATION	3-4
	3.3	ANALYTICAL PARAMETERS	3-6
	3.4	QUALITY CONTROL/QUALITY ASSURANCE	3-6
4.0	HUMAN HEALTH RISK ASSESSMENTS		4-1
5.0	DISCUSSION OF QUARTERLY MONITORING RESULTS		5-1
	5.1	DATA SCREENING	5-1
	5.2	EVALUATION AND DISCUSSION OF RESULTS	5-2
		5.2.1 Sediment	5-2
		5.2.1.1 Metals	5-3
		5.2.1.2 PCB's and Chlorinated Pesticides	5-4
		5.2.1.3 Semivolatile Organics	5-5

	5.2.1.4	Volatiles	5-9
	5.2.1.5	Tentatively Identified Compounds	5-9
5.2.2	Surface Water		5-11
	5.2.2.1	Metals	5-11
	5.2.2.2	PCBs and Chlorinated Pesticides	5-13
	5.2.2.3	Semivolatiles	5-13
	5.2.2.4	Volatiles	5-13
	5.2.2.5	Wet Chemistry	5-14
	5.2.2.6	Tentatively Identified Compounds	5-14

6.0	REVIEW OF GROUNDWATER	6-1
6.1	GROUNDWATER/SURFACE WATER INTERACTION	6-1
6.2	ANALYTICAL	6-2
7.0	CONCLUSIONS	7-1
8.0	REFERENCES	8-1

LIST OF TABLES

TABLE 2-1 Soldier Creek Outfalls and Associated Buildings/Structures

TABLE 2-2 Summary of Previous Investigations and Activities

TABLE 3-1 Sample Location Rationale

TABLE 3-2 Analytes and Reporting Limits

TABLE 3-3 Analytes, Containers, Preservation, and Holding Times

TABLE 5-1 Carcinogenic and Non-Carcinogenic Baseline Health Risk Assessment (BHRA) Screening Criteria for Sediment

TABLE 5-2 Carcinogenic and Non-Carcinogenic Baseline Health Risk Assessment (BHRA) Screening Criteria for Surface Water

TABLE 5-3 Carcinogenic and Non-Carcinogenic Human Health Risk Assessment I (HHRA I) Screening Criteria for Sediment

TABLE OF CONTENTS (CONTINUED)

TABLE 5-4 Carcinogenic and Non-Carcinogenic Human Health Risk Assessment I (HHRA I) Screening Criteria for Surface Water

TABLE 5-5 Carcinogenic and Non-Carcinogenic Human Health Risk Assessment II (HHRA II) Screening Criteria for Sediment

TABLE 5-6 Carcinogenic and Non-Carcinogenic Human Health Risk Assessment II (HHRA II) Screening Criteria for Surface Water

TABLE 5-7 Statistical Evaluation of Analytes Detected in Sediment Samples Second Year Quarterly Monitoring

TABLE 5-8 Maximum Detected Concentrations and Associated Sample Location for Analytes Detected in Sediment Samples Second Year Quarterly Monitoring

TABLE 5-9 Exceedances of Baseline Health Risk Assessment 10^{-6} Screening Criteria to a Depth of One Foot

TABLE 5-10 Exceedances of Human Health Risk Assessment I 10^{-5} Screening Criteria

TABLE 5-11 Exceedances of Human Health Risk Assessment I 10^{-6} Screening Criteria

TABLE 5-12 Comparison of Quarterly Monitoring Maximum Analyte Concentrations with RI Results in Sediment

TABLE 5-13 Statistical Evaluation of Analytes Detected in Surface Water Samples Second Year Quarterly Monitoring

TABLE 5-14 Maximum Detected Concentrations and Associated Sample Locations for Analytes Detected in Surface Water Samples Second Year Quarterly Monitoring

TABLE 5-15 Comparison of Quarterly Monitoring Maximum Analyte Concentrations with RI Results in Surface Water

TABLE 6-1 Comparison of Maximum Sediment Results with Groundwater Results On-Base East Soldier Creek

TABLE 6-2 Comparison of Maximum Sediment Results with Groundwater Results Off-Base East Soldier Creek

TABLE 6-3 Comparison of Maximum Sediment Results with Groundwater Results On-Base West Soldier Creek

LIST OF FIGURES

FIGURE 2-1 Tinker Air Force Base Vicinity Map
FIGURE 2-2 Soldier Creek Quarterly Monitoring Sampling Segments
FIGURE 3-1 Soldier Creek Quarterly Monitoring Sampling Locations
FIGURE 5-1 BHRA PAH Exceedances for 0-6 Inch Sediment Samples
FIGURE 5-2a Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE01
FIGURE 5-2b Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE02
FIGURE 5-2c Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE03
FIGURE 5-2d Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE04
FIGURE 5-2e Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE05
FIGURE 5-2f Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE06
FIGURE 5-2g Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE07
FIGURE 5-2h Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE08
FIGURE 5-2i Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QE10
FIGURE 5-2j Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QW02
FIGURE 5-2k Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QW03
FIGURE 5-2l Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QW04
FIGURE 5-2m Temporal Sediment PAH Concentration Gradient (0-6 inches bgs) QW05
FIGURE 5-3a East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 1Qtr1Yr - November 1994
FIGURE 5-3b East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 2Qtr1Yr - January 1995
FIGURE 5-3c East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 3Qtr1Yr - April 1995
FIGURE 5-3d East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 4Qtr1Yr - July 1995
FIGURE 5-3e East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 1Qtr2Yr - October 1995
FIGURE 5-3f East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 2Qtr2Yr - March 1996

FIGURE 5-3g East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 3Qtr2Yr - May 1996
FIGURE 5-3h East Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 4Qtr2Yr - August 1996
FIGURE 5-4a West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 1Qtr1Yr - November 1994
FIGURE 5-4b West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 2Qtr1Yr - January 1995
FIGURE 5-4c West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 3Qtr1Yr - April 1995
FIGURE 5-4d West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 4Qtr1Yr - July 1995
FIGURE 5-4e West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 1Qtr2Yr - October 1995
FIGURE 5-4f West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 2Qtr2Yr - March 1996
FIGURE 5-4g West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 3Qtr2Yr - May 1996
FIGURE 5-4h West Soldier Creek Sediment PAH Concentration Gradient (0-6 inches bgs) 4Qtr2Yr - August 1996
FIGURE 6-1 Monitoring Well Location Map

LIST OF APPENDICES

APPENDIX A Human Health Risk Assessment
APPENDIX B Supporting Tables

AOC	Area of Concern
ACC	Air Combat Command
AFB	Air Force Base
AFMC	Air Force Materiel Command
bgs	Below Ground Surface
BHRA	Baseline Health Risk Assessment
CAA	Clean Air Act
CERCLA	Comprehensive Emergency Response and Compensation Liability Act
COC	Contaminant of Concern
CWA	Clean Water Act
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
EM	Environmental Management
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Indices
HPLC	High Performance Liquid Chromatography
IRP	Installation Restoration Program
IRIS	Integrated Risk Information System
I-40	Interstate Highway 40
IWTP	Industrial Wastewater Treatment Plant
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
OSDH	Oklahoma State Department of Health
OU	Operable Unit
PAH	Polyaromatic Hydrocarbon

PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act
STP	Sanitary Treatment Plant
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TIC	Tentatively Identified Compound
TSCA	Toxic Substance Control Act
VOC	Volatile Organic Compound
USAF	United States Air Force
WCFS	Woodward-Clyde Federal Services

Quarterly monitoring of the Sediment and Surface Water Operable Unit of Soldier Creek at Tinker Air Force Base was conducted in response to the signed Record of Decision (ROD), dated September, 1993. The focus of this monitoring program was to evaluate sediment and surface water contamination from the Soldier Creek Sediment and Surface Water Operable Unit from the headwaters of East and West Soldier Creeks to Interstate Highway 40.

Surface water samples were collected prior to sediment sampling. Sediment samples were collected at three intervals from 0-6 inches, 6-12 inches and 3-5 feet below ground surface (bgs). When refusal of the sampling device occurred prior to 5 feet bgs, a sediment sample was typically collected from the bottom one foot interval of the boring.

This report summarizes findings from the second year of quarterly monitoring. The first year of quarterly monitoring is presented in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). The second year of quarterly monitoring occurred in October 1995, March, May, and August, 1996. During the second year of quarterly monitoring, a total of 140 sediment and 61 surface water samples were collected from 19 segments on East and West Soldier Creeks and a sample location on Tributary B. Samples were analyzed for volatile organics, semi-volatile organics, metals, polychlorinated biphenyl's (PCBs), and pesticides. Beginning with the second quarter of the second year of monitoring, surface water samples were also analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. Also beginning with the second quarter of the second year of monitoring, surface water and sediment samples from 0-6 inches bgs were analyzed for hexavalent chromium. Surface water measurements performed in the field included temperature, pH, conductivity, dissolved oxygen, and flow.

An evaluation of risks associated with Soldier Creek surface water and sediments was previously performed by B&V in the Baseline Health Risk Assessment (BHRA). A Human Health Risk Assessment I (HHRA I) was performed for the first year of quarterly monitoring (WCFS, 1997a). As part of this project, the Human Health Risk Assessment II (HHRA II) was performed to provide updated information on potential current and future risks based on

current surface water and sediment contaminant levels, compare the results with those of the HHRA I to see if the previous conclusions are still valid, and develop updated cleanup goals that are protective of the human populations.

Analyte concentrations detected in the sediment and surface water were screened using the screening criteria set forth in the ROD. Screening criteria were based on exposure factors developed by the BHRA for human health under the RI/FS, and the HHRA I. Unacceptable exposures were determined based on the following criteria:

- Contaminant concentrations in sediment or surface water exceeding health levels based on an excess lifetime cancer risk of 10^{-4}
- Contaminant concentrations in sediment or surface water with non-carcinogenic hazard indices (HIs) greater than 1.0

Contaminant concentrations detected in the 10^{-4} to 10^{-6} range may potentially indicate an unacceptable exposure level and were also evaluated.

Surface water analyte concentrations from the second year of quarterly monitoring did not exceed any of the screening criteria set forth in the BHRA and the HHRA I.

Sediment analyte concentrations from the second year of quarterly monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA I. However, the HHRA I noncarcinogenic hazard screening criteria for aroclor 1254 was exceeded at one location in segment QW03 on West Soldier Creek.

BHRA 10^{-6} screening criteria were exceeded by five semivolatile (SVOCs) classified as polyaromatic hydrocarbons (PAHs) (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene, HHRA I 10^{-6} screening criteria were exceeded by two pesticides (aldrin and heptachlor) and five SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), and HHRA I 10^{-5} screening criteria were exceeded by one pesticide (heptachlor), and one SVOC (benzo(a)pyrene) in sediment samples. Based on the ROD, exceedance of these 10^{-5}

and 10^{-6} screening criteria may potentially indicate a need to evaluate if the exposure is unacceptable.

The results of the HHRA II were compared to those presented in the HHRA I. The results of the comparison between the HHRA I and HHRA II showed no dramatic changes. Although the non-carcinogenic screening criteria was exceeded by one sample on-base West Soldier Creek, under the worker scenario, the exceedance does not trigger an unacceptable non-carcinogenic hazard. Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current or future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

1.0
INTRODUCTION

1.1 PURPOSE OF REPORT

Quarterly Monitoring of the Sediment and Surface Water Operable Unit of Soldier Creek at Tinker Air Force Base (Tinker AFB) was conducted in response to the signed Record of Decision (ROD), dated September, 1993. This work was performed under Contract No. F34650-93-D-0109, Order 5005 and 5014 between Tinker AFB and Woodward-Clyde Federal Services (WCFS). Results of the first year of quarterly monitoring is presented in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). The second year of quarterly monitoring occurred in October 1995, March, May, and August, 1996. This report describes the sampling methods, analytical results, and conclusions of the investigation.

1.2 REGULATORY BASIS

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986 established the Defense Environmental Restoration Program (DERP) for the U.S. Department of Defense (DoD) to clean up past hazardous waste disposal and spill sites nationwide. In 1980, the United States Air Force (USAF) began implementing the DoD Installation Restoration Program (IRP). The IRP is designed to identify and evaluate suspected problems associated with past hazardous waste management practices, including impacts on human health and the environment.

Section 105 of SARA mandates that procedures for undertaking response actions follow the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as promulgated by the U.S. Environmental Protection Agency (EPA).

Two sites located within Tinker AFB, Building 3001 and Soldier Creek, were listed on the CERCLA National Priority List (NPL) in 1987. Tinker AFB, EPA Region VI, and the Oklahoma State Department of Health (OSDH) signed a Federal Facilities Agreement (FFA) (Administrative Docket Number NPL-U3-2-27) under Section 120 CERCLA in December

1988. The intent of this agreement is to ensure that past and present activities of Tinker AFBs NPL sites are thoroughly investigated and appropriately remediated to protect the public health, welfare, and the environment.

1.3 INVESTIGATION SCOPE AND OBJECTIVES

The focus of this monitoring program is sediment and surface water contamination from the Soldier Creek Sediment and Surface Water Operable Unit (OU) from the headwaters of East and West Soldier Creeks to Interstate Highway 40 (I-40). The Soldier Creek OU is located in the northeast portion of Tinker AFB and was identified in the ROD as a potential threat to human health and the environment. The objective of quarterly monitoring is to evaluate analytical results of sediment and surface water samples for exceedance of health based cleanup goals developed during the Baseline Health Risk Assessment (BHRA) (B&V, 1993a), and reported in the ROD (B&V, 1993b).

The second year of quarterly monitoring of sediment and surface water began in October 1995 and was scheduled to proceed at approximately 3 month intervals. However, due to the government shut-down in early 1996, the second quarter, second year monitoring event did not occur until the end of March 1996. The following quarterly monitoring events occurred in May and August 1996. Results of sediment and surface water sampling are included in this report. Sediment samples were collected at three intervals from 0-6 inches, 6-12 inches and 3-5 feet below ground surface (bgs). When refusal of the sampling device occurred prior to 5 feet bgs, a sample was typically collected from the bottom one foot interval of the boring.

1.4 REPORT ORGANIZATION

This report describes the results of the second year of quarterly monitoring of the Soldier Creek OU.

Section 1 is the introduction describing the purpose of this report, the regulatory basis of the study, and the objectives and scope of the monitoring program

Section 2 describes Tinker AFB and the project site. This section also summarizes site history and previous investigations

Section 3 describes sampling methods used during quarterly monitoring of sediments and surface water

Section 4 contains a brief summary of the Human Health Risk Assessment II presented in Appendix A

Section 5 contains a review and discussion of quarterly sampling results and analytical exceedances of screening criteria

Section 6 contains a review of groundwater data from the Remedial Investigation (RI) conducted on the Soldier/Off-Base Groundwater Operable Unit and subsequent quarterly groundwater monitoring for 1995 and 1996

Section 7 presents conclusions from the second year of quarterly monitoring

Section 8 presents the list of references cited

2.0
BACKGROUND

2.1 INSTALLATION DESCRIPTION AND HISTORY

Tinker AFB is located in Oklahoma County in central Oklahoma approximately 8 miles southeast of downtown Oklahoma City. The base is bounded by Sooner Road to the west, Douglas Boulevard to the east, I-40 to the north, and Southeast 74th Street to the south. The base is comprised of approximately 5,277 acres. Municipalities of the metro area which adjoin Tinker AFB are Midwest City to the north, Del City to the northwest, and Oklahoma City to the east, south, and southwest (Figure 2-1). Midwest City and Del City are heavily populated with mixed residential and commercial areas. The area under Oklahoma City jurisdiction is lightly developed residential.

To attract the war industries in the early 1940's, Oklahoma City donated the land required for the facility and offered necessary improvements at no cost to the War Department. The Oklahoma Industries Foundation was established to bid for a military maintenance and supply depot and to acquire the land for the site. Oklahoma City was considered a favorable location for the depot for several reasons, including mild winters, flat terrain, and strategic location near the geographic center of the United States. During this period, Midwest City was formed as a new town to provide housing and community facilities for the air depot. The original site, consisting of 960 acres, was selected by the Army on May 21, 1941, seven months before the United States officially entered World War II.

The name designations for the Oklahoma City Air Depot and Tinker Air Field have changed several times over the life of the base, as the depot and air base were redesignated and reorganized. Tinker AFB was officially known as Midwest Air Depot during its construction, and then as the Oklahoma City Air Depot after it was activated. In January 1943, the name of the depot was officially changed to Oklahoma City Air Depot Control Area Command. In May 1943, the name was changed to Oklahoma Air Technical Area Service Command to reflect new responsibilities at the depot. The name changed again in July 1946, to Oklahoma City Air Material Area. In 1974, the depot was redesignated Oklahoma City Air Logistic Center to reflect the last change in function at the depot.

Pressure from local citizens was instrumental in the decision to name the air field at the depot "Tinker Field", honoring General Clarence L. Tinker. Tinker was an Osage Indian who died in 1942 while leading a bomber strike against the Japanese at Wake Island. Following the creation of the DoD and the Air Force as a separate military establishment, Tinker Field became "Tinker Air Force Base" on January 13, 1948. Subsequently, the base became the worldwide repair depot for B-36 and B-45 aircraft, as well as a multitude of other weapons and engines.

The Oklahoma City Air Depot was partially operational in 1942. Tinker Air Field was built adjacent to and concurrently with the depot. The Douglas Cargo Airplane Plant was built in 1942-1943 to manufacture specially modified DC-3s. The depot and aircraft plant shared Tinker Air Field. After World War II, the Douglas Cargo Aircraft Plant was closed and the Air Depot took over the buildings and expanded the Base operations, to include facilities for testing and overhauling jet engines. During this time, Tinker AFB became involved in jet engine overhaul and, later, modification of aircraft from storage as part of a massive program to rebuild the nation's air power.

An important development during the 1980s was the increased emphasis on environmental management. In 1985, a separate Directorate of Environmental Management (EM) was formed. The new Directorate incorporated functions related to environmental laws such as the Clear Air Act (CAA), Clean Water Act (CWA), Resource Conservation and Recovery Act (RCRA), CERCLA as amended by SARA, and Toxic Substances Control Act (TSCA).

As early as 1983, measures to clean up sites at Tinker AFB contaminated by past activities were being undertaken under the Air Force IRP. Two sites, Building 3001 and Soldier Creek were listed on the CERCLA NPL in 1987. In 1988, Tinker AFB signed the FFA with EPA and the State of Oklahoma to remediate these sites. A RCRA Facility Assessment (RFA) conducted in May 1989 identified 105 Solid Waste Management Units (SWMUs) and nineteen Areas of Concern (AOCs). The base was issued a RCRA Part B permit on July 1, 1991. The permit specified that a RCRA Facility Investigation (RFI) be conducted for forty-three SWMUs and two AOCs. The Directorate of Environmental Management has now grown to approximately eighty personnel and works closely with the Bioenvironmental Office and the Office of Safety.

In 1992, major organizational changes occurred in response to the end of the cold war and the down sizing of the entire military structure. Of most importance to the OC-ALC is the fact that on July 1, 1992, its parent command, Air Force Logistics Command (AFLC), was merged with the Air Force Systems Command to form the Air Force Materiel Command (AFMC). The new command comprises 52 percent of the Air Force budget. Eighteen percent of all Air Force personnel and 42 percent of the civilian workforce are assigned to the new command.

During 1992, the L-62 Strategic Communications Wing of the U.S. Navy was installed at Tinker AFB. The L-62 Strategic Communications Wing is composed of two squadrons of aircraft that maintain communications with the Navy's submarines.

2.2 SITE DESCRIPTION AND HISTORY

The Soldier Creek Sediment and Surface Water Operable Unit was defined by the ROD as the two unnamed tributaries to Soldier Creek that originate on Tinker AFB. The tributary east of Building 3001 is designated East Soldier Creek and the tributary west of Building 3001 is designated West Soldier Creek. The boundaries for the study were:

- All sediment and surface water of East Soldier Creek that originates on Tinker AFB to the intersection of East Soldier Creek and I-40 north of Tinker AFB

- All sediment and surface water of West Soldier Creek that originates on Tinker AFB to the intersection of West Soldier Creek and I-40 north of Tinker AFB

These initial boundaries included the ditches leading from the thirteen outfalls, eight of which are National Pollutant Discharge Elimination System (NPDES) outfalls, to East and West Soldier Creeks. The boundaries also included the lower portion of Tributary B, as defined in the Remedial Investigation/Feasibility Study (RI/FS) (B&V, 1993c), just upstream of its confluence with East Soldier Creek.

Study area boundaries were identified based on the Remedial Investigation (RI) (B&V, 1993c). Data from the RI indicated that a contaminant concentration gradient exists to a point just south (upstream) of the study boundary. The study area boundary was established based on the following criteria:

- Limits of measurable levels of contaminants (as compared to background locations)
- Area of such size that a definitive assessment could be performed
- Allowance for source identification

2.2.1 East Soldier Creek

East and West Soldier Creeks drain the northeastern portion of Tinker AFB. Both streams are first-order (headwater) tributaries that have been substantially modified over the years (Figure 2-2). East Soldier Creek now originates where several storm sewers, known as Outfalls H, I, and J, emerge from the north side of 44th Street (north of Building 3705). The emerged portion of East Soldier Creek flows northward about 500 feet and is joined by a tributary from the west which is fed by process effluent and cooling water blow-down (Outfall G). The combined flow continues about 630 feet northward along the east side of Building 3001 to a culvert at Bradley Drive, near which two storm water ditches (Outfalls M and L) enter from the west. This portion of the creek flows in a narrow channel through dense woods. The substrate is mainly bedrock (sandstone), with occasional areas of gravel and sand; virtually no fine-grained depositional sediment is present in this portion of East Soldier Creek.

After crossing under Bradley Drive, East Soldier Creek has a short stretch of flowing water and then becomes an elongated pond, about 600 feet long by 75 feet wide and terminating at a dam. Approximately midway along the pond a tributary fed from process effluent and storm water discharge (Outfall F) enters from the west. Except for the flowing stretch near Bradley Drive, the entire ponded portion of East Soldier Creek is depositional, with relatively thick organically rich silt and fine sand sediments.

Normal flows from the ponded portion of East Soldier Creek are diverted via underground piping through a concrete detention basin (former oil/water separator). Downstream from the dam the stream has a divided channel, the easternmost is fed by the culvert from the detention basin, and the westernmost of which during normal flow is backwater and during storm events is fed by the dam overflow. Between the dam and Douglas Boulevard, East Soldier Creek bends eastward. This stretch is about 400 feet long, varying from about 20 to 40 feet in width with sand, silt and gravel substrate and moderate flows. The Industrial Wastewater Treatment Plant (IWTP) and Sanitary Treatment Plant (STP) outfall to East Soldier Creek is located about a third of the way between the dam and Douglas Boulevard. The IWTP receives industrial process wastewater for treatment from the Building 3001, as well as process wastewater from other industrial sources throughout the base, via a network of underground piping. In April 1996, the IWTP/STP discharge was rerouted to the Oklahoma City Public Owned Treatment Works, and discharge to East Soldier Creek ceased. The IWTP is currently utilized for pretreatment of industrial waste. In case of emergency, discharges to East Soldier Creek from the IWTP/STP may occur under NPDES Permit OK1571724391.

Near where the stream exits Tinker under Douglas Boulevard, a large storm water conveyance enters from the north. Beyond Douglas Boulevard, East Soldier Creek flow east-northeastward about 800 feet and is joined by an intermittent tributary (Tributary B) from the south. The stream then flows north-northeast about 1,200 feet to I-40. This off-base stretch is in a deeply incised channel with steep clay banks, surrounded by commercial and residential property near Douglas Boulevard and riparian woodlands beyond Tributary B. Tributary B headwaters are located just upstream of S.E. 36th Street where it flows northward to its confluence with East Soldier Creek north of S.E. 36th Street and east of Douglas Boulevard. East Soldier Creek begins to assume a quasi-natural riffle-and-pool configuration in this stretch, with natural substrates predominated by gravel, sand, and silt. There are also substantial amounts of concrete rubble and other anthropogenic debris (e.g., discarded appliances, automobile parts, household trash) in this section of the stream. Beyond I-40, East Soldier Creek flows northward to its confluence with the mainstem of Soldier Creek, which originates off-base near Southeast 59th Street, about 1.5 miles south-southeast of the Building 3001 Complex.

The following buildings were determined during the storm sewer investigation (NUS, 1989) to be partially or totally associated with the East Soldier Creek sewer system.

- Building 2122 - Airframe paint stripping
- Building 3234 - Jet engine test stands
- Building 3703 - Jet engine test stands
- Building 3105 - Hangar and process vacuum heat treat area
- Building 3102 - Hangar and fire station
- Building 3123 - Battery repair
- Building 3108 - Hydraulic test and calibration
- Building 3705 - Engine parts storage
- Building 3001 - Engine repair
- Building 3333 - Administrative
- Building 2210 - Accessories
- Building 3220 - Missiles and avionics
- Building 3221 - Blade repair
- Building 2212 - Boiler house
- Defense Reutilization and Marketing Office Area (DRMO)

Building 3001 consists of an aircraft overhaul and modification facility to support the mission of the Oklahoma City Air Logistics Center. Table 2-1 presents the buildings and associated outfalls which contribute discharge to East Soldier Creek.

2.2.2 West Soldier Creek

West Soldier Creek starts between the Tinker North/South runway and Building 3001 in a broad grassy swale. It flows northward about 3500 feet and is fed by runoff from the runways and the area west of Building 3001 and from several outfalls (Outfalls A, B, C, D, and E), which normally discharge very little to no water. Table 2-1 presents the buildings and associated outfalls which contribute discharge to West Soldier Creek.

The drainage continues to a point opposite the north end of Building 3001, enters a storm sewer, and emerges off-base from under Industrial Road to flow parallel to and then cross under I-40. The off-base reach of West Soldier Creek is moderately incised, with substrates

consisting of bedrock, gravel, sand, and substantial amounts of concrete rubble. Riparian habitat consists of a narrow band of trees along most of the highway side, and wooded slope on the base side. This reach is approximately 500 feet long and is divided by a spill containment structure midway from its emergence from on-base Tinker and the culverts at I-40. North of I-40, West Soldier Creek flows northeastward through a mixed residential/commercial area and joins the mainstream of Soldier Creek, just west of Douglas Boulevard. From this point, Soldier Creek flows north-northwest approximately 3 miles to join Crutcho Creek, which continues northward about 2 miles and enters the North Fork of the Canadian River.

2.2.3 Previous Investigations

Table 2-2 presents a brief summary of previous activities conducted on or near the Soldier Creek OU under the IRP. As part of the overall IRP, Tinker AFB began a preliminary assessment of previous waste disposal sites in 1981. As a result of a basewide sampling program in 1983, which detected trichloroethene (TCE) in the groundwater, extensive investigations were conducted in and around Building 3001. On July 22, 1987, the Building 3001 Site and Soldier Creek Site were added to the NPL. In 1990 and 1991, Black and Veatch Waste Science Technology (B&V) conducted a Phase I and a Phase II RI/FS to determine the extent of sediment and surface water contamination along East, West and Main Soldier Creek. The baseline health risk assessment performed by B&V (1993a) determined that the sediment and surface water of the Soldier Creek OU do not pose a risk to human health in excess of acceptable risk-based exposure levels established by the EPA. The Final Workplans for Long-Term Monitoring and Ecological Assessment of Soldier Creek (Workplans) provided sampling procedures and quality assurance protocol for the quarterly monitoring events (WCFS, 1994). The first year of quarterly monitoring occurred in November 1994, and January, April, and June 1995 and is presented in the Final Quarterly Monitoring Annual Report for Long-Term Monitoring of Soldier Creek Sediment and Surface Water Operable Unit (WCFS, 1997a). Results of the ecological assessment I of Soldier Creek is presented in the Final Ecological Assessment (WCFS, 1997b).

TABLES

TABLE 2-1
SOLDIER CREEK
OUTFALLS AND ASSOCIATED BUILDINGS/STRUCTURES

Location	Outfall	Building
West Soldier Creek	A	3001
	B	Drains roadway
	C	3001
	D	3001
	E	3001, 3108
	N	Drains Outfalls A, B, C, D, E
East Soldier Creek	F	3001
	G	3001
	H	2122, 2210, 3001, 3102, 3105, 3220, 3221, 3234, 3703
	I	2122, 2210, 3001, 3102, 3105, 3220, 3221, 3234, 3703
	J	Drains roadway and DRMO area
	L	3001
	M	Drains roadway

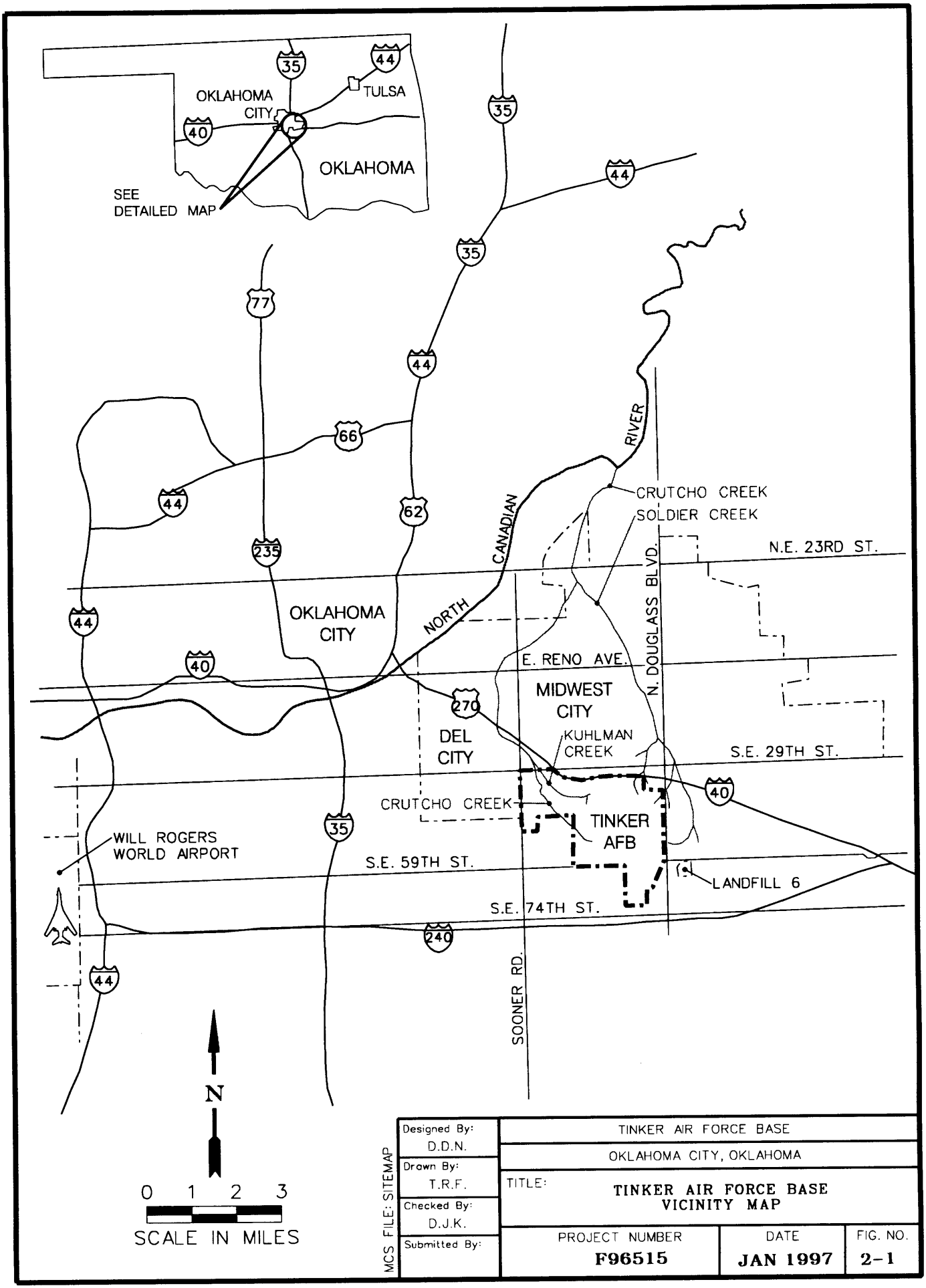
Adapted from NUS (1989)

TABLE 2-2
SUMMARY OF PREVIOUS INVESTIGATIONS AND ACTIVITIES

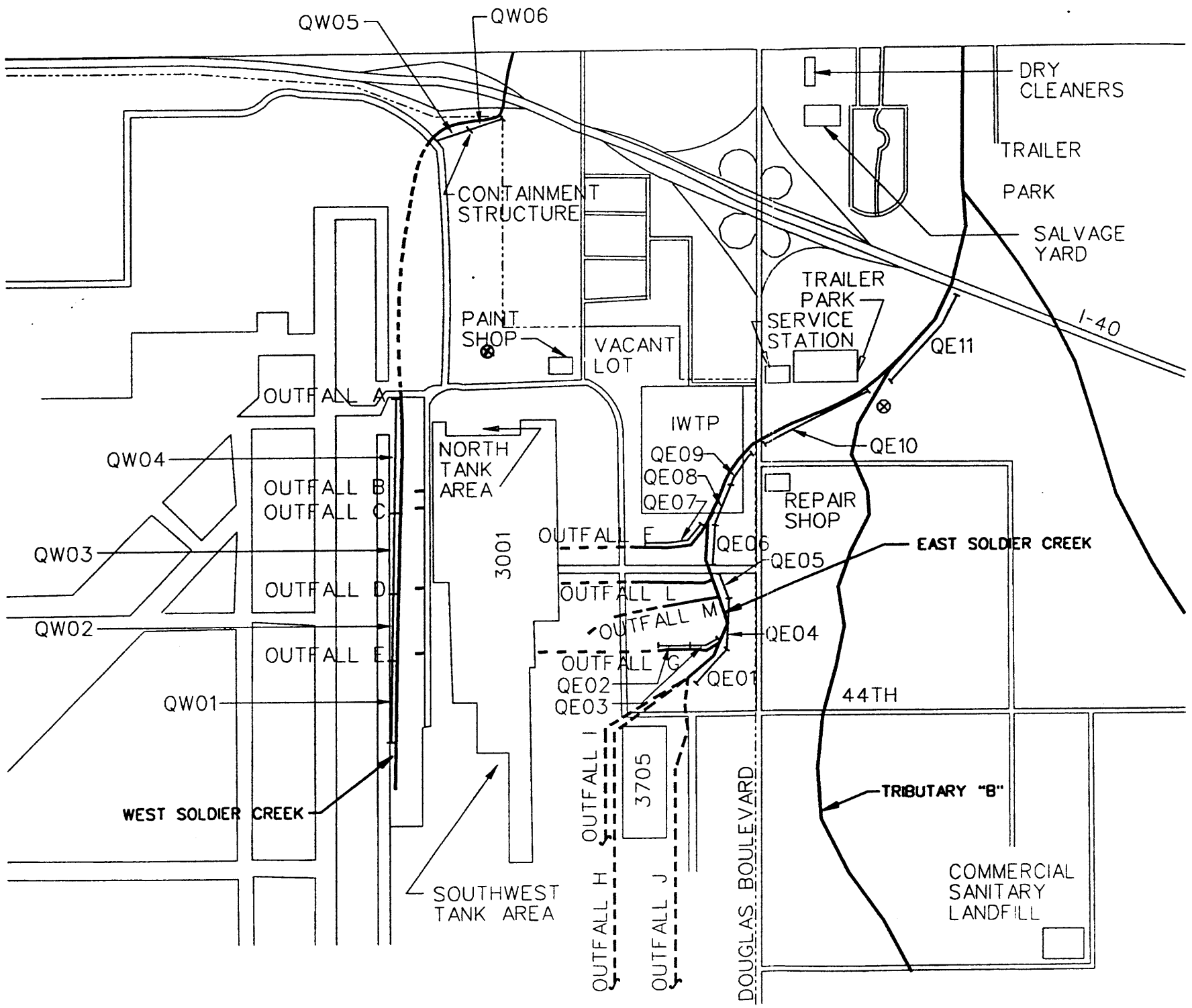
INVESTIGATION/REPORT	ORGANIZATION	DATE
Quarterly Groundwater Sampling	Tulsa COE	December 1987 - March 1989, March and October 1988
Surface Water Sampling	Tinker AFB	March - September 1987
Sediment and Surface Water Sampling	Oklahoma State Department of Health	June 1987
NPDES Surface Water Sampling	Tinker AFB	September 1986 - July 1987
Sediment and Surface Water Sampling	EPA	October 1984, November 1984
Sediment Sampling and Dredging	Harry Keith & Sons, Inc.	October 1985, April and May 1986
Final Storm Sewer Investigation for Soldier Creek	NUS Corporation	October 1989
Industrial Wastewater Treatment Plant Remedial Investigation	Tulsa COE	March 1988 - September 1990
Soldier Creek Remedial Investigation, Phase I and II	B&V Waste Science and Technology Corporation	July 1990, June 1991
Soldier Creek Baseline Risk Assessment	B&V Waste Science and Technology Corporation	February 1993
Soldier Creek Record of Decision	B&V Waste Science and Technology Corporation	August 1993
Workplans for Long-Term Monitoring and Ecological Assessment of Soldier Creek	Woodward-Clyde Federal Services	July 1995
Draft Ecological Assessment	Woodward-Clyde Federal Services	January 1996
Quarterly Monitoring of Sediment and Surface Water	Woodward-Clyde Federal Services	November 1994, January, April, July, and October 1995, March, May, and August 1996
Soldier Creek/Off-Base Groundwater Operable Unit, Remedial Investigation	Parsons Engineering Science	July 1995

source: B&V 1993, and PES 1995

FIGURES



MCS FILE: SITEMAP	Designed By: D.D.N.	TINKER AIR FORCE BASE	
	Drawn By: T.R.F.	OKLAHOMA CITY, OKLAHOMA	
	Checked By: D.J.K.	TITLE: **TINKER AIR FORCE BASE VICINITY MAP**	
	Submitted By:	PROJECT NUMBER **F96515**	DATE **JAN 1997**
			FIG. NO. **2-1**



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B

N

1000 0 1000 2000

SCALE FEET

MCS FILE: F94506A

Designed By: D.D.N.	TINKER AIR FORCE BASE
Drawn By: D.R.T.	OKLAHOMA CITY, OKLAHOMA
Checked By: L.S.Y.	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING SEGMENTS
Submitted By:	PROJECT NUMBER F93506 / DATE 01/12/95 / FIG. NO. 2-2

3.0
INVESTIGATION METHODS

3.1 SAMPLING LOCATIONS

During the second year of the long-term monitoring program, quarterly sampling and analysis of sediment and surface water was performed for the segments identified in Figure 2-2. On-base sampling segments included four segments and one additional location along West Soldier Creek, and nine segments on East Soldier Creek. An additional sampling location (QW07) was added to a tributary to West Soldier Creek during the second quarter of the second year sampling event. The sample location, QW07, is located at the culvert on the northeast corner of the Building 3001 north parking lot, north of Industrial Boulevard. The off-base portion of the Soldier Creek OU, bounded by I-40, was split into four segments, two on West Soldier Creek and two on East Soldier Creek. One additional sample was collected each quarter from the same location on Tributary B, just above the junction with East Soldier Creek, east of Douglas Boulevard. Stream segments were established based on the locations of known outfalls and structures (i.e., spill containment structures), known or suspected areas of contamination, stream morphology, and by communication with Tinker AFB EM personnel familiar with the project (WCFS, 1994).

Each stream segment was divided into quarters. During each quarterly sampling event, a different quarter of each segment was sampled starting from the upstream quarter of each segment the first event and ending with the most downstream quarter of each segment on the final quarterly sampling event. Two exceptions were at Tributary B and QW07, where the same location was sampled during all sampling events. Due to the grade of QW07, sufficient water for sampling was available only near the outlet of the outfall. Table 3-1 presents the rationale for sample locations. Figure 3-1 illustrates the sample locations within each respective sampling section.

The rationale for dividing the stream into segments was to better characterize Soldier Creek surface water and sediment quality temporally and spatially. This sampling methodology was set forth in the ROD (B&V, 1993b).

3.1.1 Sediment Sampling

Sediment samples were collected from a representative location along the stream channel. Sample locations within the quarter of the stream segment being sampled were determined in the field. Basic criteria for determining a representative sample location included flow, depth, deposition, occurrence of discolored sediments, and change in stream morphology.

Depending on the water column depth and sediment characteristics, a trowel, ponar dredge, or hand auger/multi-stage sampler was used to collect sediment samples. Stainless steel trowels were used to collect samples from the 0-6 inch interval. In areas where the water column was too deep to use a trowel, a stainless steel hand auger/multi-stage sampler was used. Sediment samples obtained from 6-12 inches and 3-5 feet were also collected using a stainless steel hand auger.

For discrete sample collection using the trowel, the sampling area was first cleared of vegetation and/or debris. The sample was collected from the upper 6 inches. Upon reaching the surface, the sample was placed in a stainless steel bowl or on a clean sheet of aluminum foil. The sample for volatile and semi-volatile analyses was placed immediately into sample containers. Free water obtained during sample collection was used to eliminate headspace in the volatile and semi-volatile sample containers. The remaining portion of the sediment sample was composited and then transferred to the appropriate containers based upon analysis to be performed. Any remaining free water from the sample collection was returned to the stream. To the extent practical, the sample hole was backfilled with native sediment and vegetation.

The hand auger sampler was lowered to the sediment surface and manually augured to the desired sampling depth or to refusal of the device. Upon reaching the surface, the sample was placed on a clean sheet of aluminum foil. The sample for volatile and semi-volatile analyses was placed immediately into sample containers. Free water obtained during sample collection was used to eliminate headspace in the volatile and semi-volatile sample containers. The remaining portion of the sample was composited and then transferred to the appropriate containers based upon analysis to be performed. Any remaining free water from the sample collection was returned to the stream. To the extent practical, the sample hole was backfilled with native sediment and vegetation.

3.1.2 Surface Water Sampling

Surface water samples were collected prior to sediment sampling and were obtained from the same location as sediment samples. Care was taken not to disturb the sediments during sampling. When possible, high velocity areas were avoided due to increased volatilization in turbulent waters. Stagnant waters were unavoidable in many segments due to the intermittent nature of the streams. Grab surface water samples were collected by submerging glass or stainless steel sampling devices directly into the creek. The opening of the container faced upstream. The water was then transferred directly into the sample containers and submitted for laboratory analysis.

Field parameters were conducted on surface water samples. These parameters included pH, specific conductance, temperature, and dissolved oxygen. Field measurements were recorded on field sheets. A total of four replicates were measured and averaged for each parameter. Volumetric stream flow in each segment was estimated by determining the cross-sectional area and measuring current velocities across a representative transect in accordance with USGS flow-measurement techniques (wading method) (USGS, 1984).

3.1.3 Decontamination Procedures

All sampling equipment was decontaminated prior to each sampling location and prior to initial use. Decontamination of equipment minimized the risk of cross-contamination to environmental samples from improperly cleaned sampling equipment and ensured that representative samples were obtained. Potable water for all decontamination activities was provided by Tinker AFB.

Equipment used in the cleaning or decontamination of field equipment included:

- Methanol, reagent grade
- Aluminum foil
- Disposable gloves
- Teflon and stainless steel squeeze bottles or sprayers
- Wash tubs of various sizes and scrub brushes
- Potable water

- High Performance Liquid Chromatography (HPLC) water
- Plastic sheeting
- Washwater containment tubs or containers

Equipment decontamination procedures that were employed in the Soldier Creek investigation are as follows:

- Only Teflon and stainless steel containers were used to dispense water, methanol, or other cleaning agents. No plastic containers were used.

- All personnel performing decontamination procedures wore appropriate protective clothing such as disposable gloves, rubber boots, etc., as specified by the Site Safety Officer.

- All decontamination waste fluids were collected in containers with secondary containment and were stored at the drum staging area until disposal.

- All surface water and sediment sampling equipment (e.g. stainless steel bowls, trowels, dredges, and samplers) was decontaminated using brushes and a laboratory-grade detergent/potable water solution, followed by a potable water rinse, a pesticide-grade methanol rinse, and a HPLC water rinse. All equipment was allowed to air dry before sampling. If not immediately used, all decontaminated sampling equipment was wrapped in aluminum foil before storage or reuse.

- All cleaning or wash buckets or tubs were cleaned using laboratory grade detergent/potable water solution and potable water rinse upon mobilization and demobilization.

3.2 SAMPLE IDENTIFICATION

Each sample was identified by a specific field identification number which indicates site name, sampling location, sample type, and sequence number. An example of the sample identification number is as follows:

SC-QE01-SD-501

where SC indicates the site name (Soldier Creek Sediment and Surface Water Operable Unit), QE01 indicates the sampling segment, SD the sample type, and 501 the sequence number.

Following the site name, a four digit alpha-numeric code was used to identify the sampling location. Sampling locations for the investigation were as follows:

- Quarterly monitoring sampling segments on East Soldier Creek were designated by QE01, QE02,...,QE11
- Quarterly monitoring sampling segments on West Soldier Creek were designated by QW01, QW02,..., QW07
- Sample location on Tributary B was designated TR01

A two-letter designation was used to identify the specific type of sample collected. For the investigation, these sample types were:

- SW - surface water sample
- SD - sediment sample

The last three-digit code is the sequence identifier. This number was used to separate samples collected at the same sampling location but at different depth intervals (for soil samples) or time intervals or for duplicate samples. The first digit of the sequence number indicates the quarter of the stream segment being sampled for quarterly monitoring The sequence the samples were taken is indicated by the second and third digits. The second and third digits always began with 01 at each location. In the above example, 501 indicates the first sample taken in the first quarter second year of segment QE01 (i.e., 0-6 inches). A sequence identifier of 502 indicates the second sample taken in the first quarter second year of segment QE01 (i.e., 6-12 inches). A sequence identifier of 601 indicates the first sample taken in the second quarter second year of segment QE01. Duplicate samples for each

sampling event were identified by adding 500 to the sequence identifier of the corresponding sample (i.e., SC-QE01-SD-501 duplicate would be identified as SC-QE01-SD-1001).

3.3 ANALYTICAL PARAMETERS

Sediment and surface water were analyzed quarterly by SW-846 methodologies for volatile organics, semi-volatile organics, metals, hexavalent chromium, polychlorinated biphenyl's and pesticides. Surface water samples were also analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. The hexavalent chromium and wet chemistry analysis began during the second quarter second year monitoring event. Table 3-2 presents a list of analytes by method and reporting limits. Actual sediment reporting limits were raised due to percent moisture in the sediment and elevated analyte concentrations.

A summary of the constituents for analysis, containers, preservation, and holding times are presented in Table 3-2. Due to the short holding time, samples collected for hexavalent chromium analysis were analyzed locally by Alpha Analytical for the second and third quarters of monitoring, and Southwell Analytical Laboratories for the remaining quarter of the second year of monitoring. Both Alpha Analytical and Southwell Analytical Laboratories are located in Oklahoma City, Oklahoma. The remaining analysis was performed by Quanterra Environmental Services of Arvada, Colorado.

3.4 QUALITY CONTROL/QUALITY ASSURANCE

Quality Assurance (QA) procedures were performed in general accordance with the Quality Assurance Project Plan (QAPP) of the Workplans (WCFS, 1994). No deviations from the QAPP occurred in the field during the quarterly sampling.

Field duplicates, matrix spikes, and matrix spike duplicates were collected at a rate of approximately 10 percent (i.e., 1 for every 10 samples). One rinsate was collected for each day of sampling. These Quality Assurance/Quality Control (QA/QC) samples were collected to assess field sampling procedures (including decontamination) and field collection precision. Laboratory controlled trip blank samples accompanied each cooler with samples

for VOC analysis to assess potential cross-contamination. One field ambient blank for each quarterly sampling event was collected by pouring HPLC water, used for decontamination of equipment and rinsate samples, directly into sample bottles. The ambient blank sample was collected to assess the effects of background conditions, potential sample container contamination, and the quality of the HPLC water.

A Quality Assurance/Quality Control (QA/QC) review was performed by Quanterra. A QA/QC data assessment was performed by WCFS which included full validation of twenty percent of the data, for each quarterly monitoring event, using the SW-846 methods (EPA, 1992) and the EPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review (Guidelines) (USEPA, 1994a, 1994b). Data assessment is herein defined as the systematic, structured process of evaluating, editing, screening, checking, verifying, and reviewing to assure that analytical data are in compliance with established criteria and are valid for the intended use.

The full validation consisted of a review of SW-846 results summary sheets and instrument reports for QA/QC parameters such as matrix spikes (MS), matrix spike duplicates (MSDs), detection limits, calibrations, duplicate control samples (DCS), single control samples (SCS), chain of custody forms, sample preparations, holding times, etc. In addition the review, consisted of recalculating laboratory data and standard calibration curves, checking for transcription errors, and carefully checking chromatograms and reconstructed ion chromatograms. The purpose of the full validation is to evaluate whether laboratory performance and analytical data are in compliance with method requirements and project specifications for accuracy, precision, validity, and completeness.

The data assessment process provides information on analytical limitations of data based on regulatory or method specific QA/QC criteria. In addition, the review process assigns data qualifiers and provides a statement concerning usability of data. To ensure the data gathered during the investigation activities are adequate; precision, accuracy, representativeness, completeness, and comparability (PARCC) parameter targets have been identified for Level III analyses during the development of Data Quality Objectives (DQOs) and planning of the field activities. Level III analyses included all laboratory analyses using EPA methods. Quality of the analytical data is indicated by the calculation of values for precision, accuracy, and

completeness. The quantitative target values for precision, accuracy, and completeness are as follows:

- Precision = 20 percent
- Accuracy = control limits specified for the particular analysis
- Completeness = 90 percent

Comparability and representativeness are assessed in a qualitative evaluation of the data generated during the field investigation.

The data generated during the second year of quarterly monitoring at Soldier Creek, Tinker AFB were reviewed as described above. The data were evaluated to be usable as received from Quanterra, Alpha Analytical, and Southwell labs for their stated and intended purpose. Complete results of data validation and signed Chain of Custody Forms are presented in the quarterly reports (WCFS, 1996 a,b,c,d).

TABLES

TABLE 3-1
SAMPLE LOCATION RATIONALE

WEST SOLDIER CREEK ON-BASE PORTION	
Section 1 (QW01)	South Tank Area to Outfall E
Section 2 (QW02)	Outfall E to just above Outfall D
Section 3 (QW03)	Outfall D to just above Outfall C
Section 4 (QW04)	Outfall C to culvert opposite north end of Building 3001, where on-base above ground portion of West Soldier Creek ends.
Section 5 (QW07)	Single location located on tributary to West Soldier Creek at emergence from north-east corner of parking lot, north of Building 3001 .

WEST SOLDIER CREEK OFF-BASE PORTION	
Section 1 (QW05)	Above-ground reach from it's emergence at three culverts near Tinker Gate 7 to the spill containment structure
Section 2 (QW06)	Spill containment structure to Interstate 40

EAST SOLDIER CREEK ON-BASE PORTION	
Section 1 (QE01)	Mainstem from its emergence at 44th Street to just above the confluence of Outfall G
Section 2 (QE02)	Outfall G from its emergence east, half way to its confluence with the mainstem
Section 3 (QE03)	Outfall G from halfway to its confluence with the mainstem to the mainstem.
Section 4 (QE04)	Mainstem from Outfall G to just above the confluence of Outfall M
Section 5 (QE05)	Outfall M to Bradley Drive
Section 6 (QE06)	The long pool from Bradley Drive north to just above Outfall F
Section 7 (QE07)	Outfall F from its emergence to its confluence with the mainstem
Section 8 (QE08)	The mainstem from Outfall F to the dam on the mainstem
Section 9 (QE09)	The mainstem from the dam to the spill containment structure on Douglas Blvd.

EAST SOLDIER CREEK OFF-BASE PORTION	
Section 1 (QE10)	The mainstem from Douglas Boulevard to just above the confluence with Tributary B
Section 2 (QE11)	The mainstem from Tributary B to Interstate 40

TABLE 3-2
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Recoverable Metals - Method 6010/6020		
Aluminum	10*	15
Antimony	6*	3
Barium	1*	1
Beryllium	0.2*	0.5
Cadmium	0.5*	0.3
Calcium	20*	200*
Chromium	1*	5
Cobalt	1*	0.5
Copper	2*	2
Iron	10*	100*
Lead	5*	1
Magnesium	20*	200*
Manganese	1*	0.2
Molybdenum	2*	1
Nickel	4*	0.2
Potassium	500*	5000*
Silver	1*	0.5
Sodium	500*	5000*
Thallium	200*	0.1
Vanadium	1*	0.5
Zinc	-	10
Selenium	0.5	5
Metals - Methods As(7060), Hg(7470/7471), Hexavalent Chromium (7196A)	**mg/kg**	**mg/L**
Arsenic	0.5	0.005
Mercury	.033	0.0002
Selenium	0.5	-
Hexavalent Chromium[2]	2.5	0.1
PCB's and Chlorinated Pesticides - Method 8080	**mg/kg**	**ug/L**
4,4'-DDD	3.3	0.01
4,4'-DDE	3.3	0.01
4,4'-DDT	3.3	0.01
Aldrin	1.7	0.005
alpha-BHC	1.7	0.005
alpha-Chlordane	1.7	0.005
Aroclor 1016	33	0.1
Aroclor 1221	33	0.1
Aroclor 1232	33	0.1
Aroclor 1242	33	0.1
Aroclor 1248	33	0.1

TABLE 3-2
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Aroclor 1254	33	0.1
Aroclor 1260	33	0.1
beta-BHC	1.7	0.005
delta-BHC	1.7	0.005
Dieldrin	3.3	0.01
Endosulfan I	1.7	0.005
Endosulfan II	3.3	0.01
Endosulfan sulfate	3.3	0.01
Endrin	3.3	0.01
gamma-BHC (Lindane)	1.7	0.005
gamma-Chlordane	1.7	0.005
Heptachlor	1.7	0.005
Heptachlor epoxide	1.7	0.005
Methoxychlor	17	0.05
Toxaphene	170	0.25
Volatile Organics - Method 8240/8260	**mg/kg**	**ug/L**
Acetone	10	10
Acrolein	100	100
Acrylonitrile	100	100
Benzene	5	5
Bromodichloromethane	5	5
Bromoform	5	5
Bromomethane	10	10
2-Butanone (MEK)	10	10
Carbon disulfide	5	5
Carbon tetrachloride	5	5
Chlorobenzene	5	5
Chloroethane	10	10
Chloroform	5	5
Chloromethane	10	10
Dibromochloromethane	5	5
Dibromomethane	5	5
trans-1,4-Dichloro-2-butene	5	5
Dichlorodifluoromethane	20	20
1,1-Dichloroethane	5	5
1,2-Dichloroethane	5	5
1,1-Dichloroethene	5	5
1,2-Dichloropropane	5	5
cis-1,3-Dichloropropene	5	5
trans-1,3-Dichloropropene	5	5
Ethylbenzene	5	5
Ethyl methacrylate	20	20
Iodomethane	5	5
2-Hexanone	10	10

TABLE 3-2
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Methylene chloride	5	5
4-Methyl-2-pentanone (MIBK)	10	10
Styrene	5	5
1,1,1,2-Tetrachloroethane	5	5
1,1,2,2-Tetrachloroethane	5	5
Tetrachloroethene	5	5
Toluene	5	5
1,1,1-Trichloroethane	5	5
1,1,2-Trichloroethane	5	5
Trichlorethene	5	5
Trichlorofluoromethane	5	5
1,2,3-Trichloropropane	5	5
Vinyl acetate	10	10
Vinyl chloride	10	10
Xylenes (total)	5	5
total 1,2-Dichloroethene	5	5
Ethanol	--	--
2-Chlorethyl vinyl ether	10	10
Semivolatile Organics - Method 8270	**mg/kg**	**ug/L**
Acenaphthene	330	10
Acenaphthylene	330	10
Acetophenone	330	10
4-Aminobiphenyl	330	10
Aniline	330	10
Anthracene	330	10
Benzo(a)anthracene	330	10
Benzo(b)fluoranthene	330	10
Benzo(k)fluoranthene	330	10
Benzo(g,h,i)perylene	330	10
Benzo(a)pyrene	330	10
Benzyl alcohol	330	10
4-Bromophenyl phenyl ether	330	10
Butyl benzyl phthalate	330	10
4-Chloroaniline	330	10
bis(2-Chloroethoxy)methane	330	10
bis(2-Chloroethyl)ether	330	10
bis(2-Chloroisopropyl)ether	330	10
4-Chloro-3-methylphenol	330	10
2-Chloronaphthalene	330	10
2-Chlorophenol	330	10
4-Chlorophenyl phenyl ether	330	10
Chrysene	330	10
Dibenz(a,h,)anthracene	330	10
Dibenzofuran	330	10

TABLE 3-2
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Di-n-butyl phthalate	330	10
1,2-Dichlorobenzene	330	10
1,3-Dichlorobenzene	330	10
1,4-Dichlorobenzene	330	10
3,3'-Dichlorobenzidine	660	20
2,4-Dichlorophenol	330	10
2,6-Dichlorophenol	330	10
Diethyl phthalate	330	10
p-Dimethylaminoazobenzene	330	10
7,12-Dimethylbenz(a)-anthracene	330	10
a,a-Dimethylphenethyl-amine	330	10
2,4-Dimethylphenol	330	10
Dimethyl phthalate	330	10
4,6-Dinitro-2-methylphenol	1600	50
2,4-Dinitrophenol	1600	50
2,4-Dinitrotoluene	330	10
2,6-Dinitrotoluene	330	10
Di-n-octyl phthalate	330	10
Diphenylamine	330	10
bis(2-Ethylhexyl)phthalate	330	10
Ethyl methanesulfonate	330	10
Fluoranthene	330	10
Fluorene	330	10
Hexachlorobenzene	330	10
Hexachlorobutadiene	330	10
Hexachlorocyclopentadiene	330	10
Hexachloroethane	330	10
Indeno(1,2,3-cd)pyrene	330	10
Isophorone	330	10
3-Methylcholanthrene	330	10
Methyl methanesulfonate	330	10
2-Methylnaphthalene	330	10
2-Methylphenol	330	10
3/4-Methylphenol	330	10
Naphthalene	330	10
1-Naphthylamine	330	10
2-Naphthylamine	330	10
3-Nitroaniline	1600	50
4-Nitroaniline	1600	50
Nitrobenzene	330	10
2-Nitrophenol	330	10
4-Nitrophenol	1600	10
N-Nitroso-di-n-butylamine	330	10
N-Nitrosodiphenylamine	330	10
N-Nitroso-di-n-propylamine	330	10

TABLE 3-2
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
N-Nitrosopiperidine	330	10
Pentachlorobenzene	330	10
Pentachloronitrobenzene	1600	10
Pentachlorophenol	1600	10
Phenacetin	330	10
Phenanthrene	330	10
Phenol	330	10
2-Picoline	330	10
Pronamide	330	10
Pyrene	330	10
1,2,4,5-Tetrachloro-benzene	330	10
2,3,4,6-Tetrachlorophenol	1600	50
1,2,4-Trichlorobenzene	330	10
2,4,5-Trichlorophenol	1600	50
2,4,6-Trichlorophenol	330	10
Benzidine	2500	50
1-Chloronaphthalene	2500	50
Dibenz(a,j)acridine	--	--
Azobenzene	2500	50
Benzoic acid	2500	50
Wet Chemistry	**mg/kg**	**mg/L**
Hardness	NA	5
COD	NA	20
TOC	NA	1.0
TSS	NA	2
TDS	NA	10
ALK	NA	5
Chloride	NA	0.5
Sulfate	NA	0.5

NA - Not applicable

* Indicates Method 6010, all other metals by Method 6020

[1] Actual sediment reporting limits vary due to percent moisture, and preparation dilution

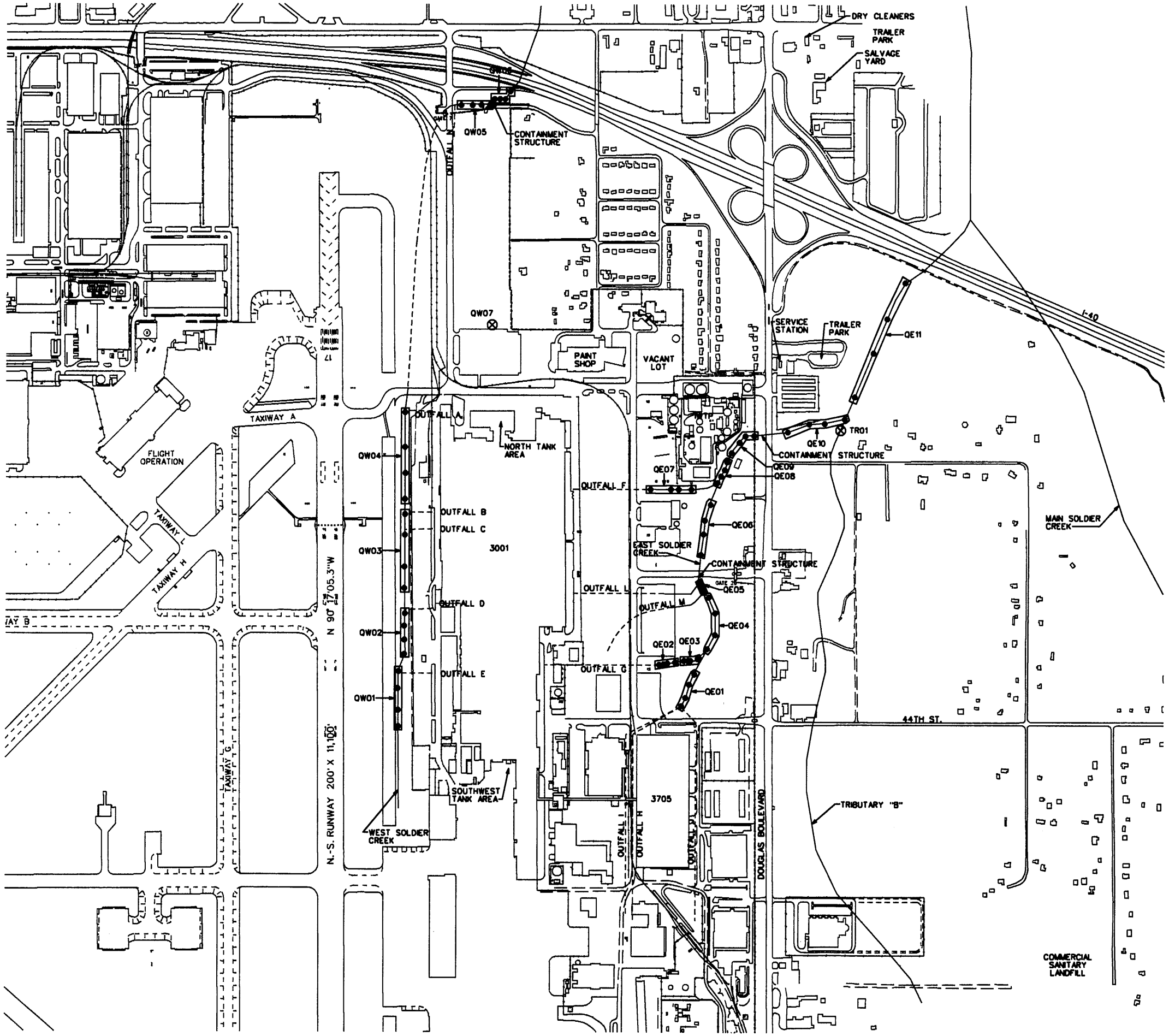
[2] Reporting units for sediment & surface hexavalent chromium analysis for second and third quarters second year monitoring were 20 mg/kg and 0.5 mg/L, respectively.

TABLE 3-3
ANALYTES, CONTAINERS, PRESERVATION, AND HOLDING TIMES

MEDIA	METHOD	PARAMETER	CONTAINER	PRESERVATION	HOLDING TIME
Sediment	SW-486 8240/8260	Volatile Organics	Two 4 oz. wide-mouthed jars	4° C	14 days
Sediment	SW-846 8270	Semivolatile Organics	*16 oz. wide-mouthed jars	4° C	14 days to extraction 40 days to analysis
Sediment	SW-846 8080	Pesticides (with PCB's)	*16 oz. wide-mouthed jars	4° C	14 days to extraction 40 days to analysis
Sediment	SW-846 6010/6020/7000	Metals	*16 oz. wide-mouthed jars	4° C	180 days Hg - 28 days
Sediment	7196	Hexavalent Chromium	4 oz. wide mouth jar	4° C	24 hours
Water	SW-846 8240	Volatile Organics	Three 40-ml. glass vial w/Teflon cap	4° C HCl pH<2	14 days
Water	SW-846 8270	Semivolatile Organics	Two 32oz glass (amber)	4° C	7 days to extraction 40 days to analysis
Water	SW-846 8080	Pesticides (with PCB's)	Two 32oz glass (amber)	4° C	7 days to extraction 40 days to analysis
Water	SW-846 6010//6020/7060/7470	Total Metals, As, Hg	One 500-ml plastic bottle**	HNO_3 pH<2	180 days Hg - 28 days
Water	6010/6020	Dissolved Metals	One 500-ml plastic bottle**	HNO_3 pH<2	180 days Hg - 28 days
Water	130.2	Hardness	One 500-ml plastic bottle**	HNO_3 pH<2	180 days
Water	410.4, 415.1	Chemical Oxygen Demand / Total Organic Carbon	One 16-oz glass	4° C H_2S0_4 pH<2	COD 24 days, TOC 28 days
Water	160.1, 160.2, 310.1, 300.0	Total Suspended Solids, Total Dissolved Solids, Alkalinity, Chloride, Sulfate	Two 500-ml plastic bottles	4° C	TSS 7 days, TDS 7 days, Alkalinity 14 days, Chloride 14 days, Sulfate 28 days
Water	7196	Hexavalent Chromium	One liter amber	4° C	24 hours

*One 16oz glass container filled is sufficient for metals, semivolatile organics, and pesticides & PCB sediment analysis
**One 500-ml bottle is sufficient for total metals, As, Hg, and hardness analysis

FIGURES



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B AND QW07
- • 1ST QUARTER SAMPLE LOCATION
- • 2ND QUARTER SAMPLE LOCATION
- • 3RD QUARTER SAMPLE LOCATION
- • 4TH QUARTER SAMPLE LOCATION

N

800 0 800 1600

SCALE FEET

Designed By: D.D.N.	TINKER AIR FORCE BASE
Drawn By: T.R.F.	OKLAHOMA CITY, OKLAHOMA
Checked By: D.J.K	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING LOCATIONS
Submitted By:	PROJECT NUMBER F96515 / DATE JAN 1997 / FIG. NO. 3-1

MCS FILE: SOLDQ-01-RF-CTA881

4.0
HUMAN HEALTH RISK ASSESSMENTS

An evaluation of risks associated with Soldier Creek surface water and sediments was previously performed by Black & Veatch Waste Science Technology (B&V, 1993). Since the time of the original risk assessment, additional information on the nature and extent of stream contamination has been collected, including additional sediment and surface water sampling, as well as information on pesticides and PCBs not previously evaluated. The Human Health Risk Assessment I (HHRA I) was prepared for the first year of quarterly monitoring to provide information on potential current and future risks based on current surface water and sediment contaminant levels, to compare the results with those of B&V to see if the previous conclusions are still valid, and to develop cleanup goals that are protective of human populations. The HHRA I is presented in its entirety in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). Based on results of the second year of quarterly monitoring the Human Health Risk Assessment II (HHRA II) was prepared to address the same issues as the HHRA I, and to compare current results with those of the HHRA I to see if the previous conclusions were still valid. The HHRA II is presented in its entirety in Appendix A.

The HHRA II was performed using guidance provided in the Risk Assessment Guidance for Superfund - Part A and Part B, Exposure Factors Handbook, Standard Default Exposure Factors, Dermal Exposure Assessment: Principles and Applications, and EPA Supplemental Region IV Risk Assessment Guidance. Environmental data obtained from surface water and sediment samples collected by Woodward-Clyde in the second year quarterly monitoring sampling events (WCFS, 1996 a, b, c, d) were used in the HHRA II. In addition, the HHRA II made use of recent EPA databases, including the Integrated Risk Information System (IRIS;, Health Effects Assessment Summary Tables (HEAST); EPA Region III Risk-Based Concentration Table and Drinking Water Regulation and Health Advisories. References used in the HHRA II are cited in Appendix A.

The HHRA II utilized the same stream segments and exposure scenarios as the HHRA I. Based on differences in contaminant sources and exposed populations, the following four stream segments were evaluated in this risk assessment:

- West Soldier Creek, on-base
- West Soldier Creek, off-base
- East Soldier Creek, on-base
- East Soldier Creek, off-base

The chemicals of potential concern identified include metals, PCBs, chlorinated pesticides, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). An evaluation of potential health risks was performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-base portions of the creeks

- Residents wading or swimming in the off-base portion of West and East Soldier Creeks. (Swimming was only evaluated for the child scenario for East Soldier Creek; all other scenarios assume wading only)

Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that potential cancer risks and non-carcinogenic health hazards for all scenarios are less than the advisory range of 10^{-6} to 10^{-4} and 1.0, respectively. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or non-carcinogenic hazard for any on-base or off-base populations under current or future stream use conditions.

The following differences in approaches/assumptions were noted between the HHRAs and Baseline Health Risk Assessment (BHRA):

- The HHRAs evaluated PCBs/chlorinated pesticides as potential COCs. The BHRA prepared by B&V did not include these data

- The individual stream segments, evaluated in the B&V BHRA are not identical to the segments evaluated in the HHRAs (the stream segments evaluated in the HHRAs are thought to be more representative of actual stream use)

- Some of the exposure assumptions used in HHRAs are different than those used in B&V BHRA (e.g., the HHRAs utilized age-corrected surface area for

evaluating exposure to surface water and sediments; B&V BHRA values were not age corrected, which was not required at the time of the BHRA).

The results of the HHRA II were compared to those presented in the HHRA I. The results of the comparison between the HHRA I and HHRA II showed no dramatic changes. Although the non-carcinogenic screening criteria was exceeded by one sample on-base West Soldier Creek, under the worker scenario, the exceedance does not trigger an unacceptable non-carcinogenic hazard. Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

As part of the risk assessment, a set of cleanup goals was developed to identify health-protective levels for each COC. Although remediation does not appear to be warranted at the present time (based on risk to human health), these cleanup goals provide a set of "action criteria", should remedial action be required in the future.

5.0
DISCUSSION OF QUARTERLY MONITORING RESULTS

This section discusses data screening and evaluation procedures and the results of the second year of sediment and surface water quarterly monitoring of the Soldier Creek Operable Unit.

5.1 DATA SCREENING

The purpose of data screening and analysis was to determine which analytes are present and which of those exceed medium specific screening criteria. For this assessment, a simple two step procedure was used. The basis of the first step was to establish the presence or absence of analytes in the sediment and surface water samples. First, all analytes reported in detectable concentrations were tabulated on a site by site basis for each quarter.

The second step involved sample by sample comparisons to screening criteria. Screening criteria were set forth in the ROD (B&V, 1993b) and the WCFS HHRA I (WCFS, 1997a). These screening criteria are risk-based values to which specific analyte concentrations are compared. If sample concentrations were below the decision criteria, it was assumed that the analyte does not pose an unacceptable risk to human health and response actions are not required. Therefore, the analyte was dropped from further consideration. If screening criteria were exceeded, the analyte was considered a potential COC and was retained for additional analysis.

According to the ROD (B&V, 1993b), unacceptable exposures were determined based on the following criteria:

- Contaminant concentrations in sediment or surface water exceeding health levels based on an excess lifetime cancer risk of 10^{-4}. Contaminant concentrations detected in the 10^{-4} to 10^{-6} range may potentially indicate an unacceptable exposure level and will be evaluated to determine if the exposure level was unacceptable and remediation, therefore, necessary.

- Contaminant concentrations in sediment or surface water with non-carcinogenic hazard indices (HIs) greater than 1.0

- Contaminant concentrations in sediment or surface water that present an unacceptable ecological risk

The first two criteria were based on exposure factors developed by the BHRA for human health under the RI/FS, and the HHRA I. Summaries of carcinogenic and non-carcinogenic risks for contaminants of concern in sediment and surface water from the BHRA are presented in Table 5-1 and Table 5-2. Risk based cleanup levels developed by the HHRA I and for sediment and surface water are presented in Tables 5-3 through 5-4. Risk based cleanup levels developed by the HHRA II for sediment and surface water are summarized in Tables 5-5 and 5-6. The following evaluation and discussion of analytical results is for the second year quarterly monitoring results. These results were screened against the BHRA and HHRA I screening criteria as described above. The second year analytical results were also evaluated under the HHRA II for unacceptable cancer risk or non-carcinogenic hazard presented in Appendix A. Ecological criteria are being addressed under a separate evaluation (WCFS, 1997b).

5.2 EVALUATION AND DISCUSSION OF RESULTS

5.2.1 Sediment

A total of 140 sediment samples were collected during the second year of quarterly monitoring. Total sediment samples collected from the 18 segments and sample locations on QW07 and Tributary B for the first through fourth quarters of the second year of monitoring were 36, 32, 38, and 34, respectively. Sediment samples were collected at three intervals from 0-6 inches, 6-12 inches, and 3-5 feet. Beginning the second quarter of the second year of monitoring, samples from TR01 were only collected from 0-6 inches. When refusal of the sampling device occurred prior to 5 feet bgs, a sample was typically collected from the bottom one foot interval of the boring. The number of sediment samples collected varied quarterly based on the depth of sediment at each sampling location. In some sampling segments, particularly on-base East Soldier Creek, upstream of Bradley Drive, the stream bed is scoured to bedrock with few, shallow depositional areas.

Appendix B contains tables which summarize the analyte detections by quarter. Table 5-7 presents the frequency of detection, maximum, minimum and average concentrations of analytes detected in sediment. Statistical summaries were calculated based on detected concentrations in analytical samples excluding non-detects and QA/QC samples. The sample location at which the maximum concentration of an analyte was detected is presented in Table 5-8. Table 5-9 presents a summary of analytes for 0-6 inches and 6-12 inches bgs for the first and second years of quarterly monitoring which exceeded the BHRA screening criteria. Analytes which exceeded HHRA I 10^{-5} and 10^{-6} carcinogenic screening criteria during the first and second years of quarterly monitoring are presented in Table 5-10 and Table 5-11. No analytes in sediment samples exceeded the HHRA I 10^{-4} carcinogenic screening criteria. One sample exceeded the HHRA I non-carcinogenic screening criteria for Aroclor 1254 as discussed below. Table 5-12 presents a comparison of the maximum analyte concentration for each quarter of the first two years of monitoring to the maximum RI sampling analytical results.

5.2.1.1 Metals

Twenty-four metals were detected during the four quarters of monitoring. Metals detected by Method 6010/6020 were: aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. Metals detected by Methods 7060, and 7470, were arsenic, and mercury, respectively. Hexavalent chromium was not detected in sediment analytical samples.

The most frequently detected metals and their maximum concentrations were aluminum (23,400 mg/kg), arsenic (13.2 mg/kg), barium (5,560 mg/kg), calcium (231,000 mg/kg), chromium (5,140 mg/kg), cobalt (109), copper (17,000 mg/kg), iron (31,800 mg/kg), magnesium (24,100 mg/kg), manganese (4,140 mg/kg), nickel (8,790 mg/kg), vanadium (121 mg/kg), and zinc (2,570 mg/kg). These metals were detected in all 140 sediment samples collected during the second year of quarterly monitoring. Metals concentrations did not exceed BHRA or HHRA I screening criteria in any sediment samples.

5.2.1.2 PCB's and Chlorinated Pesticides

4,4'-DDD, 4,4'-DDE, aldrin, alpha-chlordane, aroclor 1254, aroclor 1260, delta-BHC, dieldrin, gamma-chlordane, and heptaclor were detected in the sediments during the second year of quarterly monitoring. When pesticides or PCBs were detected in an analytical sample, a second column was run. Analytical results were qualified with M (primary result), L (estimated result due to collusion), and no qualifier. Data qualified with L were not included in the evaluation and are not included in the review of analytical results.

The HHRA I non-carcinogenic screening criteria of 66.2 mg/kg was exceeded by one sample during the second year of quarterly monitoring. The highest concentration of Aroclor 1254 was 86 mg/kg in sample QW03-602 collected from West Soldier Creek. The sample was collected the second quarter in March 1996 from 6-12 inches. The average reported concentrations of Aroclor 1254 for the second year of quarterly sampling was 5.82 mg/kg. Aroclor 1254 was also the most frequently detected pesticide compound with 76 detections in sediment samples.

Pesticides and PCBs were not identified as potential COC in the BHRA (B&V, 1993a). Consequently, screening criteria were not available from the BHRA for evaluation.

However, aldrin, alpha-chlordane, and heptaclor were identified as potential COCs by exceeding HHRA I 10^{-6} screening criteria during the second year of quarterly monitoring.

Aldrin was detected in 19 analytical samples. Aldrin detected in three samples, QE02-501 (0.81 mg/kg), QE07-501 (3.7 mg/kg), and QE07-502 (2.5 mg/kg) exceeded the HHRA I 10^{-6} screening criteria (0.454 mg/kg). The highest concentration of aldrin was detected in sample QE07-501, collected from the upper portion of Outfall F on East Soldier Creek. The sample was collected during the first quarter second year sampling event from 0-6 inches. The average detected concentration of aldrin during the second year of quarterly monitoring was 0.41 mg/kg.

Alpha-Chlordane was detected in 15 analytical samples. Alpha-Chlordane detected in samples QE07-501 (16 mg/kg) and QE07-502 (15 mg/kg) exceeded the HHRA I 10^{-6} screening criteria (5.94 mg/kg). The samples were collected during the first quarter second

year sampling event from Outfall F on East Soldier Creek from 0-6 and 6-12 inches, respectively. The average concentration of alpha-chlordane during the second year of quarterly monitoring was 2.48 mg/kg.

Heptaclor was detected in 34 samples. Heptachlor detected in samples QE07-501 (7.0 mg/kg), and QE07-502 (4.6 mg/kg) exceeded the HHRA I 10^{-6} screening criteria (1.715 mg/kg). The samples were collected during the first quarter second year sampling event from Outfall F on East Soldier Creek from 0-6 and 6-12 inches, respectively. The average concentration of heptaclor during the second year of quarterly monitoring was 0.49 mg/kg.

5.2.1.3 Semivolatile Organics

Forty-three semivolatile organic compounds (SVOCs) were detected during the second year of quarterly monitoring. The SVOCs detected during the second year of monitoring are presented in Table 5-7.

The highest volatile concentration was fluoranthene (120 mg/kg) which was detected in segments QE02 and QE03 during the third and fourth quarters, respectively. Fluoranthene was detected in 111 analytical samples. The average concentration for fluoranthene over the second year of sampling was 7.9 mg/kg.

Seven semivolatile analytes were identified as potential contaminants of concern by exceeding risk-based screening criteria during the second year of quarterly monitoring. Benzidine was identified as a potential contaminant of concern during the first year of quarterly monitoring. However, benzidine concentrations did not exceed the screening criteria during the second year of quarterly monitoring. The following polyaromatic hydrocarbons (PAHs): benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene, exceeded the BHRA screening criteria during every sampling event (Table 5-9). HHRA I 10^{-5} screening criteria were exceeded for benzo(a)pyrene (Table 5-10). Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene exceeded the HHRA I 10^{-6} screening criteria (Table 5-11).

Benzo(a)anthracene was detected in 86 analytical samples, 32 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg and 8 of which exceeded HHRA I 10^{-6} screening criteria of

10.575 mg/kg. The highest concentration of benzo(a)anthracene was 59 mg/kg detected in sample QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches. The average detected concentration of benzo(a)anthracene during the second year of quarterly monitoring was 3.69 mg/kg.

Benzo(b)fluoranthene was detected in 96 analytical samples, 42 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg and 10 of which exceeded HHRA I 10^{-6} screening criteria of 10.575 mg/kg. The highest concentration of benzo(b)fluoranthene was 83 mg/kg detected in sample QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches. The average detected concentration of benzo(b)fluoranthene during the second year of quarterly monitoring was 4.96 mg/kg.

Benzo(k)fluoranthene was detected in 18 analytical samples, 4 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg. The highest concentration of benzo(k)fluoranthene was 23 mg/kg detected in sample QE02-702, collected from Outfall G. The sample was collected the during the third quarter second sampling event from 6-12 inches. The average detected concentration of benzo(k)fluoranthene during the second year of quarterly monitoring was 2.26 mg/kg.

Benzo(a)pyrene was detected in 88 analytical samples, 33 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg, 7 of which exceeded HHRA I 10^{-5} screening criteria of 10.575 mg/kg, and 34 of which exceeded HHRA I 10^{-6} screening criteria of 1.057 mg/kg. The highest concentration of benzo(a)pyrene was 45 mg/kg detected in sample QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches. The average detected concentration of benzo(a)pyrene during the second year of quarterly monitoring was 3.14 mg/kg.

Chrysene was detected in 92 analytical samples, 36 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg. Chrysene concentrations did not exceed HHRA I screening criteria. The highest concentration of chrysene was 57 mg/kg detected in sample QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches.. The average detected concentrations of chrysene during the second year of quarterly monitoring was 3.75 mg/kg.

Dibenz(a,h)anthracene was detected in 40 analytical samples, five of which exceeded the HHRA I 10^{-6} screening criteria of 1.057 mg/kg. The highest concentration of dibenz(a,h)anthracene was 6.0 mg/kg detected in sample QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches. The average detected concentration of dibenz(a,h)anthracene during the second year of quarterly monitoring was 0.63 mg/kg.

Indeno(1,2,3-cd)pyrene was detected in 76 analytical samples, three of which exceeded the HHRA I 10^{-6} screening criteria of 10.575 mg/kg. The highest concentration of indeno(1,2,3-cd)pyrene was 20.0 mg/kg detected in samples QE03-601, collected from Outfall G. The sample was collected during the second quarter second year sampling event from 0-6 inches. The average detected concentration of indeno(1,2,3-cd)pyrene during the second year of quarterly monitoring was 1.77 mg/kg.

Figure 5-1 presents sample locations in which 0-6 inch sediment samples exceeded the BHRA screening criteria for PAHs, during the second year of quarterly monitoring. Figures 5-2a through 5-2m present graphs by stream segment that illustrate the sediment concentrations at 0-6 inches for the five PAHs which exceeded BHRA screening criteria in every sampling event (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene). Graphs are presented for those segments in which exceedance of the BHRA PAH screening criteria occurred during the first and/or second year of quarterly monitoring (QE01-QE08, QE10, and QW02-QW05). The graphs illustrate that typically the detected PAH concentrations follow the same trend (e.g., an increase in one PAH compound is associated with increases in the other detected PAH compounds).

The graphs also illustrate that the sampling quarter with the highest concentration of the PAHs varies between the sampling segments. This relationship suggests that multiple origins for the PAHs could exist.

Figures 5-3a through 5-3h present the upstream to downstream concentration gradient of PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene) in 0-6 inch bgs sediment samples by quarter for East Soldier Creek. Similarly, Figures 5-4 a through 5-4h present the upstream to downstream concentration gradient of PAHs in 0-6 inch bgs sediment samples for West Soldier Creek.

The following discussion presents a summary of peak discharges, and any trends in the PAH data observed in Figure 5-2a through 5-2m over the first two years of quarterly monitoring:

- QE01 shows the highest PAH concentrations occurred at the first quarter sample location in each year and during the fourth quarter second year sampling event.

- QE02 and QE03 show no apparent trends from the first to second year monitoring among quarters. At QE03, PAH concentrations peaked during the second quarter second year event. At QE02, two peaks in PAH concentrations occurred, during the third quarter first year and the fourth quarter second year sampling events. Sediments along Outfall G are shallow in most locations. The peaks in location may be also related to the availability of depositional sediments. Although peaks from QE02 and QE03 do not occur during the same monitoring events, peaks may be related to spill events, and the depositional characteristics of each sample location.

- QE04 and QE05 show peak concentrations of PAHs during the third and fourth quarter first year sampling events, respectively. The peak is not seen in the second year indicating a flushing of the system or possible spill event.

- QE06 shows the highest PAH concentrations at the third and fourth quarter sample locations for both years of quarterly monitoring. The concentrations appear to decrease from the first to second year of quarterly monitoring. The sediments at these sample locations are highly organic, and the creek is marshy.

- QE07 shows a peak concentrations at the first quarter sample location during the second year of monitoring. The peak concentration the second year is an order of magnitude greater than the first year, potentially indicating a spill event.

- QE08 shows the highest PAH concentrations occurred at the third quarter sample location for both years of quarterly monitoring.

- The peak PAH concentrations for segments QW02 and QW03 occurred during the first quarter second year sampling event. The peak PAH concentrations for QW04 occurred

during the third quarter second year event. During the second year of quarterly monitoring, PAH concentrations did not exceed screening criteria off-base.

The graphs illustrate that concentrations of analytes decrease off-base as compared to on-base. Exceedances of 10^{-6} screening criteria (BHRA and HHRA I) occurred during only one quarter the first year of quarterly monitoring on a off-base portion of East Soldier Creek (QE10) and off-base portion of West Soldier Creek (QW05). Analytical results from the downstream most segments of both East and West Soldier Creek (QE11, and QW06) and on-base East Soldier Creek QE09 did not exceed BHRA or HHRA I screening criteria during any sampling event.

The primary source of release of PAHs to the environment occurs as a result of combustion emissions. Discharges may also occur from spills of fuel oils, gasoline, etc., or from runoff from sources such as roadways, asphalt parking lots, or railroad ties.

PAHs consist of two or more aromatic rings fused in linear, angular, or cluster arrangements containing only carbon and hydrogen atoms. Their chemical, physical, and biological properties vary based on their size and shape. In general, PAHs are poorly soluble in water explaining their low concentrations in the surface water in comparison with the sediment. The log octanol/water partition coefficients (log K_{ow}) for most PAHs range from 4 to 8, indicating that they are adsorbed by soils and sediments, limiting potential migration into deep soils and groundwater (USDHHS, 1990).

5.2.1.4 Volatiles

Fifteen volatile compounds were detected in sediment samples during the second year of quarterly monitoring. The compounds detected were: 1,1,1-trichloroethane, 1,1-dichloroethane, 2-butanone (MEK), acetone, acrylonitrile, carbon disulfide, carbon tetrachloride, chlorobenzene, chloromethane, ethylbenzene, methylene chloride, tetrachloroethene, toluene, trichloroethene, and xylenes (total).

The most frequently detected volatile compound was acetone followed by methylene chloride. Acetone was detected in 113 analytical samples with a maximum concentration of 0.74 mg/kg and average concentration of 0.04 mg/kg. The highest concentration of acetone

was detected in the sediment sample from QE08-701, collected from the pond on East Soldier Creek. The sample was collected during the third quarter second year sampling event for 0-6 inches.

Methylene chloride was detected in 89 samples with a maximum concentration of 0.025 mg/kg. Methylene chloride was detected in 31 analytical samples with an average concentration of 0.004 mg/kg. The highest concentration of methylene chloride was detected from QE07-701, collected from Outfall F. The sample was collected during the third quarter second year sampling event.

The highest volatile concentration was chlorobenzene (25 mg/kg) which was detected in sediment sample QE08-702, collected from the pond on East Soldier Creek. The sample was collected during the third quarter second year sampling event from 6-12 inches. Chlorobenzene was detected in 29 analytical samples with an average concentration of 1.02 mg/kg.

5.2.1.5 Tentatively Identified Compounds

A total of 589 tentatively identified compounds (TICs) were detected in sediments during quarterly monitoring. TICs are compounds detected during analysis of volatile organic and semivolatile organic compounds and are not target compounds, internal standards, or surrogate standard compounds and whose response is greater than 10% of the nearest internal standard compound. The identity of a TIC must be determined using a mass spectral library search for the best match.

The most frequently detected TIC was the class of compounds "Oxygenated Hydrocarbons" which was reported 119 times. Table B-17 in Appendix B, presents the frequency of detection, minimum, and maximum concentrations for all TICs detected in the sediment. The sample location at which the maximum concentration of a TIC was detected is presented in Table B-18 in Appendix B.

5.2.2 Surface Water

A total of 61 surface water samples were collected during the second year of quarterly monitoring. Total surface water samples collected from the first through fourth quarters were 17, 13, 16, and 15, respectively. The number of surface water samples varied quarterly due to the intermittent nature of the streams. Sample locations at segment QW01 and Tributary B were dry during all four quarterly sampling events. Sample locations at QW03 were dry except during the third quarter second year sampling event. Sample locations at QW02 were dry during the first and fourth quarter second year sampling events. During the first quarter second year sampling event, all sampling locations on-base West Soldier Creek were dry.

Appendix B contains tables which summarize analyte detections by quarter. Table 5-13 presents the frequency of detection, maximum, minimum, and average concentrations of analytes detected in surface water samples. Statistical summaries were calculated based on detected concentrations in analytical samples excluding detections in QA/QC samples and non-detects. The sample location at which the maximum concentration of an analyte was detected is presented in Table 5-14. Table 5-15 presents a comparison of maximum analyte concentrations of the surface water samples for each quarter of the first two years of monitoring to the maximum RI analytical results.

5.2.2.1 Metals

Twenty-two total metals were detected during the second year of monitoring. Total metals detected in surface water by Method 6010/6020/7000 were: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, hexavalent chromium, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, sodium, vanadium, and zinc.

The most frequently detected total metals and their maximum concentrations were barium (0.65 mg/L), calcium (103 mg/L), magnesium (49.8 mg/L), and vanadium (0.026 mg/L). These metals were detected in all 61 surface water samples collected during the second year of quarterly monitoring.

The highest total metal concentration was sodium (200 mg/L) from sample QE11-601, collected downstream of Douglas Boulevard on off-base East Soldier Creek. The sample was collected the during the second quarter second year sampling event. Sodium was detected in 59 analytical samples. The average concentration of sodium from the second year of quarterly monitoring was 34.22 mg/L.

Hexavalent chromium was detected in 5 analytical samples. The highest concentration of hexavalent chromium (0.02 mg/L) was detected in sample QW07-801, collected from the tributary to West Soldier Creek. The sample was collected during the fourth quarter second year sampling event.

Dissolved metals analysis began the second quarter second year sampling event. Twenty dissolved metals were detected during the last three quarters of the second year of monitoring. Dissolved metals detected in surface water by Method 6010/6020/7000 were: aluminum, antimony, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, vanadium, and zinc.

The most frequently detected dissolved metals and their maximum concentrations were barium (0.64 mg/L), calcium (101 mg/L), magnesium (48.8 mg/L), manganese (0.23 mg/L), nickel (0.04 mg/L), and vanadium (0.027 mg/L). These metals were detected in 48 surface water samples.

The highest dissolved metal concentration was sodium (207 mg/L) from sample QE11-601 collected downstream of Douglas Boulevard on off-base East Soldier Creek. The sample was collected the during the second quarter second year sampling event. Sodium was detected in 48 analytical samples. The average concentration of sodium from the second year of quarterly monitoring were 31.4 mg/L.

No total or dissolved metals concentrations exceeded BHRA or HHRA I screening criteria in surface water samples.

5.2.2.2 PCBs and Chlorinated Pesticides

4,4'-DDT was the only pesticide detected in surface water during the second year of quarterly monitoring. 4,4'-DDT was detected in one surface water sample at QE10-601 (0.075 ug/L), collected downstream of Douglas Boulevard on off-base East Soldier Creek. The sample was collected during the second quarter second year sampling event.

PCB and pesticide concentrations did not exceed risk based screening criteria in surface water samples.

5.2.2.3 Semivolatiles

Eighteen semivolatile compounds were detected in surface water samples collected during the second year of quarterly monitoring. The semivolatile compounds detected were: 1,2-dichlorobenzene, 2,4,6-trichlorophenol, 2,6-dichlorophenol, 2-chlorophenol, 3/4-methylphenol, 4-nitrophenol, aniline, benzidine, benzoic acid, bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, di-n-butyl phthalate, dibenzofuran, diethyl phthalate, dimethyl phthalate, fluoranthene, naphthalene, and phenol.

The most frequently detected semi-volatile compound detected during the second year of quarterly monitoring was benzoic acid. Benzoic acid was detected in eight samples. The maximum concentration of benzoic acid (0.0016 mg/L) was detected at QE02-501, on Outfall G during the first quarter second year sampling event. The average concentration of benzoic acid from the second year of quarterly monitoring was 0.0013 mg/L.

Semivolatile concentrations did not exceed BHRA or HHRA I risk based screening criteria in any surface water samples.

5.2.2.4 Volatiles

Twelve volatile compounds were detected in surface water during the second year of quarterly monitoring. The volatile compounds detected were: 2-butanone (MEK), 2-hexanone, acetone, bromoform, carbon disulfide, chloroform, dibromochloromethane, dichlorodifluoromethane, methylene chloride, tetrachloroethene, trichloroethene, and toluene.

The highest volatile compound concentration was methylene chloride (0.15 mg/L) detected in sample QE10-501. This sample was collected just downstream from Douglas Boulevard on off-base East Soldier Creek during the first quarter second year sampling event.

Acetone was the most frequently detected volatile compound, being reported in 33 surface water samples. The maximum and average concentrations of acetone detected during the second year of quarterly monitoring were 0.026 and 0.0083 mg/L, respectively.

Volatiles concentrations did not exceed BHRA or HHRA I risk based screening criteria in any surface water samples.

5.2.2.5 Wet Chemistry

Surface water samples were analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. The wet chemistry analysis began during the second quarter second year monitoring event. Results of wet chemistry analysis are presented in Table B-13 through Table B-16 in Appendix B.

5.2.2.6 Tentatively Identified Compounds

A total of 133 TICs were detected in surface water during quarterly monitoring. TICs are compounds detected during analysis of volatile organic and semivolatile organic compounds and are not target compounds, internal standards, or surrogate standard compounds and whose response is greater than 10% of the nearest internal standard compound. The identity of a TIC must be determined using a mass spectral library search for the best match.

The most frequently detected TIC was the class of compounds called "Oxygenated Hydrocarbons" which was detected in 25 surface water samples. Table B-19 in Appendix B, presents the frequency of detection, minimum, and maximum concentrations for the TICs detected in surface water. The sample location at which the maximum concentration of a TIC was detected is presented in Table B-20 in Appendix B.

TABLES

TABLE 5-1
CARCINOGENIC AND NON-CARCINOGENIC
BASELINE HEALTH RISK ASSESSMENT (BHRA) SCREENING CRITERIA FOR SEDIMENT

Compound Name	Non-Caracinogenic	Carcinogenic 10-6	Carcinogenic 10-4
Inorganics (mg/kg)			
Arsenic	2.10E+06		
Mercury	6.20E+05		
Barium	1.40E+08		
Cadmium	1.00E+06		
Chromium	1.00E+07		
Manganese	2.10E+08		
Nickel	4.10E+07		
Silver	6.20E+06		
Vanadium	1.40E+07		
Zinc	4.10E+08		
Semivolatile Organics (ug/kg)			
1,2-Dichlorobenzene	7.90E+08		
1,4-Dichlorobenzene		1.00E+06	1.00E+08
2,4-Dimethylphenol	1.80E+08		
2-Methylphenol	4.40E+08		
3/4-Methylphenol	4.40E+08		
Acenaphthene	3.80E+07		
Anthracene	1.90E+08		
Benzo(a)anthracene		1.60E+03	1.60E+05
Benzo(a)pyrene		1.60E+03	1.60E+05
Benzo(b)fluoranthene		1.60E+03	1.60E+05
Benzo(k)fluoranthene		1.60E+03	1.60E+05
bis(2-Ethylhexyl)^phthalate	1.30E+07	1.00E+05	1.00E+07
Butyl benzyl phthalate	1.30E+08		
Chrysene		1.60E+03	1.60E+05
Dibenz(a,h)anthracene		1.20E+05	1.20E+07
Fluoranthene	2.50E+07		
Fluorene	2.50E+07		
Indeno(1,2,3-cd)pyrene		1.20E+05	1.20E+07
Naphthalene	2.50E+06		
Pyrene	1.90E+07		
Volatile Organics (ug/kg)			
Acetone	4.10E+07		
Benzene		3.30E+04	3.30E+06
Carbon disulfide	5.70E+08		
Chlorobenzene	8.30E+06		
Chloroform	4.10E+06	1.60E+05	1.60E+07
cis-1,2-Dichloroethene			
Ethylbenzene	5.70E+08		
Methylene chloride	2.50E+07	1.30E+05	1.30E+07
Tetrachloroethene	4.10E+06	1.90E+04	1.90E+06
Toluene	8.30E+07		
trans-1,2-Dichloroethene			
Trichloroethene		1.40E+06	1.40E+08
Vinyl acetate	5.70E+09		
Xylenes (total)	8.30E+08		

TABLE 5-2
CARCINOGENIC AND NON-CARCINOGENIC
BASELINE HEALTH RISK ASSESSMENT (BHRA) SCREENING CRITERIA FOR SURFACE WATER

Compound Name	Non-Caracinogenic	Carcinogenic 10-6	Carcinogenic 10-4
Inorganics (mg/L)			
Arsenic	8.10E+00		
Barium	2.50E+02		
Beryllium	1.50E+02		
Cadmium	2.10E+00		
Chromium	1.10E+01		
Manganese	3.50E+02		
Nickel	6.20E+01		
Silver	3.50E+02		
Vanadium	5.60E+02		
Zinc	1.30E+03		
Semivolatile Organics (ug/L)			
Benzoic acid	1.00E+05		
Chrysene		1.20E+03	1.20E+05
Fluoranthene	2.20E+04		
Pyrene	5.90E+06		
Volatile Organics (ug/L)			
1,1,1-Trichloroethane	1.10E+05		
Acetone	5.00E+05		
Benzene		2.00E+01	2.00E+03
Bromodichloromethane	8.40E+05	1.70E+03	1.70E+05
Bromoform	1.90E+06	3.30E+04	3.30E+06
Carbon disulfide	5.30E+03		
Chlorobenzene	1.30E+04		
Chloroform	2.00E+04	7.60E+02	7.60E+04
cis-1,2-Dichloroethene			
Dibromochloromethane	1.30E+06	2.00E+03	2.00E+05
Methylene chloride	1.70E+05	8.90E+02	8.90E+04
Tetrachloroethene	5.70E+04	3.10E+02	3.10E+04
Toluene	5.60E+03		
trans-1,2-Dichloroethene			
Trichloroethene		2.80E+02	2.80E+04
Xylenes (total)	1.10E+07		

CARCINOGENIC AND NON-CARCINOGENIC
HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SEDIMENT

Chemical	Reasonable Maximum Exposure (mg/kg)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [a] Action Level (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-6}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-5}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-4}) (mg/kg)
Inorganics							
Antimony	6.42E+00	3.69E-03		1.74E+03			
Beryllium	5.61E-01	2.58E-05	2.38E-07	2.18E+04	2.36E+00	2.36E+01	2.36E+02
Cadmium	1.23E+02	2.83E-02		4.35E+03			
Chromium	7.64E+02	8.94E-06		1.00E+06[c]			
Cobalt	8.22E+00	3.15E-05		2.61E+05			
Lead	1.62E+02						
Mercury	1.64E-01	1.26E-04		1.31E+03			
Nickel	2.09E+02	2.40E-03		8.71E+04			
Silver	4.95E+00	2.28E-04		2.18E+04			
Thallium	1.09E+00	3.13E-03		3.48E+02			
Vanadium	2.03E+01	6.66E-04		3.05E+04			
Pesticides and PCBs							
Aldrin	4.50E-02	4.53E-04	9.91E-08	9.93E+01	4.54E-01	4.54E+00	4.54E+01
alpha-BHC	2.00E-03		1.63E-09		1.23E+00	1.23E+01	1.23E+02
alpha-Chlordane	7.48E-02	3.77E-04	1.26E-08	1.99E+02	5.94E+00	5.94E+01	5.94E+02
Aroclor 1254	1.70E+00	2.57E-02		6.62E+01			
delta-BHC	1.27E-01						
Heptachlor	9.70E-01	5.86E-04	5.65E-07	1.65E+03	1.72E+00	1.72E+01	1.72E+02
Volatiles							
2-Butanone (MEK)	6.66E-03	3.36E-09		1.00E+06[c]			
Acetone	3.98E-02	1.20E-07		3.31E+05			
Acrylonitrile	4.50E-03	4.53E-05	9.91E-09	9.93E+01	4.54E-01	4.54E+00	4.54E+01
Benzene	5.60E-03		1.68E-12		3.33E+03	3.33E+04	3.33E+05
Carbon disulfide	9.47E-03	2.86E-08		3.31E+05			
Chlorobenzene	7.00E-03	1.06E-07		6.62E+04			
Ethylbenzene	1.30E-02	3.77E-09		1.00E+06[c]			
Methylene chloride	6.95E-03	3.50E-08	6.75E-12	1.99E+05	1.03E+03	1.03E+04	1.03E+05
Tetrachloroethene	5.45E-03	1.58E-08		3.45E+05			
Toluene	2.20E-03	3.32E-09		6.62E+05			
trans-1,2-Dichloroethene	1.50E-03	2.27E-08		6.62E+04			
Trichloroethene	1.07E-02	5.16E-08	1.22E-12	2.07E+05	8.79E+03	8.79E+04	8.79E+05
Vinyl chloride	5.66E-03		1.11E-10		5.09E+01	5.09E+02	5.09E+03
Xylenes (total)	3.25E-02	4.71E-10		1.00E+06[c]			
Semivolatiles							
1,2,4-Trichlorobenzene	4.30E-01	8.25E-07		5.21E+05			
1,2-Dichlorobenzene	5.07E-01	1.63E-07		1.00E+06[c]			
1,3-Dichlorobenzene	2.79E+00	9.08E-07		1.00E+06[c]			
1,4-Dichlorobenzene	2.10E-01		5.21E-11		4.03E+03	4.03E+04	4.03E+05

CARCINOGENIC AND NON-CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SEDIMENT

Chemical	Reasonable Maximum Exposure (mg/kg)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [a] Action Level (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-6}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-5}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-4}) (mg/kg)
1-Chloronaphthalene	1.30E+00	1.31E-05		9.93E+04			
2,4-Dimethylphenol	3.50E-01	5.07E-07		6.91E+05			
2-Chloronaphthalene	6.90E-02	2.61E-07		2.65E+05			
2-Methylnaphthalene	1.10E-01	1.11E-06		9.93E+04			
3/4-Methylphenol	1.60E-01	9.67E-07		1.65E+05			
Acenaphthene	2.41E-01	1.21E-06		1.99E+05			
Acenaphthylene	3.90E+00	3.77E-06		1.00E+06[c]			
Anthracene	7.50E-02	7.56E-08		9.93E+05			
Benzidine	1.19E+01	1.15E-04	2.83E-05	1.04E+05	4.20E-01	4.20E+00	4.20E+01
Benzo(a)anthracene	3.23E+00		3.05E-07		1.06E+01	1.06E+02	1.06E+03
Benzo(a)pyrene	1.52E+00		1.43E-06		1.06E+00	1.06E+01	1.06E+02
Benzo(b)fluoranthene	7.61E-01		7.19E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(g,h,i)perylene	6.00E-01	6.04E-06		9.93E+04			
Benzo(k)fluoranthene	5.51E-01		5.21E-09		1.06E+02	1.06E+03	1.06E+04
Benzoic acid	1.70E-01	1.23E-09		1.00E+06[c]			
bis(2-Ethylhexyl)phthalate	4.90E+00		8.89E-09		5.51E+02	5.51E+03	5.51E+04
Butyl benzyl phthalate	3.70E-01	5.36E-08		1.00E+06[c]			
Chrysene	3.70E+00		3.50E-09		1.06E+03	1.06E+04	1.06E+05
Di-n-butyl phthalate	3.40E-02	1.03E-07		3.31E+05			
Di-n-octyl phthalate	7.70E-02	1.16E-06		6.62E+04			
Dibenz(a,h)anthracene	1.70E-01		1.61E-07		1.06E+00	1.06E+01	1.06E+02
Dibenzofuran	2.13E-01	1.61E-05		1.32E+04			
Dimethyl phthalate	4.50E-02	1.36E-09		1.00E+06[c]			
Fluoranthene	5.30E+00	4.00E-05		1.32E+05			
Fluorene	1.71E+00	1.24E-06		1.00E+06[c]			
Indeno(1,2,3-cd)pyrene	5.38E-01		5.09E-08		1.06E+01	1.06E+02	1.06E+03
Naphthalene	4.50E-01	4.34E-07		1.00E+06[c]			
Phenanthrene	7.27E-01	7.32E-06		9.93E+04			
Phenol	6.30E-02	3.17E-08		1.00E+06[c]			
Pyrene	6.40E+00	6.45E-05		9.93E+04			

Note: a). Action level = (Risk Assessment Conc/HQ) x HI where HI = 1.0

b). Action level = (Risk Assessment Conc/Cancer risk) x Target cancer Risk

c). Calculated action level is greater than 100% concentration and 100% concentration is assigned as the cleanup goal

TABLE 5-4

CARCINOGENIC AND NON-CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SURFACE WATER

Chemical	Reasonable Maximum Exposure (mg/L)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [a] Action Level (mg/L)	Carcinogenic [b] Action (Risk = 1 x 10^{-6}) (mg/L)	Carcinogenic [b] Action (Risk = 1 x 10^{-5}) (mg/L)	Carcinogenic [b] Action (Risk = 1 x 10^{-4}) (mg/L)
Inorganics							
Arsenic	1.40E-03	1.65E-03	3.18E-07	8.50E-01	4.41E-03	4.41E-02	4.41E-01
Cadmium	2.64E-03	1.88E-03		1.40E+00			
Cobalt	5.23E-03	3.10E-05		1.68E+02			
Molybdenum	2.64E-01	1.22E-03		2.16E+02			
Nickel	2.99E-02	5.92E-04		5.06E+01			
Thallium	1.20E-03	5.29E-03		2.27E-01			
Vanadium	6.66E-03	3.46E-04		1.92E+01			
Pesticides and PCBs							
Aldrin	5.36E-05	7.82E-04	1.71E-07	6.85E-02	3.13E-04	3.13E-03	3.13E-02
Volatile Organics							
2-Butanone (MEK)	2.80E-03	3.65E-08		7.67E+04			
Acetone	5.30E-03	1.64E-05		3.23E+02			
Bromoform	2.46E-03	9.64E-07	5.44E-11	2.56E+03	4.53E+01	4.53E+02	4.53E+03
Carbon disulfide	1.00E-03	1.60E-08		6.25E+04			
Chlorobenzene	1.80E-03	7.05E-07		2.56E+03			
Chloroform	1.80E-03	1.41E-06	3.07E-11	1.28E+03	5.86E+01	5.86E+02	5.86E+03
Methylene chloride	1.25E-02	6.44E-05	1.24E-08	1.94E+02	1.00E+00	1.00E+01	1.00E+02
Tetrachloroethene	9.79E-03	7.66E-06		1.28E+03			
Toluene	1.70E-03	6.65E-08		2.56E+04			
Trichloroethene	1.00E-02	1.31E-05	3.09E-10	7.67E+02	3.25E+01	3.25E+02	3.25E+03
Vinyl chloride	1.00E-03		5.31E-09		1.88E-01	1.88E+00	1.88E+01
Semivolatile Organics							
3/4-Methylphenol	1.70E-03	9.66E-06		1.76E+02			
4-Nitrophenol	2.00E-03	3.34E-05		5.99E+01			
Benzoic acid	3.90E-03	7.63E-09		5.11E+05			
Benzyl alcohol	1.70E-03	4.44E-08		3.83E+04			
bis(2-Ethylhexyl)phthalate	3.60E-03	3.10E-04	3.72E-08	1.16E+01	9.67E-02	9.67E-01	9.67E+00
Fluoranthene	1.50E-03	2.94E-07		5.11E+03			
N-Nitroso-di-n-propylamine	1.80E-03		3.67E-07		4.91E-03	4.91E-02	4.91E-01
Phenol	1.40E-03	3.12E-07		4.49E+03			

Note: a). Action level = (Risk Assessment Conc/HQ) x HI where HI = 1.0

b). Action level = (Risk Assessment Conc/Cancer risk) x Target cancer Risk

TABLE 5-5
CARCINOGENIC AND NONCARCINOGENIC HUMAN HEALTH RISK ASSESSMENT II (HHRA II) SCREENING CRITERIA FOR SEDIMENT

Chemical	RME[a] (mg/kg)	Total HQ[b]	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcnogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
1,2,4-Trichlorobenzene	1.40E-01	4.05E-07		3.46E+05			
1,2-Dichlorobenzene	8.21E-01	9.48E-08		8.66E+06 [e]			
1,3-Dichlorobenzene	1.50E-01	1.75E-08		8.56E+06 [e]			
1,4-Dichlorobenzene	3.00E-01		7.45E-11		4.03E+03	4.03E+04	4.03E+05
1-Chloronaphthalene	2.70E-01	2.72E-06		9.94E+04			
1-Naphthylamine	5.60E-01		7.53E-07		7.44E-01	7.44E+00	7.44E+01
2-Butanone (MEK)	2.20E-03	1.11E-09		1.98E+06 [e]			
2-Chloronaphthalene	3.10E-01	1.12E-07		2.76E+06 [e]			
2-Methylnaphthalene	5.96E-01	5.76E-07		1.03E+06 [e]			
3/4-Methylphenol	4.00E-01	2.42E-06		1.66E+05			
4,4'-DDE	7.20E-02		1.02E-10		7.04E+02	7.04E+03	7.04E+04
4,6-Dinitro-2-methylphenol	4.42E+00						
Acenaphthene	1.79E+00	8.64E-07		2.07E+06 [e]			
Acetone	9.74E-03	2.95E-08		3.31E+05			
Aldrin	8.93E-03	8.99E-05	1.96E-08	9.93E+01	4.55E-01	4.55E+00	4.55E+01
alpha-Chlordane	3.00E-02	1.51E-04	5.05E-09	1.98E+02	5.94E+00	5.94E+01	5.94E+02
Anthracene	4.89E-01	4.72E-08		1.04E+07 [e]			
Antimony	4.10E+00	2.35E-03		1.74E+03			
Aroclor 1254	2.16E-01	3.26E-03		6.62E+01			
Barium	6.18E+02	1.03E-04		5.98E+06 [e]			
Benzidine	4.60E-02	4.64E-06	1.37E-06	9.91E+03	3.37E-02	3.37E-01	3.37E+00
Benzo(a)anthracene	2.62E-01		2.48E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(a)pyrene	2.10E-01		1.99E-07		1.06E+00	1.06E+01	1.06E+02
Benzo(b)fluoranthene	3.64E-01		3.45E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(g,h,i)perylene	1.10E-01	1.11E-06		9.92E+04			
Benzo(k)fluoranthene	2.05E-01		1.94E-09		1.06E+02	1.06E+03	1.06E+04
Benzoic acid	5.60E-02	4.23E-09		1.32E+07 [e]			
Benzyl alcohol	7.90E-02	7.96E-08		9.92E+05			
Beryllium	2.78E-01	1.27E-05	1.18E-07	2.18E+04	2.36E+00	2.36E+01	2.36E+02
bis(2-Ethylhexyl)phthalate	3.74E-01	5.66E-06	6.79E-10	6.61E+04	5.51E+02	5.51E+03	5.51E+04
Butyl benzyl phthalate	1.10E-01	1.66E-07		6.61E+05			
Cadmium	2.34E+01	5.38E-03		4.35E+03			

TABLE 5-5
CARCINOGENIC AND NONCARCINOGENIC HUMAN HEALTH RISK ASSESSMENT II (HHRA II) SCREENING CRITERIA FOR SEDIMENT

Chemical	RME[a] (mg/kg)	Total HQ[b]	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcnogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
Carbon disulfide	3.71E-03	1.12E-08		3.31E+05			
Chlorobenzene	1.70E-03	2.57E-08		6.63E+04			
Chromium	7.36E+02	8.61E-06		8.55E+07 [e]			
Chrysene	2.89E-01		2.73E-10		1.06E+03	1.06E+04	1.06E+05
Cobalt	6.61E+00	2.53E-05		2.61E+05			
delta-BHC	1.96E-01						
Di-n-butyl phthalate	5.10E-01	1.48E-07		3.45E+06 [e]			
Di-n-octyl phthalate	1.00E-01	1.51E-06		6.61E+04			
Dibenz(a,h)anthracene	4.93E-01		3.73E-08		1.32E+01	1.32E+02	1.32E+03
Dibenzofuran	3.10E-01	2.25E-06		1.38E+05			
Dieldrin	5.77E-02	3.49E-04	1.20E-07	1.65E+02	4.83E-01	4.83E+00	4.83E+01
Dimethyl phthalate	1.60E-01	4.84E-09		3.31E+07 [e]			
Fluoranthene	4.96E-01	3.75E-06		1.32E+05			
Fluorene	3.20E-01	2.31E-07		1.38E+06 [e]			
Heptachlor	9.93E-02	6.00E-05	5.78E-08	1.65E+03	1.72E+00	1.72E+01	1.72E+02
Indeno(1,2,3-cd)pyrene	1.20E-01		1.14E-08		1.06E+01	1.06E+02	1.06E+03
Lead	2.66E+02						
Mercury	1.13E-01	8.66E-05		1.31E+03			
Naphthalene	5.10E-01	4.92E-07		1.04E+06 [e]			
Nickel	3.57E+02	2.09E-04		1.71E+06 [e]			
Phenanthrene	7.80E-02	7.86E-07		9.92E+04			
Pyrene	3.90E-01	3.93E-06		9.92E+04			
Silver	6.40E+00	1.50E-05		4.28E+05			
Tetrachloroethene	9.43E-03	2.73E-08		3.45E+05			
Thallium	6.26E+01	9.16E-03		6.83E+03			
Toluene	4.25E-03	6.42E-09		6.63E+05			
Trichloroethene	6.06E-03	3.32E-08	7.84E-13	1.83E+05	7.73E+03	7.73E+04	7.73E+05
Vanadium	2.14E+01	7.03E-04		3.05E+04			
Xylenes (total)	2.60E-03	3.76E-11		6.91E+07 [e]			

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CARCINOGENIC AND NONCARCINOGENIC HUMAN HEALTH RISK ASSESSMENT II (HHRA II) SCREENING CRITERIA FOR SURFACE WATER

Chemical	RME (mg/L)	Total HQ	Total Cancer Risk	Noncarcinogenic [a] Clean-up Level (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-6}) (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-5}) (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-4}) (mg/L)
1,2-Dichlorobenzene	1.70E-03	1.78E-05		9.52E+01			
2,6-Dichlorophenol	2.80E-03	2.69E-03		1.04E+00			
2-Butanone (MEK)	5.03E-03	6.56E-08		7.66E+04			
3/4-Methylphenol	1.20E-03	2.28E-05		5.25E+01			
4,4'-DDT	5.87E-05	2.20E-03	1.61E-07	2.67E-02	3.66E-04	3.66E-03	3.66E-02
4-Nitrophenol	1.30E-03	1.65E-05		7.89E+01			
Acetone	7.36E-03	2.28E-05		3.23E+02			
Aniline	4.00E-03		3.39E-10		1.18E+01	1.18E+02	1.18E+03
Antimony	5.90E-04	5.20E-04		1.13E+00			
Benzidine	1.20E-03	1.11E-05	2.74E-06	1.08E+02	4.38E-04	4.38E-03	4.38E-02
Benzoic acid	1.20E-03	1.04E-07		1.16E+04			
Bromoform	2.59E-03	1.01E-06	5.72E-11	2.56E+03	4.53E+01	4.53E+02	4.53E+03
Butyl benzyl phthalate	3.20E-03	1.80E-05		1.78E+02			
Cadmium	7.03E-04	4.96E-04		1.42E+00			
Carbon disulfide	2.47E-03	1.94E-07		1.28E+04			
Cobalt	6.69E-04	3.94E-06		1.70E+02			
Di-n-butyl phthalate	1.40E-03	7.20E-06		1.94E+02			
Dimethyl phthalate	1.00E-03	3.23E-09		3.09E+05			
Fluoranthene	1.60E-03	2.21E-04		7.23E+00			
Nickel	8.70E-03	1.54E-04		5.66E+01			
Phenol	2.00E-03	1.82E-06		1.10E+03			
Silver	2.00E-04	1.41E-05		1.42E+01			
Tetrachloroethene	1.50E-03	1.17E-06		1.28E+03			
Toluene	2.85E-03	1.11E-07		2.56E+04			
Trichloroethene	7.98E-03	1.04E-05	2.45E-10	7.67E+02	3.26E+01	3.26E+02	3.26E+03
Vanadium	1.70E-02	8.57E-04		1.98E+01			

Note: a). Cleanup level = (Risk Assessment Conc/HQ) x HI where HI = 1.0

b). Cleanup level = (Risk Assessment Conc/Cancer risk) x Target Cancer Risk

TABLE 5-7
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
SECOND YEAR QUARTERLY MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Inorganics (mg/kg)				
Aluminum	140/140	7030.90	23400	547
Antimony	10/140	8.25	17.3	5.6
Arsenic	140/140	2.88	13.2	0.36
Barium	140/140	573.88	5560	71
Beryllium	113/140	0.57	1.6	0.13
Cadmium	109/140	29.98	390	0.56
Calcium	140/140	32272.47	231000	702
Chromium	140/140	298.36	5140	9.1
Cobalt	140/140	12.41	109	1.4
Copper	140/140	214.96	17000	2.9
Iron	140/140	11530.79	31800	1680
Lead	137/140	94.92	1210	5.7
Magnesium	140/140	4185.12	24100	552
Manganese	140/140	426.93	4140	63.5
Mercury	75/140	0.45	4.7	0.013
Molybdenum	77/140	14.06	136	1.7
Nickel	140/140	238.02	8790	6
Potassium	133/140	1051.96	4370	108
Selenium	48/140	1.60	17.7	0.2
Silver	81/140	14.75	245	0.42
Sodium	14/140	308.07	937	169
Thallium	19/140	20.36	62.6	0.12
Vanadium	140/140	24.99	121	3.8
Zinc	140/140	166.52	2570	11.3
PCBs and Pesticides (mg/kg)				
4,4'-DDD	1/140	0.26	0.26	0.26
4,4'-DDE	4/140	0.26	0.89	0.013
Aldrin	19/140	0.41	3.7	0.0012
alpha-Chlordane	15/140	2.48	16	0.0016
Aroclor 1254	76/140	5.82	86	0.028
Aroclor 1260	1/140	0.48	0.48	0.48
delta-BHC	1/140	3.20	3.2	3.2
Dieldrin	13/140	3.72	25	0.005
gamma-Chlordane	2/140	0.02	0.038	0.0027
Heptachlor	34/140	0.49	7	0.0028
Semivolatile Organics (mg/kg)				
1,2,4-Trichlorobenzene	3/140	0.09	0.14	0.051
1,2-Dichlorobenzene	6/140	1.77	3.6	0.044
1,3-Dichlorobenzene	5/140	0.54	1.8	0.071
1,4-Dichlorobenzene	9/140	1.01	4.1	0.13
1-Chloronaphthalene	10/140	0.72	2.6	0.26
1-Naphthylamine	1/140	0.56	0.56	0.56

TABLE 5-7
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
SECOND YEAR QUARTERLY MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
2,4-Dimethylphenol	1/140	0.18	0.18	0.18
2-Chloronaphthalene	9/140	0.47	2.1	0.071
2-Methylnaphthalene	15/140	1.26	10	0.042
2-Naphthylamine	1/140	0.14	0.14	0.14
3-Methylcholanthrene	2/140	1.15	1.3	1
3/4-Methylphenol	4/140	0.18	0.44	0.06
4,6-Dinitro-^2-methylphenol	1/140	17.00	17	17
4-Nitrophenol	2/140	0.40	0.57	0.23
Acenaphthene	40/140	1.48	17	0.071
Acenaphthylene	2/140	0.34	0.36	0.31
Anthracene	54/140	2.53	36	0.052
Benzidine	3/140	0.23	0.35	0.046
Benzo(a)anthracene	86/140	3.69	59	0.045
Benzo(a)pyrene	88/140	3.14	45	0.045
Benzo(b)fluoranthene	96/140	4.96	83	0.04
Benzo(g,h,i)perylene	78/140	1.94	20	0.041
Benzo(k)fluoranthene	18/140	2.26	23	0.053
Benzoic acid	3/140	0.06	0.069	0.05
Benzyl alcohol	1/140	0.08	0.079	0.079
bis(2-Ethylhexyl)phthalate	114/140	2.40	24	0.051
Butyl benzyl phthalate	5/140	0.11	0.23	0.06
Chrysene	92/140	3.75	57	0.058
Di-n-butyl phthalate	8/140	0.19	0.51	0.037
Di-n-octyl phthalate	16/140	1.08	8.9	0.056
Dibenz(a,h)anthracene	40/140	0.63	6	0.059
Dibenzofuran	29/140	1.12	11	0.048
Diethyl phthalate	1/140	0.12	0.12	0.12
Dimethyl phthalate	4/140	0.21	0.3	0.086
Fluoranthene	111/140	7.90	120	0.04
Fluorene	43/140	1.63	23	0.057
Indeno(1,2,3-cd)pyrene	76/140	1.77	20	0.042
N-Nitrosodiphenylamine	1/140	0.05	0.047	0.047
Naphthalene	30/140	1.54	15	0.06
Pentachlorophenol	2/140	0.29	0.49	0.096
Phenanthrene	87/140	7.29	110	0.046
Phenol	1/140	0.04	0.044	0.044
Pyrene	101/140	6.90	110	0.048
Volatile Organics (mg/kg)				
1,1,1-Trichloroethane	3/140	0.019	0.029	0.0026
1,1-Dichloroethane	2/140	0.002	0.0025	0.0017
2-Butanone (MEK)	27/140	0.038	0.25	0.0022
Acetone	113/140	0.037	0.74	0.0013
Acrylonitrile	1/140	0.001	0.0012	0.0012

TABLE 5-7
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
SECOND YEAR QUARTERLY MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Carbon disulfide	26/140	0.004	0.027	0.0014
Carbon tetrachloride	2/140	0.003	0.0036	0.0031
Chlorobenzene	29/140	1.020	25	0.0014
Chloromethane	1/140	0.003	0.0034	0.0034
Ethylbenzene	3/140	0.146	0.42	0.0013
Methylene chloride	89/140	0.004	0.025	0.0012
Tetrachloroethene	9/140	0.028	0.089	0.002
Toluene	29/140	0.063	0.76	0.0013
Trichloroethene	9/140	0.007	0.016	0.0024
Xylenes (total)	7/140	0.112	0.77	0.0015

TABLE 5-8
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR ANALYTES DETECTED IN SEDIMENT SAMPLES
SECOND YEAR QUARTERLY MONITORING

Analyte	Result	Client Description	Footnotes[1]	Detection Limit	% Water
Inorganics (mg/kg)					
Aluminum	23400	SC-QW01-SD-801		15.3	34.8
Antimony	17.3	SC-QW06-SD-801		14.6	18
Arsenic	13.2	SC-QE02-SD-801		1.7	42.7
Barium	5560	SC-QW07-SD-803		1.2	17.1
Beryllium	1.6	SC-QW01-SD-503		0.23	15
Cadmium	390	SC-QE07-SD-701		0.64	21.8
Calcium	231000	SC-QE05-SD-601		47.4	15.6
Chromium	5140	SC-QW03-SD-502		2	50
Cobalt	109	SC-QW04-SD-701		1.6	35.5
Copper	17000	SC-QW06-SD-801		4.9	18
Iron	31800	SC-QW03-SD-802		13.1	23.9
Lead	1210	SC-QE02-SD-801		8.7	42.7
Magnesium	24100	SC-QE11-SD-501		24.8	19
Manganese	4140	SC-QW04-SD-701		1.6	35.5
Mercury	4.7	SC-QE03-SD-601		1.7	61
Molybdenum	136	SC-QW03-SD-502		4	50
Nickel	8790	SC-QW03-SD-502		7.9	50
Potassium	4370	SC-QW01-SD-503		586	15
Selenium	17.7	SC-QW03-SD-502		9.9	50
Silver	245	SC-QW03-SD-502		2	50
Sodium	937	SC-QW01-SD-503		586	15
Thallium	62.6	SC-QE03-SD-701	J	249	19.8
Vanadium	121	SC-QW03-SD-601		2.2	54.2
Zinc	2570	SC-QW03-SD-502		4	50
PCBs and Pesticides (mg/kg)					
4,4'-DDD	0.26	SC-QE08-SD-501		0.12	45
4,4'-DDE	0.89	SC-TR01-SD-601	Ld	0.0094	64.8
Aldrin	3.7	SC-QE07-SD-501		2.1	17
alpha-Chlordane	16	SC-QE07-SD-501	M	2.1	17
Aroclor 1254	86	SC-QW03-SD-602	M	13	50.1
Aroclor 1260	0.48	SC-QE01-SD-801		0.21	38
delta-BHC	3.2	SC-QE07-SD-501		2.1	17
Dieldrin	25	SC-QE07-SD-501	M	4	17
gamma-Chlordane	0.038	SC-QE08-SD-502		0.026	35
Heptachlor	7	SC-QE07-SD-501		2.1	17
Semivolatile Organics (mg/kg)					
1,2,4-Trichlorobenzene	0.14	SC-QW04-SD-701	J	1	35.5
1,2-Dichlorobenzene	3.6	SC-QE02-SD-801		2.9	42.7
1,3-Dichlorobenzene	1.8	SC-QE08-SD-702	J	11	38.9
1,4-Dichlorobenzene	4.1	SC-QE08-SD-702	J	11	38.9
1-Chloronaphthalene	2.6	SC-QE07-SD-602	J	11	26.9
1-Naphthylamine	0.56	SC-QW04-SD-503	J	2.3	29
2,4-Dimethylphenol	0.18	SC-QW04-SD-701	J	1	35.5
2-Chloronaphthalene	2.1	SC-QE08-SD-702	J	11	38.9
2-Methylnaphthalene	10	SC-QE08-SD-702	J	11	38.9
2-Naphthylamine	0.14	SC-QE09-SD-803	J	0.4	16.7
3-Methylcholanthrene	1.3	SC-QE03-SD-601	J	8.5	61
3/4-Methylphenol	0.44	SC-QE11-SD-601		0.43	22.5
4,6-Dinitro-^2-methylphenol	17	SC-QW02-SD-501		3.1	48
4-Nitrophenol	0.57	SC-QE03-SD-802	J	21	22.9
Acenaphthene	17	SC-QE03-SD-601		8.5	61
Acenaphthylene	0.36	SC-QE02-SD-801	J	2.9	42.7
Anthracene	36	SC-QE03-SD-601		8.5	61
Benzidine	0.35	SC-QW03-SD-501	J	19	48
Benzo(a)anthracene	59	SC-QE03-SD-601		8.5	61
Benzo(a)pyrene	45	SC-QE03-SD-601		8.5	61

TABLE 5-8
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR ANALYTES DETECTED IN SEDIMENT SAMPLES
SECOND YEAR QUARTERLY MONITORING

Analyte	Result	Client Description	Footnotes[1]	Detection Limit	% Water
Benzo(b)fluoranthene	83	SC-QE03-SD-601		8.5	61
Benzo(g,h,i)perylene	20	SC-QE07-SD-501		16	17
Benzo(k)fluoranthene	23	SC-QE02-SD-702		8	17.7
Benzoic acid	0.069	SC-QW03-SD-602	J	3.2	50.1
Benzyl alcohol	0.079	SC-QW05-SD-601	J	0.41	20.1
bis(2-Ethylhexyl)phthalate	24	SC-QE07-SD-602		2.3	26.9
Butyl benzyl phthalate	0.23	SC-QE06-SD-501	J	0.85	22
Chrysene	57	SC-QE03-SD-601		8.5	61
Di-n-butyl phthalate	0.51	SC-QE01-SD-801	J	2.7	38
Di-n-butyl phthalate	0.51	SC-QW01-SD-801	J	0.51	34.8
Di-n-octyl phthalate	8.9	SC-QE07-SD-602		2.3	26.9
Dibenz(a,h)anthracene	6	SC-QE03-SD-601	J	8.5	61
Dibenzofuran	11	SC-QE03-SD-601		8.5	61
Diethyl phthalate	0.12	SC-QE05-SD-501	J	0.81	19
Dimethyl phthalate	0.3	SC-QW02-SD-501	J	0.63	48
Fluoranthene	120	SC-QE02-SD-702		8	17.7
Fluoranthene	120	SC-QE03-SD-601		8.5	61
Fluorene	23	SC-QE03-SD-601		8.5	61
Indeno(1,2,3-cd)pyrene	20	SC-QE03-SD-601		8.5	61
N-Nitrosodiphenylamine	0.047	SC-QE09-SD-701	J	0.38	13.8
Naphthalene	15	SC-QE03-SD-601		8.5	61
Pentachlorophenol	0.49	SC-QE03-SD-801	J	21	25.1
Phenanthrene	110	SC-QE02-SD-702		8	17.7
Phenanthrene	110	SC-QE03-SD-601		8.5	61
Phenol	0.044	SC-QE09-SD-803	J	0.4	16.7
Pyrene	110	SC-QE03-SD-601		8.5	61
Volatile Organics (mg/kg)					
1,1,1-Trichloroethane	0.029	SC-QE07-SD-502		0.0062	20
1,1-Dichloroethane	0.0025	SC-QE07-SD-502	J	0.0062	20
2-Butanone (MEK)	0.25	SC-QE08-SD-701		0.12	57.7
Acetone	0.74	SC-QE08-SD-701	B	0.12	57.7
Acrylonitrile	0.0012	SC-QW04-SD-803	J	0.12	18
Carbon disulfide	0.027	SC-QE09-SD-803		0.012	16.7
Carbon tetrachloride	0.0036	SC-QE07-SD-502	J	0.0062	20
Chlorobenzene	25	SC-QE08-SD-702		0.82	38.9
Chloromethane	0.0034	SC-QE06-SD-801	J	0.017	41.6
Ethylbenzene	0.42	SC-QE08-SD-702	J	0.82	38.9
Methylene chloride	0.025	SC-QE07-SD-701		0.0064	21.8
Tetrachloroethene	0.089	SC-QW03-SD-501		0.0097	48
Toluene	0.76	SC-QE08-SD-701		0.059	57.7
Trichloroethene	0.016	SC-QW03-SD-502		0.0099	50
Xylenes (total)	0.77	SC-QE08-SD-702	J	0.82	38.9

[1] B=Compound is also detected in blank
J=Result is detected below the reporting limit or is an estimated concentration
L=Components are not separable using this method and are quantified together
M=Primary result
d=the second column run provides the primary result

TABLE 5-9

EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1qtr1yr Nov 1994 Detections (ug/kg)	2qtr1yr Jan 1995 Detections (ug/kg)	3qtr1yr April 1995 Detections (ug/kg)	4qtr1yr July 1995 Detections (ug/kg)	1qtr2yr Oct 1995 Detections (ug/kg)	2qtr2yr Mar 1996 Detections (ug/kg)	3qtr2yr May 1996 Detections (ug/kg)	4qtr2yr Aug 1996 Detections (ug/kg)
QE01	0-0.5	Benzo(a)anthracene	1,600	2,900	1,600	2,000	ND	2,800	640	710	3,300
		Benzo(a)pyrene	1,600	2,200	1,100	2,200	ND	2,400	670	600	3,000
		Benzo(b)fluoranthene	1,600	6,100	2,600	4,000	ND	5,700	1,500	1,000	5,600
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	410	ND
		Chrysene	1,600	5,200	1,900	2,200	ND	2,300	980	860	4,100
QE02	0-0.5	Benzo(a)anthracene	1,600	1,100	750	11,000	6,800	530	2,600	8,600	16,000
		Benzo(a)pyrene	1,600	930	720	9,800	6,300	420	3,000	7,300	14,000
		Benzo(b)fluoranthene	1,600	2,100	1,600	ND	6,300	1,700	4,900	12,000	27,000
		Benzo(k)fluoranthene	1,600	ND	ND	15,000	5,500	ND	ND	ND	ND
		Chrysene	1,600	1,100	860	14,000	7,200	800	3,300	8,600	18,000
QE02	0.5-1.0	Benzo(a)anthracene	1,600	NS	NS	13,000	NS	NS	NS	46,000	NS
		Benzo(a)pyrene	1,600	NS	NS	11,000	NS	NS	NS	35,000	NS
		Benzo(b)fluoranthene	1,600	NS	NS	20,000	NS	NS	NS	43,000	NS
		Benzo(k)fluoranthene	1,600	NS	NS	ND	NS	NS	NS	23,000	NS
		Chrysene	1,600	NS	NS	15,000	NS	NS	NS	42,000	NS
QE03	0-0.5	Benzo(a)anthracene	1,600	130	1,500	7,100	770	15,000	59,000	3,500	13,000
		Benzo(a)pyrene	1,600	210	1,300	5,600	750	12,000	45,000	3,000	11,000
		Benzo(b)fluoranthene	1,600	430	ND	11,000	1,400	21,000	83,000	5,900	14,000
		Benzo(k)fluoranthene	1,600	ND	2,800	ND	ND	ND	ND	ND	7,400
		Chrysene	1,600	200	1,800	8,500	1,200	14,000	57,000	3,800	15,000
QE03	0.5-1.0	Benzo(a)anthracene	1,600	NS	NS	NS	3,200	NS	NS	6,800	6,300
		Benzo(a)pyrene	1,600	NS	NS	NS	2,800	NS	NS	5,600	6,200
		Benzo(b)fluoranthene	1,600	NS	NS	NS	3,400	NS	NS	11,000	9,300
		Benzo(k)fluoranthene	1,600	NS	NS	NS	2,600	NS	NS	ND	ND
		Chrysene	1,600	NS	NS	NS	3,900	NS	NS	6,600	7,200
QE04	0-0.5	Benzo(a)anthracene	1,600	42	NS	70	39,000	240	ND	ND	ND
		Benzo(a)pyrene	1,600	ND	NS	61	26,000	230	ND	ND	ND
		Benzo(b)fluoranthene	1,600	140	NS	150	ND	520	ND	ND	ND
		Benzo(k)fluoranthene	1,600	ND	NS	ND	39,000	ND	ND	ND	ND
		Chrysene	1,600	93	NS	130	35,000	300	ND	ND	ND
QE05	0-0.5	Benzo(a)anthracene	1,600	81	680	710	3,600	1,600	1,100	180	530
		Benzo(a)pyrene	1,600	84	690	640	3,200	1,300	910	170	590
		Benzo(b)fluoranthene	1,600	180	1,600	1,400	3,100	2,200	1,700	360	1,200
		Benzo(k)fluoranthene	1,600	ND	ND	ND	3,400	ND	ND	ND	ND
		Chrysene	1,600	130	870	980	4,400	1,800	1,200	240	810
QE06	0-0.5	Benzo(a)anthracene	1,600	1,100	130	8,100	8,200	1,700	2,200	2,200	3,900
		Benzo(a)pyrene	1,600	920	100	7,400	8,800	1,500	1,900	2,100	3,300
		Benzo(b)fluoranthene	1,600	2,000	300	10,000	9,800	2,800	3,700	4,200	6,900

TABLE 5-9

EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1qtr1yr Nov 1994 Detections (ug/kg)	2qtr1yr Jan 1995 Detections (ug/kg)	3qtr1yr April 1995 Detections (ug/kg)	4qtr1yr July 1995 Detections (ug/kg)	1qtr2yr Oct 1995 Detections (ug/kg)	2qtr2yr Mar 1996 Detections (ug/kg)	3qtr2yr May 1996 Detections (ug/kg)	4qtr2yr Aug 1996 Detections (ug/kg)
		Benzo(k)fluoranthene	1,600	ND	ND	4,700	9,300	ND	ND	ND	ND
		Chrysene	1,600	1,200	200	9,300	11,000	1,900	2,700	2,600	5,300
QE06	0.5-1.0	Benzo(a)anthracene	1,600	15,000	1,300	4,900	830	1,300	1,300	1,100	1,600
		Benzo(a)pyrene	1,600	14,000	1,200	6,000	1,200	1,100	1,500	1,000	1,500
		Benzo(b)fluoranthene	1,600	28,000	2,100	11,000	1,800	ND	2,600	2,000	3,300
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	2,100	ND	ND	ND
		Chrysene	1,600	19,000	1,300	6,600	1,300	1,400	1,800	1,300	2,200
QE07	0-0.5	Benzo(a)anthracene	1,600	1,100	2,000	2,300	720	26,000	2,100	1,000	880
		Benzo(a)pyrene	1,600	830	2,200	2,200	670	26,000	2,100	1,000	720
		Benzo(b)fluoranthene	1,600	1,600	3,900	3,800	1,300	49,000	4,000	2,000	1,400
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	ND
		Chrysene	1,600	1,200	2,000	2,200	1,000	33,000	2,700	1,400	1,000
QE07	0.5-1.0	Benzo(a)anthracene	1,600	1,600	3,000	4,000	NS	21,000	6,200	1,300	NS
		Benzo(a)pyrene	1,600	1,400	2,700	2,600	NS	19,000	4,700	1,400	NS
		Benzo(b)fluoranthene	1,600	2,600	4,900	4,500	NS	33,000	8,300	2,800	NS
		Benzo(k)fluoranthene	1,600	ND	ND	ND	NS	ND	ND	ND	NS
		Chrysene	1,600	1,800	3,300	3,300	NS	21,000	5,900	1,800	NS
QE08	0-0.5	Benzo(a)anthracene	1,600	2,200	2,100	11,000	1,900	3,100	4,600	11,000	1,000
		Benzo(a)pyrene	1,600	2,200	1,800	7,700	1,700	3,000	5,000	10,000	1,000
		Benzo(b)fluoranthene	1,600	4,400	4,000	19,000	3,300	6,500	9,600	20,000	2,000
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	ND
		Chrysene	1,600	2,800	2,600	15,000	2,700	4,300	5,700	12,000	1,500
QE08	0.5-1.0	Benzo(a)anthracene	1,600	1,300	270	ND	990	1,900	380	1,300	5,600
		Benzo(a)pyrene	1,600	1,700	240	ND	ND	1,800	370	1,100	4,100
		Benzo(b)fluoranthene	1,600	3,500	520	350	1,600	2,400	600	2,200	7,300
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	1	250	ND	ND
		Chrysene	1,600	2,100	350	280	1,600	2,800	500	1,800	6,500
QE10	0-0.5	Benzo(a)anthracene	1,600	ND	NS	ND	1,500	45	NS	ND	ND
		Benzo(a)pyrene	1,600	ND	NS	ND	1,300	47	NS	ND	ND
		Benzo(b)fluoranthene	1,600	ND	NS	ND	2,300	94	NS	ND	ND
		Benzo(k)fluoranthene	1,600	ND	NS	ND	ND	ND	NS	ND	ND
		Chrysene	1,600	ND	NS	ND	2,100	86	NS	ND	ND
QW02	0-0.5	Benzo(a)anthracene	1,600	560	600	360	1,900	2,200	72	870	740
		Benzo(a)pyrene	1,600	660	700	430	1,400	1,900	91	960	1,000
		Benzo(b)fluoranthene	1,600	760	1,400	810	2,700	ND	180	1,900	1,400
		Benzo(k)fluoranthene	1,600	690	ND	ND	ND	ND	ND	ND	910
		Chrysene	1,600	850	730	520	2,200	2,700	96	1,000	1,200
QW02	0.5-1.0	Benzo(a)anthracene	1,600	120	250	360	2,400	ND	ND	97	NS

TABLE 5-9
EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA
TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1qtr1yr Nov 1994 Detections (ug/kg)	2qtr1yr Jan 1995 Detections (ug/kg)	3qtr1yr April 1995 Detections (ug/kg)	4qtr1yr July 1995 Detections (ug/kg)	1qtr2yr Oct 1995 Detections (ug/kg)	2qtr2yr Mar 1996 Detections (ug/kg)	3qtr2yr May 1996 Detections (ug/kg)	4qtr2yr Aug 1996 Detections (ug/kg)
		Benzo(a)pyrene	1,600	130	300	440	3,100	46	ND	96	NS
		Benzo(b)fluoranthene	1,600	130	580	790	4,600	ND	77	180	NS
		Benzo(k)fluoranthene	1,600	130	ND	ND	2,200	ND	ND	ND	NS
		Chrysene	1,600	160	330	440	3,900	ND	ND	110	NS
QW03	0-0.5	Benzo(a)anthracene	1,600	110	980	ND	440	1,600	610	530	480
		Benzo(a)pyrene	1,600	ND	1,600	1,100	470	2,100	880	660	780
		Benzo(b)fluoranthene	1,600	160	3,000	2,000	860	3,700	1,900	1,300	820
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	850
		Chrysene	1,600	190	1,700	1,100	510	2,500	910	740	720
QW03	0.5-1.0	Benzo(a)anthracene	1,600	NS	44	43	360	ND	700	230	230
		Benzo(a)pyrene	1,600	NS	66	ND	340	ND	930	310	370
		Benzo(b)fluoranthene	1,600	NS	ND	ND	65	180	1,700	650	440
		Benzo(k)fluoranthene	1,600	NS	110	81	ND	ND	ND	ND	320
		Chrysene	1,600	NS	67	42	400	ND	1,100	340	340
QW04	0-0.5	Benzo(a)anthracene	1,600	2,700	730	1,000	260	520	130	3,400	1,900
		Benzo(a)pyrene	1,600	2,600	1,100	1,300	300	480	200	3,600	2,200
		Benzo(b)fluoranthene	1,600	2,600	2,100	ND	650	790	350	7,000	2,600
		Benzo(k)fluoranthene	1,600	2,400	ND	2,400	ND	ND	ND	ND	2,100
		Chrysene	1,600	3,000	1,200	1,200	390	630	190	4,100	2,700
QW04	05.-1.0	Benzo(a)anthracene	1,600	1,100	2,500	1,200	2,400	350	120	1,100	89
		Benzo(a)pyrene	1,600	1,500	3,100	1,300	3,200	380	210	1,000	98
		Benzo(b)fluoranthene	1,600	2,200	6,000	2,200	6,600	ND	390	1,800	120
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	800	ND	ND	93
		Chrysene	1,600	1,500	3,100	1,100	5,000	450	190	1,200	120
QW05	0-0.5	Benzo(a)anthracene	1,600	360	ND	3,500	ND	ND	ND	ND	ND
		Benzo(a)pyrene	1,600	430	ND	2,100	ND	ND	ND	ND	ND
		Benzo(b)fluoranthene	1,600	920	48	ND	65	40	50	67	ND
		Benzo(k)fluoranthene	1,600	ND	ND	5,300	ND	ND	ND	ND	ND
		Chrysene	1,600	1,100	ND	3,700	51	ND	ND	ND	ND

Notes:

NS - No sample obtained during the quarter

ND - Non-detect

Shading indicates exceedance of the BHRA 10-6 screening criteria:

TABLE 5-10
EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-5} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-5} Screening Criteria (ug/kg)	1st Quarter Nov 1994 Detections (ug/kg)	2nd Quarter Jan 1995 Detections (ug/kg)	3rd Quarter April 1995 Detections (ug/kg)	4th Quarter July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)
QE02	0.5-1.0	Benzo(a)pyrene	10,575	NS	NS	11000	NS	NS	NS	35000	NS
QE03	0-0.5	Benzo(a)pyrene	10,575	NS	NS	11000	NS	12000	45000	3000	11000
QE04	0-0.5	Benzo(a)pyrene	10,575	ND	NS	61	26000	230	ND	ND	ND
QE06	0.5-1.0	Benzo(a)pyrene	10,575	14000	1200	6000	1200	1100	1500	1000	1500
QE07	0-0.5	Heptachlor	17,156	120	1200	ND	52000	7000	630	320	ND
		Benzo(a)-pyrene	10,575	830	2200	2200	670	26000	2100	1000	720
QE07	0.5-1.0	Benzo(a)-pyrene	10,575	1400	2700	2600	NS	19000	4700	1400	NS

Notes:

NS - No sample obtained during the quarter

ND - Non-detect

Shading indicates exceedance of the HHRA 10-5 screening criteria:

TABLE 5-11

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)
QE01	0-0.5	Benzo(a)pyrene	1,057	2200	1100	2200	ND	2,400	670	600	3,000
QE02	0-0.5	Benzo(a)anthracene	10,575	1100	750	11000	6800	530	2,600	8,600	16,000
		Benzo(a)pyrene	1,057	930	720	9800	6300	420	3,000	7,300	14,000
		Benzo(b)fluoranthene	10,575	2100	1600	ND	6300	1,700	4,900	12,000	27,000
		Dibenz(a,h)anthracene	10,575	ND	ND	1500	1600	ND	420	970	ND
		Aldrin	454	ND	ND	ND	1600	810	ND	ND	ND
QE02	0.5-1.0	Benzo(a)anthracene	10,575	NS	NS	13000	NS	NS	NS	46,000	NS
		Benzo(a)pyrene	1,057	NS	NS	11000	NS	NS	NS	35,000	NS
		Benzo(b)fluoranthene	10,575	NS	NS	20000	NS	NS	NS	43,000	NS
		Dibenz(a,h)anthracene	10,575	NS	NS	1300	NS	NS	NS	4,100	NS
		Indeno(1,2,3-cd)pyrene	10,575	NS	NS	5600	NS	NS	NS	15,000	NS
QE03	0-0.5	Benzo(a)anthracene	10,575	130	1500	7100	770	15,000	59,000	3,500	13,000
		Benzo(a)pyrene	1,057	210	1300	5600	750	12,000	45,000	3,000	11,000
		Benzo(b)fluoranthene	10,575	430	ND	11000	1400	21,000	83,000	5,900	14,000
		Dibenz(a,h)anthracene	10,575	ND	ND	690	ND	1,300	6,000	460	ND
		Indeno(1,2,3-cd)pyrene	10,575	ND	ND	2600	470	5,100	20,000	1,700	6,100
QE03	0.5-1.0	Benzo(a)pyrene	1,057	NS	NS	NS	2800	NS	NS	5,600	6,200
		Benzo(b)fluoranthene	10,575	NS	NS	NS	3400	NS	NS	11,000	9,300
QE04	0-0.5	Benzo(a)pyrene	1,057	ND	NS	61	26000	230	ND	ND	ND
		Benzo(a)anthracene	10,575	42	NS	70	39000	240	ND	ND	ND
		Dibenz(a,h)anthracene	10,575	ND	NS	ND	10000	ND	ND	ND	ND
		Indeno(1,2,3-cd)pyrene	10,575	ND	NS	ND	19000	89	ND	ND	ND
QE05	0-0.5	Benzo(a)pyrene	1,057	84	690	640	3200	1,300	910	170	590
QE06	0-0.5	Benzo(a)pyrene	1,057	920	100	7400	8800	1,500	1,900	2,100	3,300
		Dibenz(a,h)anthracene	10,575	ND	ND	1100	2200	170	350	290	ND
QE06	0.5-1.0	Benzo(a)anthracene	10,575	15000	1300	4900	830	1,300	1,300	1,100	1,600
		Benzo(a)pyrene	1,057	14000	1200	6000	1200	1,100	1,500	1,000	1,500
		Benzo(b)fluoranthene	10,575	28000	2100	11000	1800	ND	2,600	2,000	3,300
QE06	> 1	Benzo(a)pyrene	1,057	3100	850	NS	920	NS	1,800	560	830
QE07	0-0.5	Aldrin	454	57	ND	840	ND	3,700	ND	ND	ND
		alpha-Chlordane	5,939	ND	ND	ND	ND	16,000	480	ND	ND
		Benzo(a)anthracene	10,575	1100	2000	2300	720	26,000	2,100	1,000	880
		Benzo(a)pyrene	1,057	830	2200	2200	670	26,000	2,100	1,000	720

TABLE 5-11

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)
		Benzo(b)fluoranthene	10,575	1600	3900	3800	1300	49,000	4,000	2,000	1,400
		Heptachlor	1,715	120	1200	ND	52000	7,000	600	310	ND
		Indeno(1,2,3-cd)pyrene	10,575	440	1000	1200	420	14,000	1,100	510	250
QE07	0.5-1.0	Aldrin	454	ND	ND	650	NS	2,500	ND	ND	NS
		alpha-Chlordane	5,939	ND	ND	ND	NS	15,000	250	98	NS
		Benzo(a)anthracene	10,575	1600	3000	4000	NS	21,000	6,200	1,300	NS
		Benzo(a)pyrene	1,057	1400	2700	2600	NS	19,000	4,700	1,400	NS
		Benzo(b)fluoranthene	10,575	2600	4900	4500	NS	33,000	8,300	2,800	NS
		Dibenz(a,h)anthracene	10,575	160	ND	140	NS	2,100	570	190	NS
		Heptachlor	1,715	820	1400	ND	NS	4,600	390	140	NS
QE07	> 1	Benzo(a)pyrene	1,057	2600	NS	270	NS	1,200	NS	ND	NS
QE08	0-0.5	Benzo(a)anthracene	10,575	2200	2100	11000	1900	3,100	4,600	11,000	1,000
		Benzo(a)pyrene	1,057	2200	1800	7700	1700	3,000	5,000	10,000	1,000
		Benzo(b)fluoranthene	10,575	4400	4000	19000	3300	6,500	9,600	20,000	2,000
		Dibenz(a,h)anthracene	10,575	54	ND	1600	ND	ND	770	1,100	ND
QE08	0.5-1.0	Benzo(a)pyrene	1,057	1700	240	ND	ND	1,800	370	1,100	4,100
QE09	> 1	Heptachlor	1,715	ND	36	ND	3100	8	21	ND	ND
QE10	0-0.5	Benzo(a)pyrene	1,057	ND	NS	ND	1300	47	NS	ND	ND
QW02	0-0.5	Benzo(a)pyrene	1,057	660	700	430	1400	1,900	91	960	1,000
QW02	0.5-1.0	Benzo(a)pyrene	1,057	130	300	440	3100	46	ND	96	NS
QW03	0-0.5	Benzo(a)pyrene	1,057	ND	1600	1100	470	2,100	880	660	780
QW03	0.5-1.0	Benzidine	420	NS	430	ND	ND	ND	ND	ND	ND
QW04	0-0.5	Benzo(a)pyrene	1,057	2600	1100	1300	300	480	200	3,600	2,200
QW04	0.5-1.0	Benzo(a)pyrene	1,057	1500	3100	1300	3200	380	210	1,000	98
QW04	> 1	Benzo(a)pyrene	1,057	580	NS	3100	3200	1,900	370	330	53
QW05	0-0.5	Benzo(a)pyrene	1,057	430	ND	2100	ND	ND	ND	ND	ND

Notes:

NS - No sample obtained during the quarter

ND - Non-detect

Shading indicates exceedance of the HHRA 10-6 screening criteria:

TABLE 5-12
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Metals (mg/kg)																		
Aluminum	42300		14100	16400	23400	20000	21000	16400	13400	12900	21000	21200	17000	9490	16700	15400	23400	13500
Antimony					9.8	6.2	7.9	9.5	8.6		15.8	5.6			7.9		17.3	
Arsenic	15.7		7.5	7.5	7.2	5.3	8.4	7.2	9	5.7	5.2	8.7	10.5	3.2	6.4	6.1	13.2	7.3
Barium	2910		3850	1010	2380	1350	1860	12000	1690	1050	3350	807	2440	620	1330	1270	1840	2010
Beryllium			1.1	1.3	1.2	1.2	1.5	1.2	0.85	0.82	1.2	1.4	1.2	0.72	1	0.78	1.5	0.97
Boron																		
Cadmium	428	15.7	123	328	83.2	132	106	183	415	108	87.3	306	85.1	120	390	158	242	29.8
Calcium	72500		181000	132000	128000	36000	142000	81200	210000	174000	214000	107000	231000	54700	140000	94300	79200	76800
Chromium	2020	186	820	13350	1230	2430	1890	828	2040	3210	912	5140	2920	977	2230	1460	1870	1850
Cobalt	52.1		42.1	35.7	123	91.8	61.7	56.7	21.6	126	108	105	51.8	80.4	109	20.1	90.1	15.1
Copper	600		541	168	650	125	583	246	2210	175	654	1220	551	181	467	217	17000	292
Iron	41200		19000	26600	249000	19800	21100	21800	24900	22200	24900	27900	26700	15500	20200	17800	27500	31800
Lead	586	152	318	184	225	469	268	286	4400	746	498	616	291	187	1050	170	1210	224
Magnesium	20400		22800	15200	16700	12000	13600	10300	306000	17000	24100	13100	12400	9590	17300	15000	6120	9150
Manganese	1490		890	965	836	1750	778	2030	1930	4250	1730	1130	857	653	4140	853	1840	2940
Mercury	2.6		0.55	0.3	.9	.3	.59	.81	0.63	0.58	1.5	1.1	4.7	0.5	0.9	0.67	3.8	0.67
Molybdenum			23.8	26	62.6	34.8	36.9	56.4	25.5	17.9	39.4	136	135	28	32.6	21	62.1	27.7
Nickel	2270		704	1090	3160	1370	2830	1220	747	861	3690	8790	3600	1790	778	431	1420	801
Potassium	2300		2030	2910	4230	4880	3200	2850	1930	1590	2830	2820	2780	1380	2530	2450	3010	2400
Selenium	10.2		3.4	4.2	12	2	4.3	.79	1	0.85	7.2	17.7	6.2	1.3	0.93	0.54	7.2	5.5
Silver	112		64.6	79.4	205	72.2	91.9	6.9	18.7	15.9	112	245	131	80	102	19.1	42.7	2.3
Sodium			1890	819					191	165	400	392			270	296		
Thallium			0.38	0.19			.2		0.14	0.18	0.33	0.26			62.6	51.4	61.6	52.5
Tin																		
Vanadium	52.9		48.7	58.7	95.7	42.1	67.9	38.4	48.3	47	75.4	112	121	48.7	46.3	31.7	57	56.8
Zinc	640		668	372	1790	506	1280	311	890	542	1920	2570	1670	557	442	209	759	227
PCB's and Chlorinated Pesticides (ug/kg)																		
4,4'-DDD											260		890		72	63		
4,4'-DDE																		
4,4'-DDT																		
Aldrin			57	120		1.4	840	650			3700	2500						
alpha-BHC							2											
alpha-Chlordane				910							16000	15000	480	250	120	98		
Aroclor 1016																		
Aroclor 1221																		
Aroclor 1232																		
Aroclor 1242																		
Aroclor 1248																		
Aroclor 1254			8300	5200	24000	33000	40000	18000	25000	17000	39000	19000	15000	86000	20000	51000	61000	8200
Aroclor 1260																	480	
beta-BHC																		
delta-BHC			140	370							3200							
Dieldrin											25000	18000	890		890	280		
Endosulfan I																		
Endosulfan II																		
Endosulfan sulfate							41											
Endrin			2															
gamma-BHC (Lindane)																		
gamma-Chlordane												38						
Heptachlor			180	820	1200	1400		110	52000	49	7000	4600	600	390	310	190		
Heptachlor epoxide						210												
Methoxychlor			19															
Toxaphene																		

TABLE 5-12
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Volatile Organics (ug/kg)																		
1,1,1,2-Tetrachloroethane			2.6															
1,1,1-Trichloroethane												29			2.6			
1,1,2,2-Tetrachloroethane																		
1,1,2-Trichloroethane												2.5			1.7			
1,1-Dichloroethane																		
1,1-Dichloroethene																		
1,2,3-Trichloropropane			1.7															
1,2-Dichloroethane							2.1	6.8										
1,2-Dichloropropane																		
2-Butanone (MEK)			6.9	12	21	26	2900	51	80	15	62	99	25	7.9	250	19	56	71
2-Chlorethyl vinyl ether																		
2-Hexanone					14													
4-Methyl-2-pentanone (MIBK)					5													
Acetone	1700	51	100	62	100	130	950	240	490	82	120	54	200	70	740	62	190	79
Acrolein										10								
Acrylonitrile			4.5															
Benzene		1		2.2		1.5	1.7	5.6										
Bromodichloromethane																		
Bromoform																		
Bromomethane																		
Carbon disulfide	36	2	11	15	5.6	2.9	1.5	11	8.7	9.6	4.1	7.6	4.4		3.2	2.7	5.6	6.4
Carbon tetrachloride												3.6						
Chlorobenzene	78000	10	41	940	310	3900	18000	64	120	64	180	3.9	240	2500	95	25000	3	13
Chloroethane	86																	
Chloroform	9200	2				2.5												
Chloromethane			1.8			3.3											3.4	
cis-1,3-Dichloropropene																		
Dibromochloromethane																		
Dibromomethane																		
Dichlorodifluoromethane																		
Ethanol																		
Ethyl methacrylate																		
Ethylbenzene	4		3.3	2.3				2.5							18	420		1.3
Iodomethane																		
Methylene chloride	140000	51	24	14	5.4	390	600	15	7.1	7.2	5	6.8	21	4.3	25	24	8.2	3.2
Styrene																		
Tetrachloroethene	83000	11	7.9	16	5.5		17	5.8	3.6		89	87	11	7.3	2.1	12		33
Toluene	980	6	12	3.6		2.9	2.1	150	3	2.7	15	8.5	63	150	760	3.1	15	1.4
trans-1,2-Dichloroethene							1.5											
trans-1,3-Dichloropropene																		
trans-1,4-Dichloro-2-butene																		
Trichlorethene	4100		16	77	4.1	1.7	1.9	1.9			13	16	3.8	2.4		3.7		
Trichlorofluoromethane																		
Vinyl acetate	.9																	
Vinyl chloride						15												
Xylenes (total)	1000	6		3.4	2.3			1.7			2.2	2.4	2.6			770		

TABLE 5-12
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Semivolatile Organics (ug/kg)																		
1,2,4,5-Tetrachloro-benzene															140	51		
1,2,4-Trichlorobenzene	3100		340	200	250	570	850	2200	310		44		3000		1600	670	3600	
1,2-Dichlorobenzene	280							100							150	1800	520	
1,3-Dichlorobenzene	4400		60			210		280		46			2400		250	4100	1200	
1,4-Dichlorobenzene			250	5200	610	2400		3500	1300	960	390	420	1500	2600	260	470	350	
1-Chloronaphthalene																		
1-Naphthylamine																		
2,3,4,6-Tetrachlorophenol																		
2,4,5-Trichlorophenol																		
2,4,6-Trichlorophenol	160																	
2,4-Dichlorophenol			84		50					350					180			
2,4-Dimethylphenol																		
2,4-Dinitrophenol																		
2,4-Dinitrotoluene																		
2,6-Dichlorophenol																		
2,6-Dinitrotoluene	1600			700		210		350	1400	1000	310	600		310		2100	280	
2-Chloronaphthalene																		
2-Chlorophenol	1900		110	150		100	410	1000	1200	100	460		4000		460	10000	610	
2-Methylnaphthalene	68																	
2-Methylphenol																		
2-Naphthylamine																		
2-Nitrophenol																		
2-Picoline	1700																	
3,3'-Dichlorobenzidine													1300			1000		
3-Methylcholanthrene																		
3-Nitroaniline			88			58	140		160	220			440	60				
3/4-Methylphenol											17000							
4,6-Dinitro-2-methylphenol																		
4-Aminobiphenyl																		
4-Bromophenyl phenyl ether																		
4-Chloro-3-methylphenol																		
4-Chloroaniline																		
4-Chlorophenyl phenyl ether																		
4-Nitroaniline																	230	570
4-Nitrophenol																		
7,12-Dimethylbenz(a)-anthracene																		
a,a-Dimethylphenethyl-amine																		
Acenaphthene	1100		410	3100	260	490	1600	1800	8000	510	4200	2000	17000	500	1900	15000	3100	710
Acenaphthylene									44								360	
Acetophenone																		
Aniline																		
Anthracene	1500		830	4800	620	1400	5800	4400	26000	840	11000	11000	36000	2400	3600	29000	5000	2600
Azobenzene																		
Benzidine				160			430				350						290	
Benzo(a)anthracene	4800		2900	15000	2100	3000	11000	13000	39000	3200	26000	21000	59000	6200	11000	46000	16000	6300
Benzo(a)pyrene	4400		2600	14000	2200	3100	9800	11000	26000	3200	26000	19000	45000	4700	10000	35000	14000	6200
Benzo(b)fluoranthene	9200		6100	28000	4000	6000	19000	20000	9800	6600	49000	33000	83000	8300	20000	43000	27000	9300
Benzo(g,h,i)perylene	4100		1800	1200	1300	1700	7600	6800	17000	1900	20000	11000	19000	2000	5400	16000	10000	3600
Benzo(k)fluoranthene	5300		2400	670	2800	110	15000	81	39000	2600	210	2100		250	410	23000	7400	320
Benzoic acid			170				70						56	69	50			
Benzyl alcohol													79					
bis(2-Chloroethoxy)methane																		
bis(2-Chloroethyl)ether																		
bis(2-Chloroisopropyl)ether																		

TABLE 5-12
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
bis(2-Ethylhexyl)phthalate	46000		7000	7800	8000	11000	7800	23000			7800	5500	11000	24000	6500	22000	4500	8900
Butyl benzyl phthalate	720		6000				4900		560		230						71	
Chrysene	7100		5200	19000	2600	3300	15000	15000	35000	5000	33000	21000	57000	5900	12000	42000	18000	7200
Di-n-butyl phthalate	2200		150	150	130	150				4600	59				54		510	
Di-n-octyl phthalate	540		410	400		520	180	11000	700		500	56	1400	8900		210	84	630
Dibenz(a,h,)anthracene	110		750	420	150		1600	1300			1300	2100	6000	570	1100	4100	770	840
Dibenz(a,j)acridine									1400	89								
Dibenzofuran	480		250	1500	160	340	1000	1000	5500	310	2500	1600	11000	360	1200	8000	1600	
Diethyl phthalate											120					160		
Dimethyl phthalate					57				660	530	300		86	280				
Diphenylamine																		
Ethyl methanesulfonate																		
Fluoranthene	11000		6400	3800	6300	8100	25000	23000	53000	8000	100000	85000	120000	14000	35000	120000	30000	14000
Fluorene	880		410	2600	300	560	2400	2200	12000	530	5900	3600	23000	820	1700	16000	2700	620
Hexachlorobenzene																		
Hexachlorobutadiene																		
Hexachlorocyclopentadiene																		
Hexachloroethane																		
Indeno(1,2,3-cd)pyrene	3800		1700	4600	1100	1600	6100	5600	19000	1700	14000	8200	20000	1900	4700	15000	8900	3400
Isophorone							98			57								
Methyl methanesulfonate																		
N-Nitroso-di-n-butylamine																		
N-Nitroso-di-n-propylamine															47			
N-Nitrosodiphenylamine						150	50											
N-Nitrosopiperidine																		
Naphthalene	690		1000	860	1100	3700	980	1600	5900	800	2500	1100	15000	690	2200	4100	2700	520
Nitrobenzene																		
p-Dimethylaminoazobenzene																		
Pentachlorobenzene																		
Pentachloronitrobenzene																	490	
Pentachlorophenol					55													
Phenacetin																		
Phenanthrene	6700		3800	3700	3300	6200	22000	14000	58000	5200	73000	58000	110000	7100	18000	110000	28000	9100
Phenol					63													
Pronamide																		
Pyrene	10000		7800	55000	4500	6400	26000	33000	51000	7100	80000	58000	110000	14000	27000	88000	28000	11000

TABLE 5-13
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SURFACE WATER SAMPLES
SECOND YEAR QUARTERLY MONITORING

Corrected Analyte Name	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Inorganics, Dissolved (mg/L)				
Aluminum	36/48	0.0142	0.035	0.0021
Antimony	35/48	0.0003	0.00061	0.00012
Barium	48/48	0.3331	0.64	0.083
Cadmium	35/48	0.0006	0.0037	0.00011
Calcium	48/48	51.9875	101	15.8
Chromium	46/48	0.0135	0.042	0.0015
Cobalt	35/48	0.0004	0.0016	0.00011
Copper	46/48	0.0313	0.27	0.0012
Iron	32/48	0.0632	0.27	0.022
Lead	18/48	0.0012	0.011	0.00031
Magnesium	48/48	21.2833	48.8	1.7
Manganese	48/48	0.0334	0.23	0.0013
Molybdenum	46/48	0.0710	0.44	0.00028
Nickel	48/48	0.0080	0.04	0.0016
Potassium	46/48	3.0409	10	0.98
Selenium	21/48	0.0094	0.024	0.0022
Silver	1/48	0.0002	0.00019	0.00019
Sodium	46/48	31.4804	207	2.5
Vanadium	48/48	0.0125	0.027	0.00059
Zinc	42/48	0.0187	0.079	0.0024
Inorganics, Total (mg/L)				
Aluminum	52/61	0.0607	0.38	0.011
Antimony	36/61	0.0016	0.046	0.00012
Arsenic	2961	0.0019	0.0033	0.001
Barium	61/61	0.3512	0.65	0.075
Beryllium	4/61	0.0003	0.00068	0.000087
Cadmium	44/61	0.0008	0.0053	0.00011
Calcium	61/61	54.8180	103	16.6
Chromium	41/61	0.0083	0.02	0.00089
Cobalt	37/61	0.0005	0.0017	0.00011
Copper	59/61	0.0483	0.36	0.00083
Iron	47/61	0.2687	1.7	0.027
Lead	38/61	0.0023	0.016	0.0001
Magnesium	61/61	23.1213	49.8	1.8
Manganese	60/61	0.0355	0.23	0.0022
Molybdenum	55/61	0.0991	0.56	0.00049
Nickel	50/61	0.0079	0.049	0.00074
Potassium	60/61	3.0045	9.6	0.83
Selenium	31/61	0.0054	0.021	0.00057
Sodium	59/61	34.2322	200	2.1
Vanadium	61/61	0.0118	0.026	0.00039
Zinc	60/61	0.0252	0.1	0.0042

TABLE 5-13
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SURFACE WATER SAMPLES
SECOND YEAR QUARTERLY MONITORING

Corrected Analyte Name	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Pesticides and PCBs (ug/L)				
4,4'-DDT	1/61	0.0750	0.075	0.075
Semivolatile Organics (mg/L)				
1,2-Dichlorobenzene	2/61	0.0014	0.0017	0.001
2,4,6-Trichlorophenol	1/61	0.0010	0.00096	0.00096
2,6-Dichlorophenol	2/61	0.0024	0.0028	0.002
2-Chlorophenol	1/61	0.0014	0.0014	0.0014
3/4-Methylphenol	1/61	0.0012	0.0012	0.0012
4-Nitrophenol	2/61	0.0012	0.0013	0.001
Aniline	2/61	0.0029	0.004	0.0018
Benzidine	2/61	0.0012	0.0012	0.0011
Benzoic acid	8/61	0.0013	0.0016	0.001
Butyl benzyl phthalate	4/61	0.0023	0.0032	0.0014
Di-n-butyl phthalate	2/61	0.0013	0.0014	0.0011
Dibenzofuran	1/61	0.0011	0.0011	0.0011
Diethyl phthalate	1/61	0.0011	0.0011	0.0011
Dimethyl phthalate	2/61	0.0012	0.0013	0.001
Fluoranthene	3/61	0.0014	0.0016	0.0011
Naphthalene	1/61	0.0014	0.0014	0.0014
Phenol	4/61	0.0017	0.002	0.0014
bis(2-Ethylhexyl)phthalate	1/61	0.0013	0.0013	0.0013
Volatile Organics (mg/L)				
2-Butanone (MEK)	9/61	0.0033	0.0054	0.0014
2-Hexanone	1/61	0.0054	0.0054	0.0054
Acetone	33/61	0.0083	0.026	0.0027
Bromoform	7/61	0.0020	0.004	0.001
Carbon disulfide	3/61	0.0030	0.004	0.0025
Chloroform	1/61	0.0010	0.001	0.001
Dibromochloromethane	1/61	0.0011	0.0011	0.0011
Dichlorodifluoromethane	1/61	0.0024	0.0024	0.0024
Methylene chloride	31/61	0.0119	0.15	0.0011
Tetrachloroethene	1/61	0.0015	0.0015	0.0015
Toluene	1/61	0.0036	0.0036	0.0036
Trichloroethene	2/61	0.0112	0.013	0.0094

TABLE 5-14
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATE SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SURFACE WATER SAMPLES SECOND YEAR QUARTERLY MONITORING

Analyte Name	Result	Client Description	Footnotes[1]	Detection Limit
Inorganics, Dissolved (mg/L)				
Aluminum	0.035	SC-QE09-SW-601		0.015
Antimony	0.00061	SC-QE01-SW-601	JB	0.003
Antimony	0.00061	SC-QE11-SW-601	J	0.003
Barium	0.64	SC-QE03-SW-801		0.001
Cadmium	0.0037	SC-QE07-SW-801		0.0003
Calcium	101	SC-QE02-SW-701		0.2
Chromium	0.042	SC-QE03-SW-801		0.005
Cobalt	0.0016	SC-QE07-SW-701		0.0005
Copper	0.27	SC-QE02-SW-801		0.002
Iron	0.27	SC-QW02-SW-701		0.1
Lead	0.011	SC-QE07-SW-701		0.001
Magnesium	48.8	SC-QE02-SW-701		0.2
Manganese	0.23	SC-QW02-SW-701		0.0002
Molybdenum	0.44	SC-QE02-SW-701		0.001
Nickel	0.04	SC-QW02-SW-701		0.0002
Potassium	10	SC-QW07-SW-601		5
Selenium	0.024	SC-QE02-SW-701		0.005
Silver	0.00019	SC-QE11-SW-701	J	0.0005
Sodium	207	SC-QE11-SW-601		5
Vanadium	0.027	SC-QE02-SW-701		0.0005
Zinc	0.079	SC-QW05-SW-601		0.01
Inorganics, Total (mg/L)				
Aluminum	0.38	SC-QW06-SW-601		0.015
Antimony	0.046	SC-QW06-SW-501	J	0.06
Arsenic	0.0033	SC-QE02-SW-701	J	0.005
Arsenic	0.0033	SC-QW07-SW-601	J	0.01
Barium	0.65	SC-QE03-SW-801		0.001
Beryllium	0.00068	SC-QE07-SW-701		0.0005
Cadmium	0.0053	SC-QE07-SW-801		0.0003
Calcium	103	SC-QE02-SW-701		0.2
Calcium	103	SC-QE03-SW-501		0.2
Chromium	0.02	SC-QE03-SW-801		0.005
Cobalt	0.0017	SC-QE07-SW-701		0.0005
Copper	0.36	SC-QE02-SW-801		0.002
Iron	1.7	SC-QW02-SW-701		0.1
Lead	0.016	SC-QE07-SW-701		0.001
Magnesium	49.8	SC-QE02-SW-701		0.2
Manganese	0.23	SC-QW02-SW-701		0.0002
Molybdenum	0.56	SC-QE02-SW-701		0.001
Nickel	0.049	SC-QW02-SW-701		0.0002
Potassium	9.6	SC-QW07-SW-601		5
Selenium	0.021	SC-QE02-SW-701		0.005
Sodium	200	SC-QE11-SW-601		5
Vanadium	0.026	SC-QE02-SW-701		0.0005
Vanadium	0.026	SC-QE03-SW-501		0.01
Vanadium	0.026	SC-QE03-SW-701		0.0005

TABLE 5-14
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATE SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SURFACE WATER SAMPLES SECOND YEAR QUARTERLY MONITORING

Analyte Name	Result	Client Description	Footnotes[1]	Detection Limit
Zinc	0.1	SC-QE07-SW-701		0.01
Pesticides & PCBs (ug/L)				
4,4'-DDT	0.075	SC-QE10-SW-601	JM	0.1
Semivolatile Organics (mg/L)				
1,2-Dichlorobenzene	0.0017	SC-QE03-SW-501	J	0.01
2,4,6-Trichlorophenol	0.00096	SC-QE09-SW-801	J	0.0095
2,6-Dichlorophenol	0.0028	SC-QE10-SW-801	J	0.0097
2-Chlorophenol	0.0014	SC-QE09-SW-801	J	0.0095
3/4-Methylphenol	0.0012	SC-QE11-SW-501	J	0.01
4-Nitrophenol	0.0013	SC-QE08-SW-601	J	0.05
Aniline	0.004	SC-QE02-SW-601	J	0.01
Benzidine	0.0012	SC-QE09-SW-601	J	0.17
Benzoic acid	0.0016	SC-QE02-SW-501	J	0.05
bis(2-Ethylhexyl)phthalate	0.0013	SC-QE09-SW-801	J	0.0095
Butyl benzyl phthalate	0.0032	SC-QE01-SW-501	J	0.01
Di-n-butyl phthalate	0.0014	SC-QE02-SW-801	J	0.01
Dibenzofuran	0.0011	SC-QE09-SW-801	J	0.0095
Diethyl phthalate	0.0011	SC-QE02-SW-501	J	0.01
Dimethyl phthalate	0.0013	SC-QE06-SW-801	J	0.01
Fluoranthene	0.0016	SC-QE07-SW-601	J	0.01
Naphthalene	0.0014	SC-QE09-SW-801	J	0.0095
Phenol	0.002	SC-QE08-SW-601	J	0.01
Phenol	0.002	SC-QE11-SW-501	J	0.01
Volatile Organics (mg/L)				
2-Butanone (MEK)	0.0054	SC-QE04-SW-501	J	0.01
2-Hexanone	0.0054	SC-QE03-SW-801	J	0.01
Acetone	0.026	SC-QE02-SW-501		0.01
Bromoform	0.004	SC-QE03-SW-501	J	0.005
Carbon disulfide	0.004	SC-QW07-SW-601		0.003
Chloroform	0.001	SC-QE07-SW-701	J	0.005
Dibromochloromethane	0.0011	SC-QE01-SW-801	J	0.005
Dichlorodifluoromethane	0.0024	SC-QE02-SW-501	J	0.02
Methylene chloride	0.15	SC-QE10-SW-501		0.005
Tetrachloroethene	0.0015	SC-QW04-SW-701	J	0.003
Toluene	0.0036	SC-QW02-SW-701	J	0.005
Trichloroethene	0.013	SC-QW04-SW-701		0.005

[1] B=Compound is also detected in blank
J=Result is detected below the reporting limit or is an estimated concentration
M=Primary result

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
Metals (mg/L)										
Aluminum	7.43		4.3	0.55	0.7	0.15	0.053	0.038	0.18	0.21
Antimony							0.046	0.00091	0.00037	0.00051
Arsenic	0.0098		0.0026	0.0035	0.0024	0.0031	0.0015	0.0033	0.0033	0.0029
Barium	1.9		0.61	0.46	0.44	0.68	0.54	0.37	0.49	0.65
Beryllium	0.001								0.00068	0.00014
Boron										
Cadmium	0.0569	0.0094	0.0036	0.0061				0.001	0.0034	0.0053
Calcium	117		92.4	74.4	61.2	99.6	103	67.9	103	91.1
Chromium	0.628	0.0369	0.039	0.52	0.031	0.056	0.014	0.0097	0.015	0.02
Cobalt	0.324		0.031	0.0068	0.008			0.0012	0.0017	0.00054
Copper	0.985		0.11	0.08	0.098	0.3	0.27	0.049	0.14	0.36
Iron	4.55		3.4	1.3	1.4	0.28	0.12	1.5	1.7	1.1
Lead	0.325	0.0345	0.0066	0.03	0.0054	0.0048	0.0028	0.0035	0.016	0.0001
Magnesium	40.8		44.3	33.3	29.9	45.7	47.2	32.5	49.8	44.7
Manganese	3.06		0.35	0.13	0.44	0.14	0.086	0.12	0.23	0.091
Mercury				0.00018						
Molybdenum			0.57	0.42	0.2	0.3	0.5	0.29	0.56	0.013
Nickel	3.56		0.33	0.093	0.033	0.016	0.011	0.032	0.049	0.015
Potassium	6.68		5.7	5	4.5	5.7	5.4	9.6	6.2	3.6
Selenium	0.0209		0.0036	0.0041	0.0041	0.0024	0.0027	0.0028	0.021	0.0042
Silver	0.0131									
Sodium	130		203	106	123	111	179	200	114	68
Thallium					0.0012					
Tin										
Vanadium	0.067		0.028	0.018	0.017	0.03	0.026	0.019	0.026	0.023
Zinc	2.4		0.068	0.044	0.034	0.032	0.055	0.076	0.1	0.026
PCB's and Chlorinated Pesticides (ug/L)										
4,4'-DDD										

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
4,4'-DDE										
4,4'-DDT								0.075		
Aldrin				0.086						
alpha-BHC										
alpha-Chlordane										
Aroclor 1016										
Aroclor 1221										
Aroclor 1232										
Aroclor 1242										
Aroclor 1248										
Aroclor 1254										
Aroclor 1260										
beta-BHC										
delta-BHC										
Dieldrin										
Endosulfan I										
Endosulfan II										
Endosulfan sulfate										
Endrin										
gamma-BHC (Lindane)										
gamma-Chlordane										
Heptachlor										
Heptachlor epoxide										
Methoxychlor										
Toxaphene										
Volatile Organics (ug/L)										
1,1,1,2-Tetrachloroethane										
1,1,1-Trichloroethane	2	5								
1,1,2,2-Tetrachloroethane										
1,1,2-Trichloroethane		2								

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
1,1-Dichloroethane										
1,1-Dichloroethene										
1,2,3-Trichloropropane										
1,2-Dichloroethane										
1,2-Dichloropropane										
2-Butanone (MEK)			2.8				5.4			2.7
2-Chlorethyl vinyl ether										
2-Hexanone										5.4
4-Methyl-2-pentanone (MIBK)										
Acetone	5	60	11	4.6	8.4	12	26	4.4	12	24
Acrolein										
Acrylonitrile										
Benzene		2								
Bromodichloromethane	6	0.9								
Bromoform	4	15	1.9		2.6	1.8	4.0		1.9	2.6
Bromomethane										
Carbon disulfide		1		1				4	2.5	
Carbon tetrachloride										
Chlorobenzene		2		1.8						
Chloroethane										
Chloroform	6	9		1.8					1.0	
Chloromethane										
cis-1,3-Dichloropropene										
Dibromochloromethane	5									1.1
Dibromomethane										
Dichlorodifluoromethane							2.4			
Ethanol										
Ethyl methacrylate										
Ethylbenzene										
Iodomethane										
Methylene chloride	14	620	11	150	2.8	5.1	150	2.3	2.3	12

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
Styrene										
Tetrachloroethene	3	6	11	7.6	2.1				1.5	
Toluene	1	5		1.4					3.6	
trans-1,2-Dichloroethene										
trans-1,3-Dichloropropene										
trans-1,4-Dichloro-2-butene										
Trichlorethene			3.1	14	1.6			9.4	13	
Trichlorofluoromethane										
Vinyl acetate										
Vinyl chloride					1					
Xylenes (total)		2								
Semivolatile Organics (ug/L)										
1,2,4,5-Tetrachloro-benzene										
1,2,4-Trichlorobenzene										
1,2-Dichlorobenzene							1.7			1.0
1,3-Dichlorobenzene										
1,4-Dichlorobenzene										
1-Chloronaphthalene										
1-Naphthylamine										
2,3,4,6-Tetrachlorophenol										
2,4,5-Trichlorophenol										
2,4,6-Trichlorophenol										0.96
2,4-Dichlorophenol										
2,4-Dimethylphenol										
2,4-Dinitrophenol										
2,4-Dinitrotoluene										
2,6-Dichlorophenol										2.8
2,6-Dinitrotoluene										
2-Chloronaphthalene										
2-Chlorophenol										1.4

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
2-Methylnaphthalene										
2-Methylphenol										
2-Naphthylamine										
2-Nitrophenol										
2-Picoline										
3,3'-Dichlorobenzidine										
3-Methylcholanthrene										
3-Nitroaniline										
3/4-Methylphenol					1.3	1.7	1.2			
4,6-Dinitro-2-methylphenol										
4-Aminobiphenyl										
4-Bromophenyl phenyl ether										
4-Chloro-3-methylphenol										
4-Chloroaniline										
4-Chlorophenyl phenyl ether										
4-Nitroaniline										
4-Nitrophenol				1.7	2	1.2		1.3		
7,12-Dimethylbenz(a)-anthracene										
a,a-Dimethylphenethyl-amine										
Acenaphthene										
Acenaphthylene										
Acetophenone										
Aniline								4		
Anthracene										
Azobenzene										
Benzidine								1.2		
Benzo(a)anthracene										
Benzo(a)pyrene										
Benzo(b)fluoranthene										
Benzo(g,h,i)perylene	6									
Benzo(k)fluoranthene										

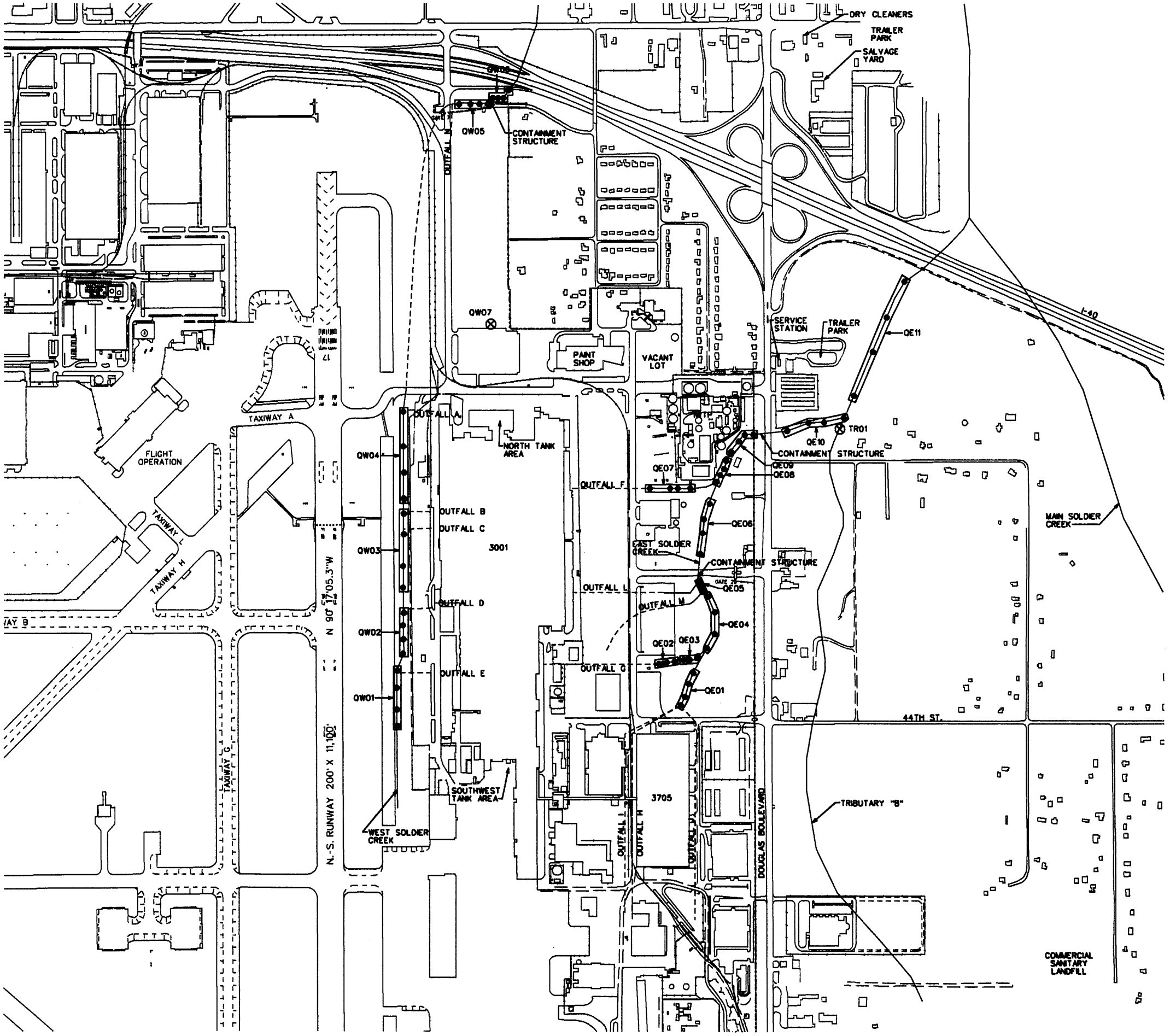
TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
Benzoic acid	0.4				2.9	3.9	1.6	1.2	1.2	1.5
Benzyl alcohol				1.7	1.2					
bis(2-Chloroethoxy)methane										
bis(2-Chloroethyl)ether										
bis(2-Chloroisopropyl)ether										
bis(2-Ethylhexyl)phthalate			1	3.6						1.3
Butyl benzyl phthalate			1				3.2			
Chrysene	5									
Di-n-butyl phthalate										1.4
Di-n-octyl phthalate										
Dibenz(a,h,)anthracene										
Dibenz(a,j)acridine										
Dibenzofuran										1.1
Diethyl phthalate						1.2	1.1			
Dimethyl phthalate								1		1.3
Diphenylamine										
Ethyl methanesulfonate										
Fluoranthene	1			1.5				1.6		1.5
Fluorene										
Hexachlorobenzene										
Hexachlorobutadiene										
Hexachlorocyclopentadiene										
Hexachloroethane										
Indeno(1,2,3-cd)pyrene										
Isophorone										
Methyl methanesulfonate										
N-Nitroso-di-n-butylamine										
N-Nitroso-di-n-propylamine										
N-Nitrosodiphenylamine										
N-Nitrosopiperidine										
Naphthalene										1.4

TABLE 5-15
COMPARISON OF QUARTERLY MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)	2qtr1yr (Jan 1995)	3qtr1yr (Apr 1995)	4qtr1yr (Jul 1995)	1qtr2yr (Oct 95)	2qtr2yr (Mar 96)	3qtr2yr (May 96)	4qtr2yr (Aug 96)
Nitrobenzene										
p-Dimethylaminoazobenzene										
Pentachlorobenzene										
Pentachloronitrobenzene										
Pentachlorophenol										
Phenacetin										
Phenanthrene				1.6						
Phenol				3.5	2.7		2	2		1.4
Pronamide										
Pyrene	1									

FIGURES



LEGEND:

——— SOLDIER CREEK AND TRIBUTARIES

- - - - - - - UNDERGROUND PORTION OF CREEK

·-·-·-·-·-· BOUNDARY OF TINKER AIR FORCE BASE

⊗ SAMPLING LOCATION ON TRIBUTARY B AND QW07

- 1ST QUARTER 2YR. BHRA PAH Exceedance(s)
- 2ND QUARTER 2YR. BHRA PAH Exceedance(s)
- 3RD QUARTER 2YR. BHRA PAH Exceedance(s)
- 4TH QUARTER 2YR. BHRA PAH Exceedance(s)

N

800 0 800 1600

SCALE FEET

08 JAN 97 16:19:52
MCS FILE: k:\tinker\dgn\soldcr-09.dgn

Designed By: D.D.N.	TINKER AIR FORCE BASE		
	OKLAHOMA CITY, OKLAHOMA		
Drawn By: R.A.D.	TITLE: BHRA PAH EXCEEDANCES FOR 0'-6" SEDIMENT SAMPLES		
Checked By: D.J.K.			
Submitted By:	PROJECT NUMBER F96515	DATE JAN 1997	FIG. NO. 5-1

FIGU 5-2a

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE01

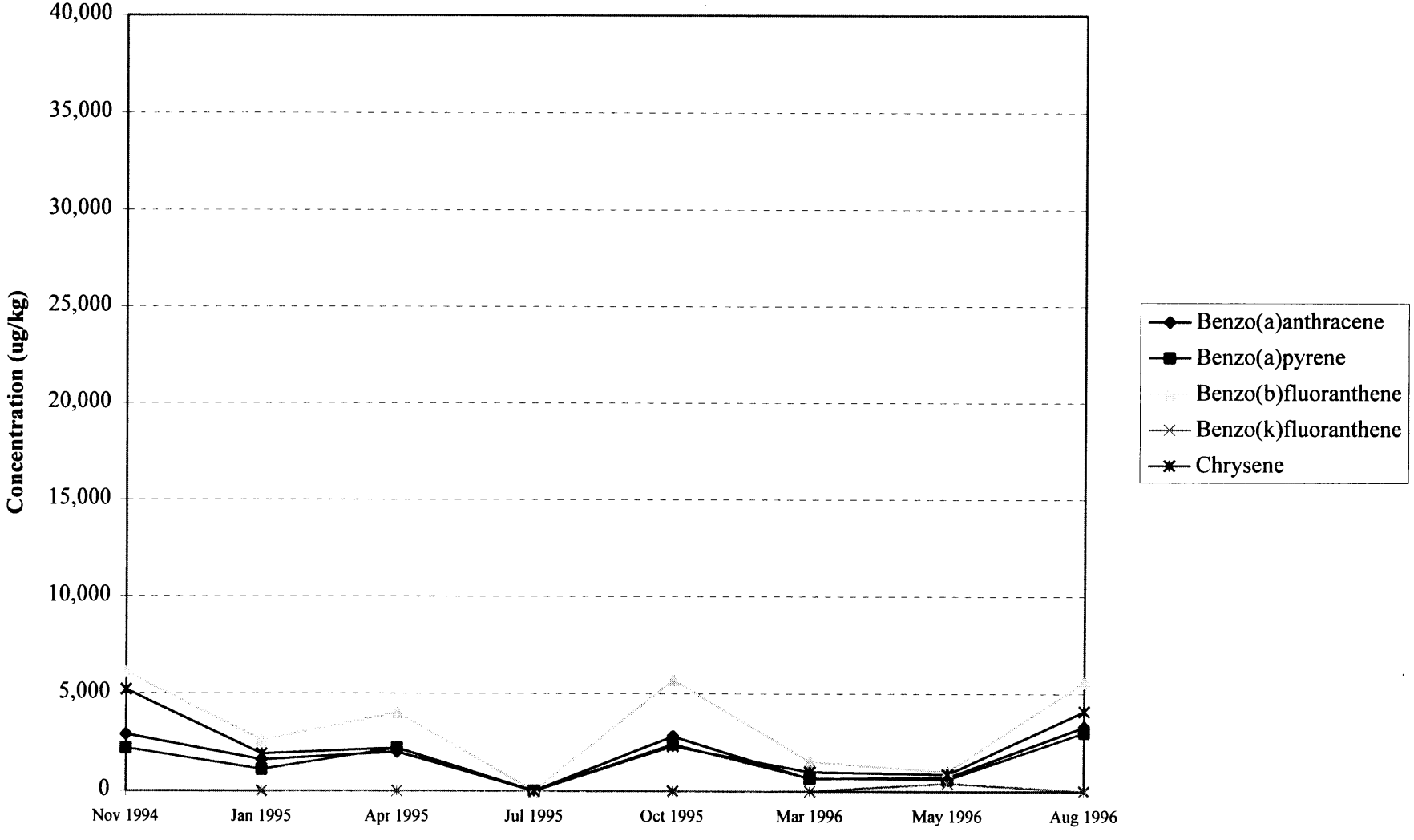
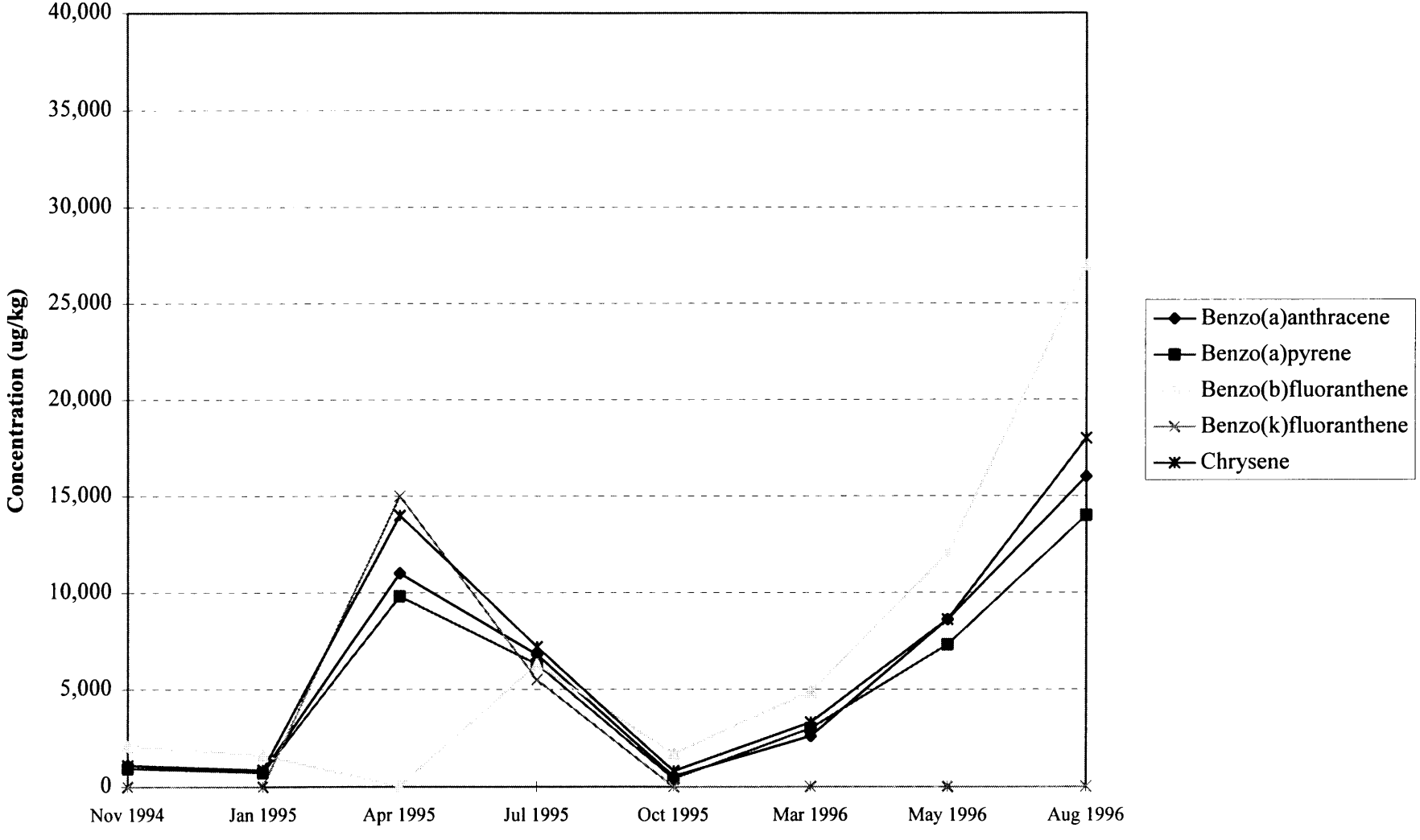


FIGURE 5-2b
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE02



FIGU 5-2c

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE03

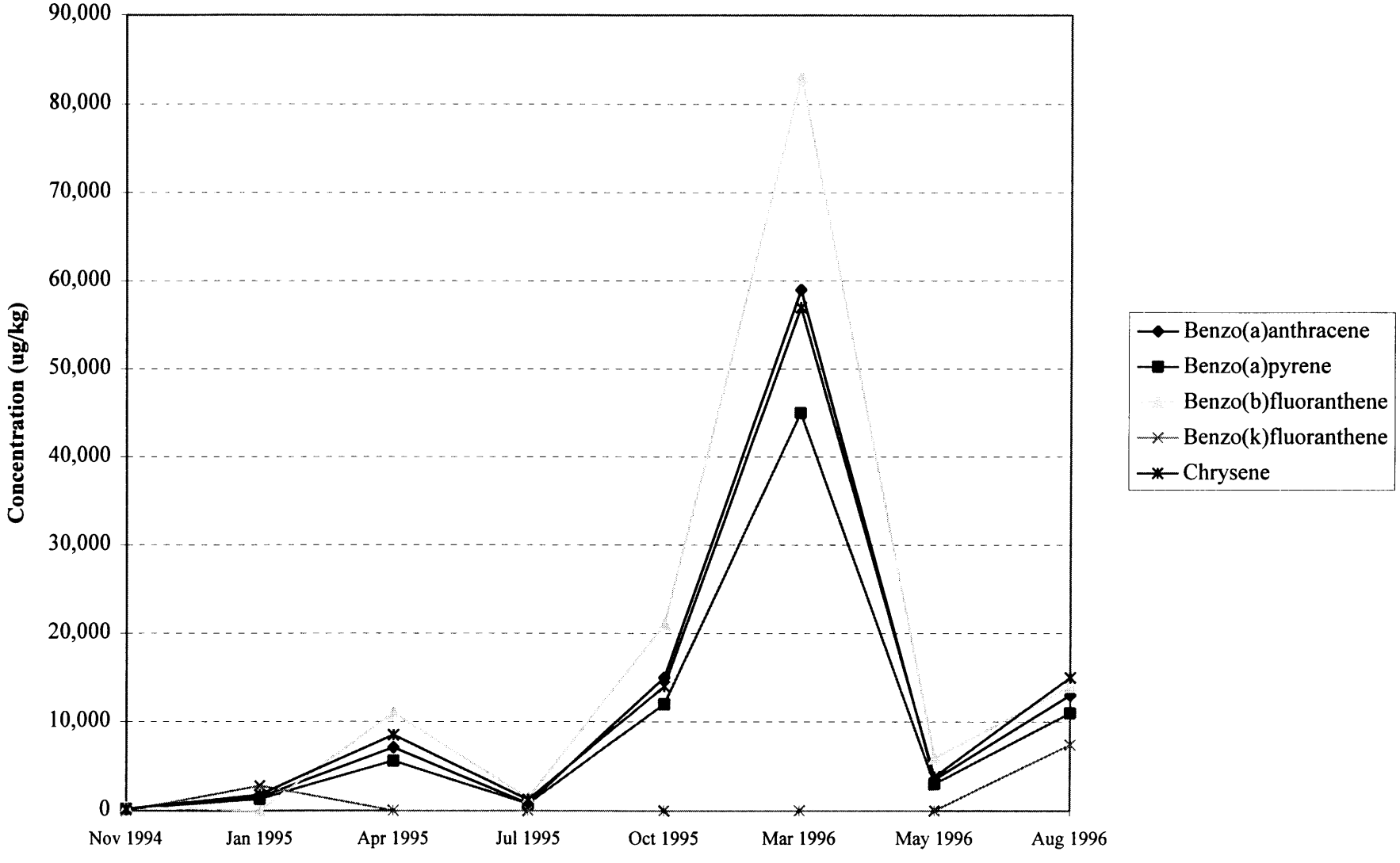


FIGURE 5-2d
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

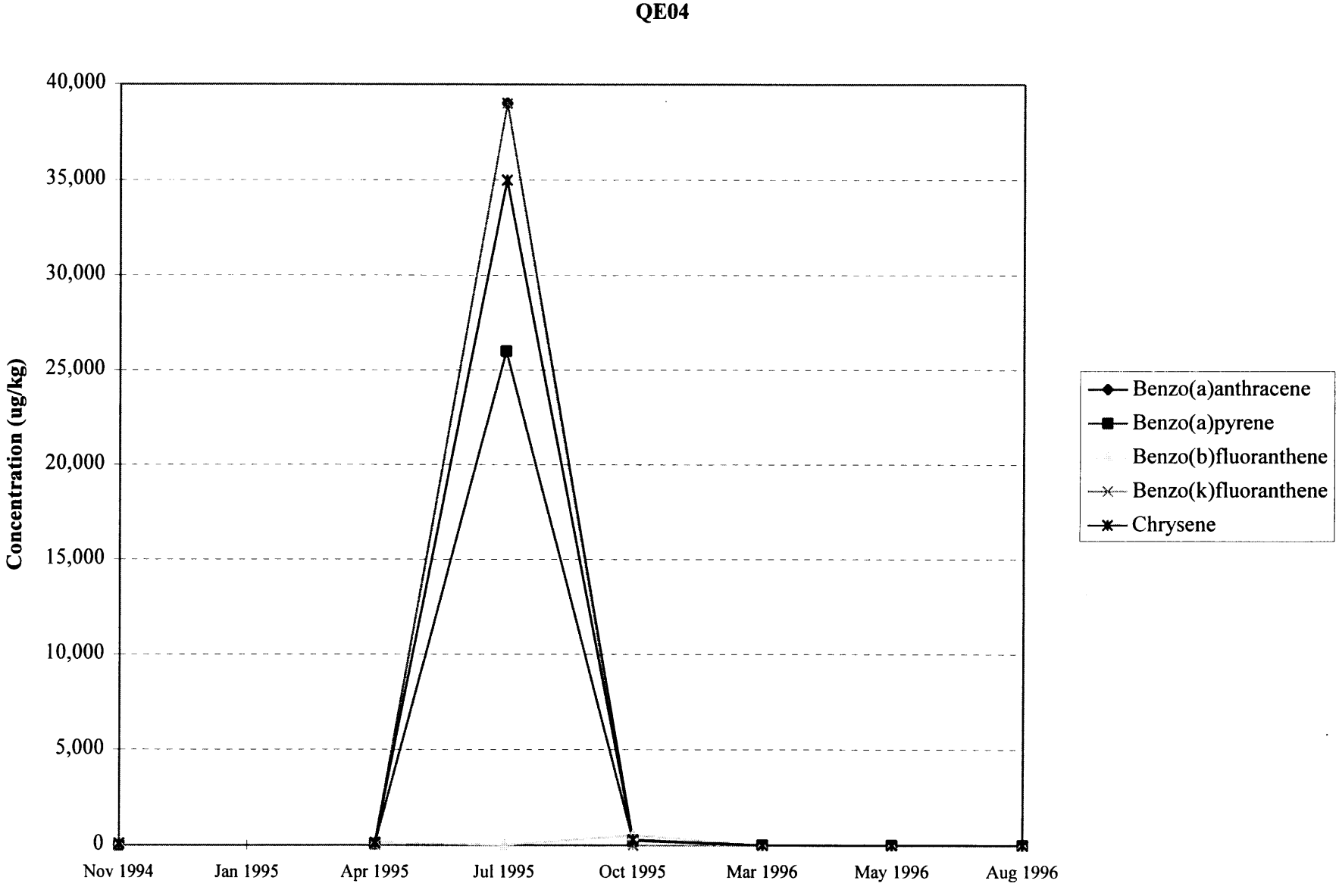


FIGURE 5-2e
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE05

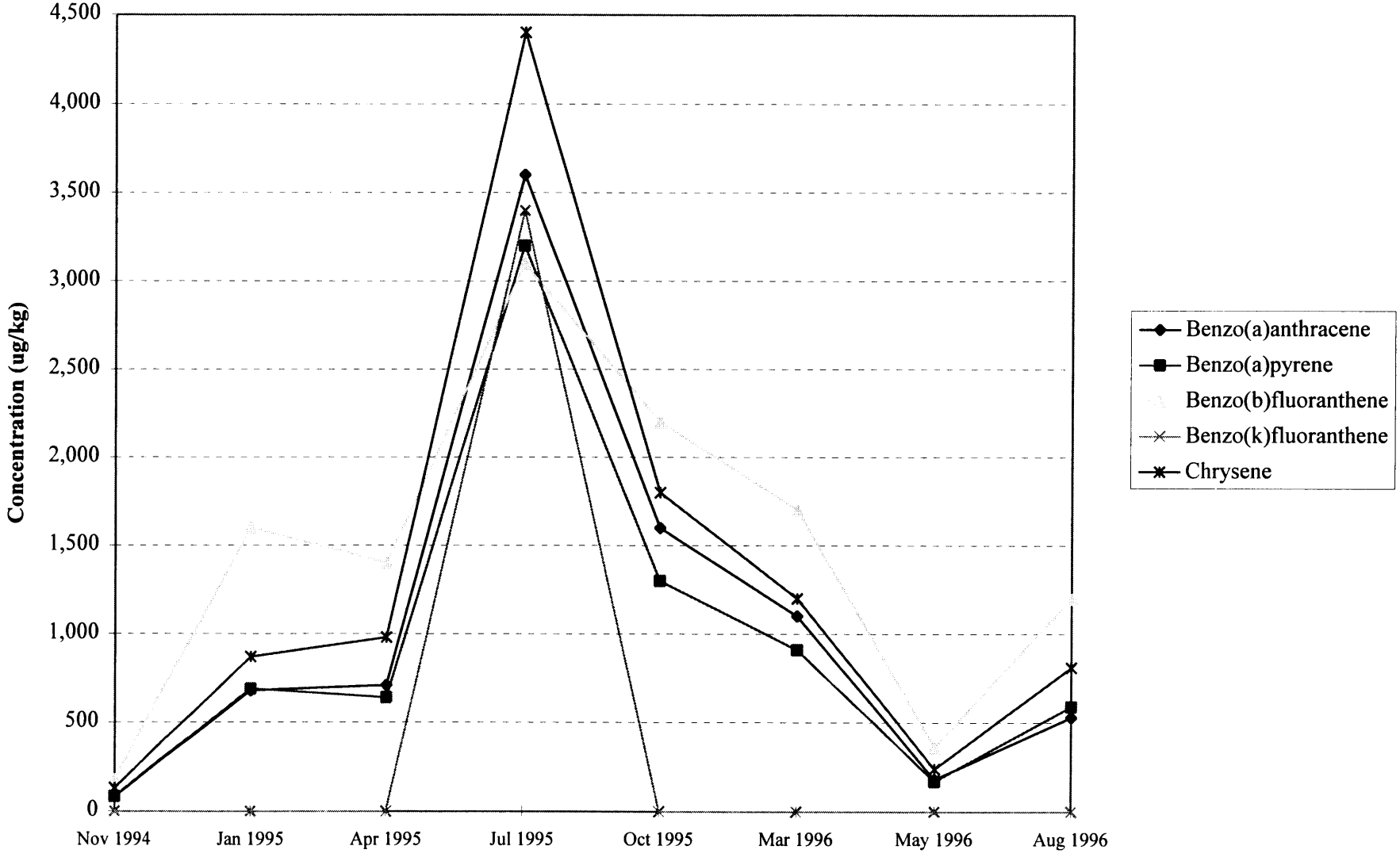
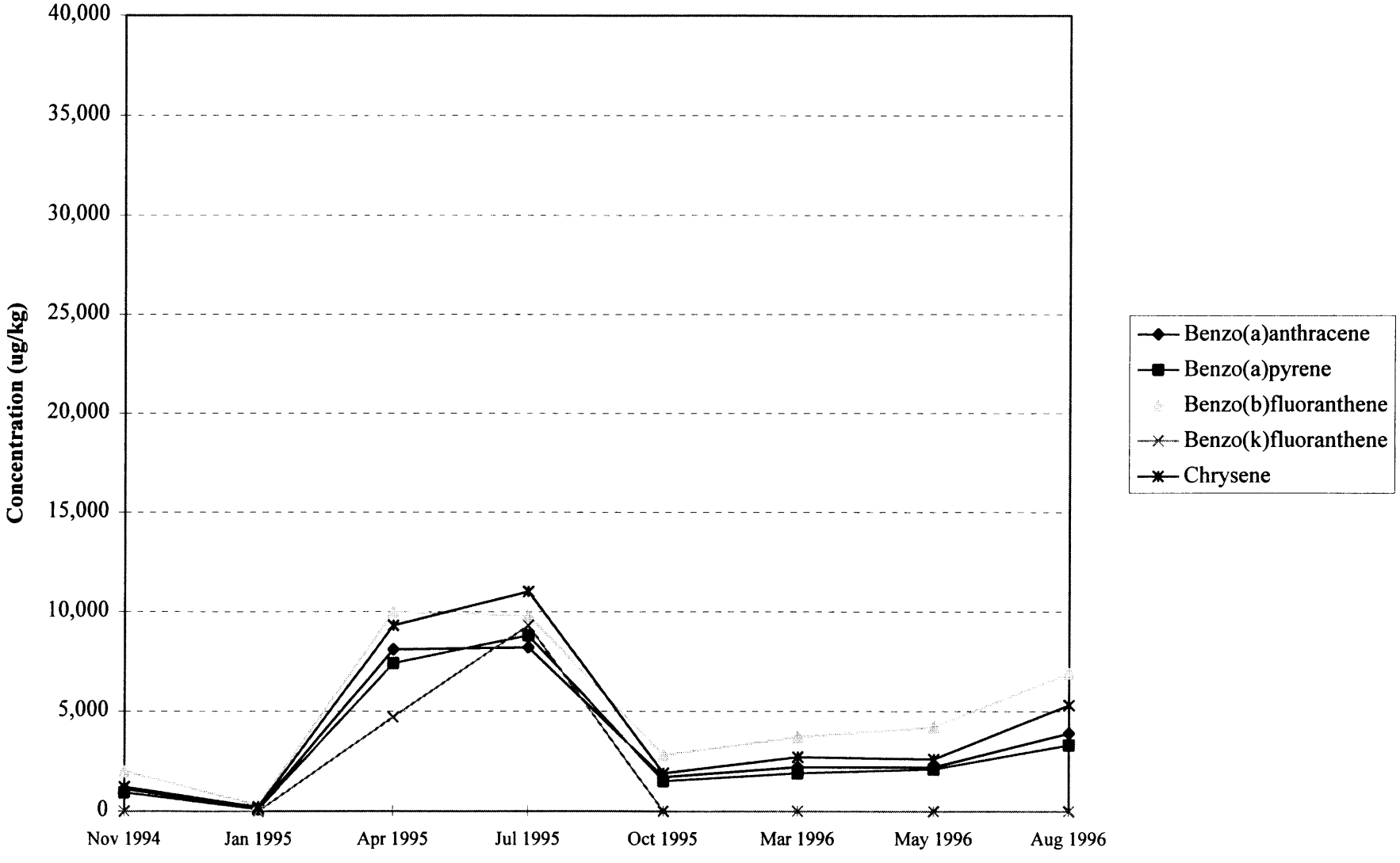


FIGURE 5-2f
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE06



FIGU 5-2g

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE07

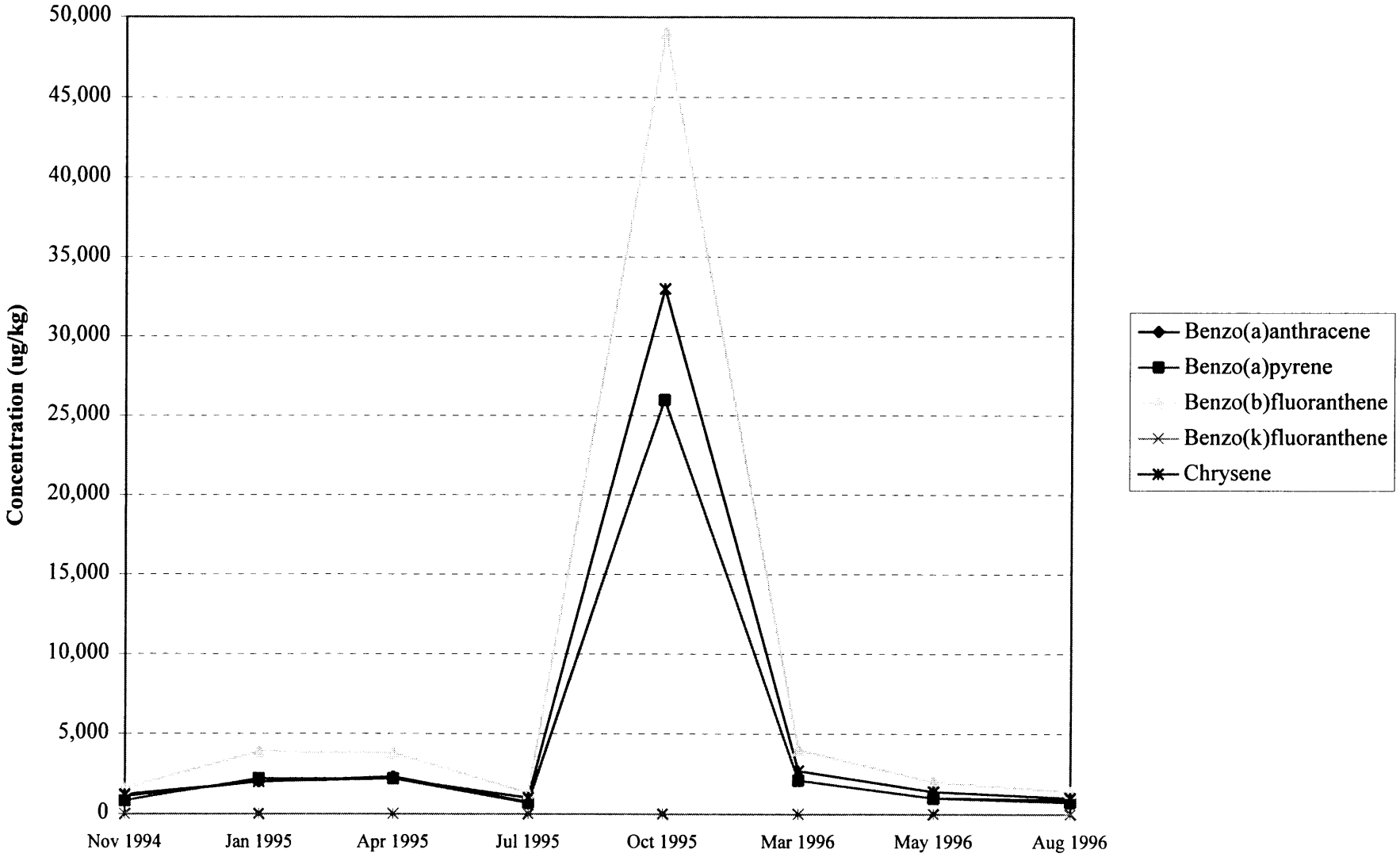
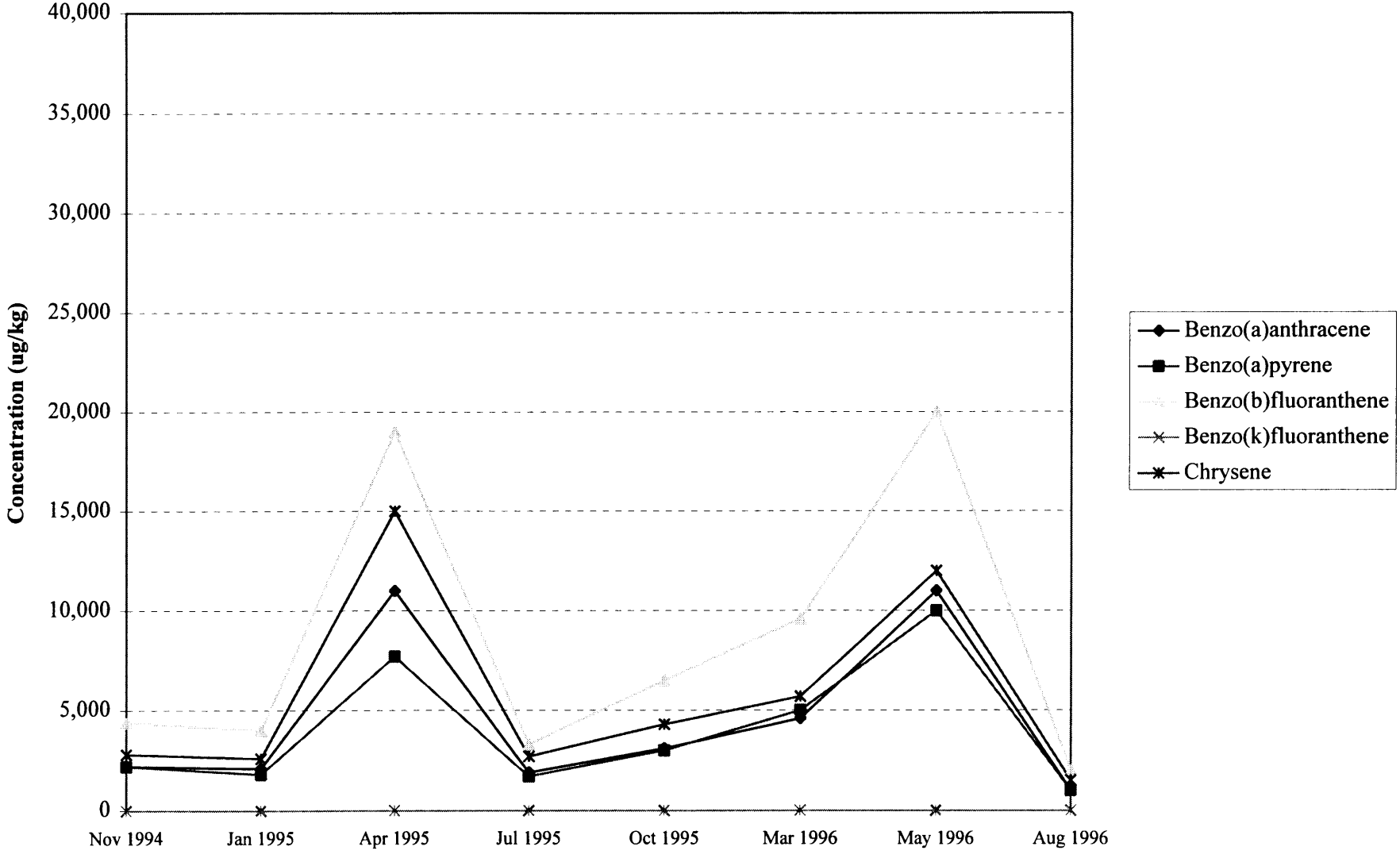


FIGURE 5-2h
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE08



FIGU . 5-2i

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QE10

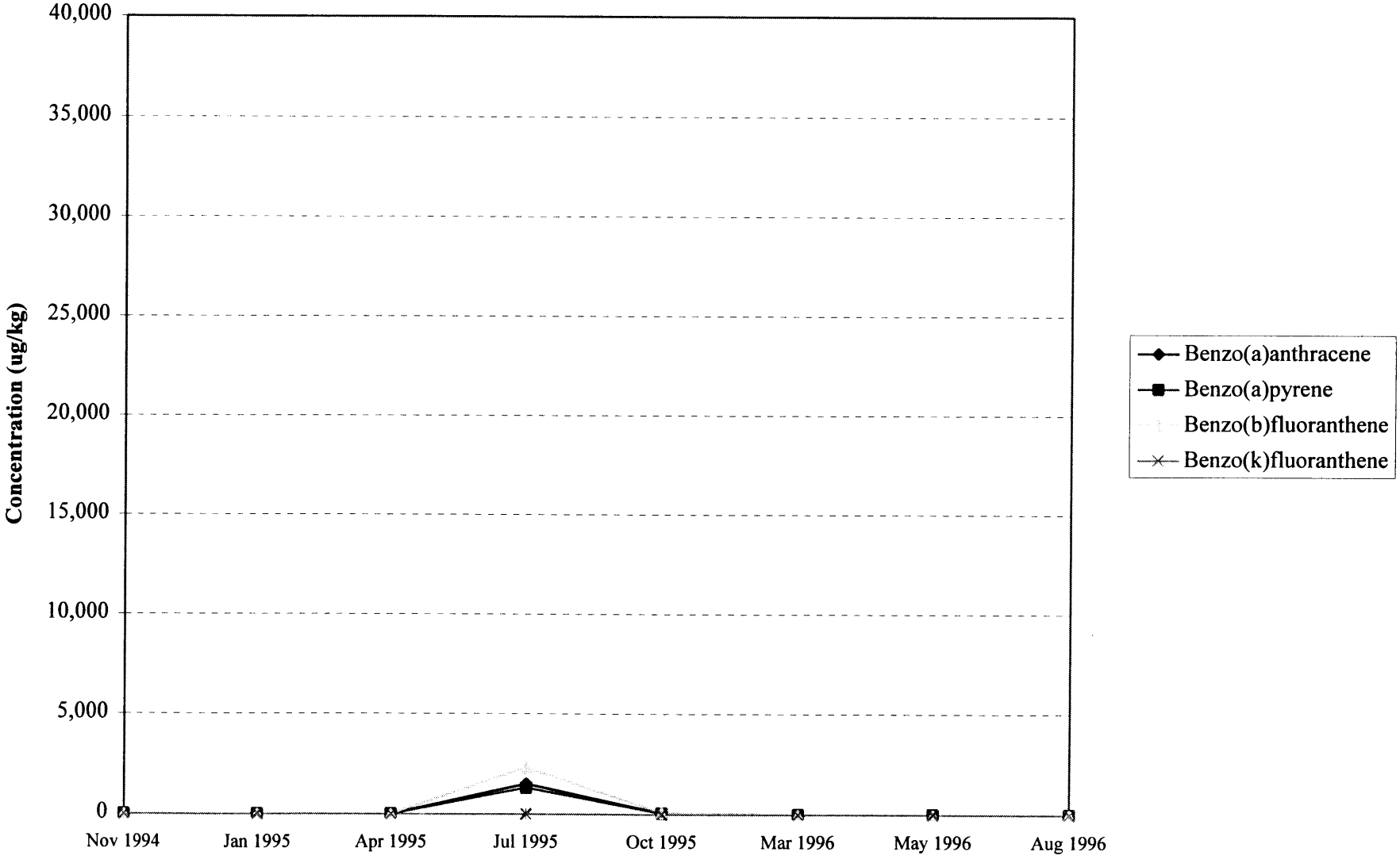


FIGURE 5-2j
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QW02

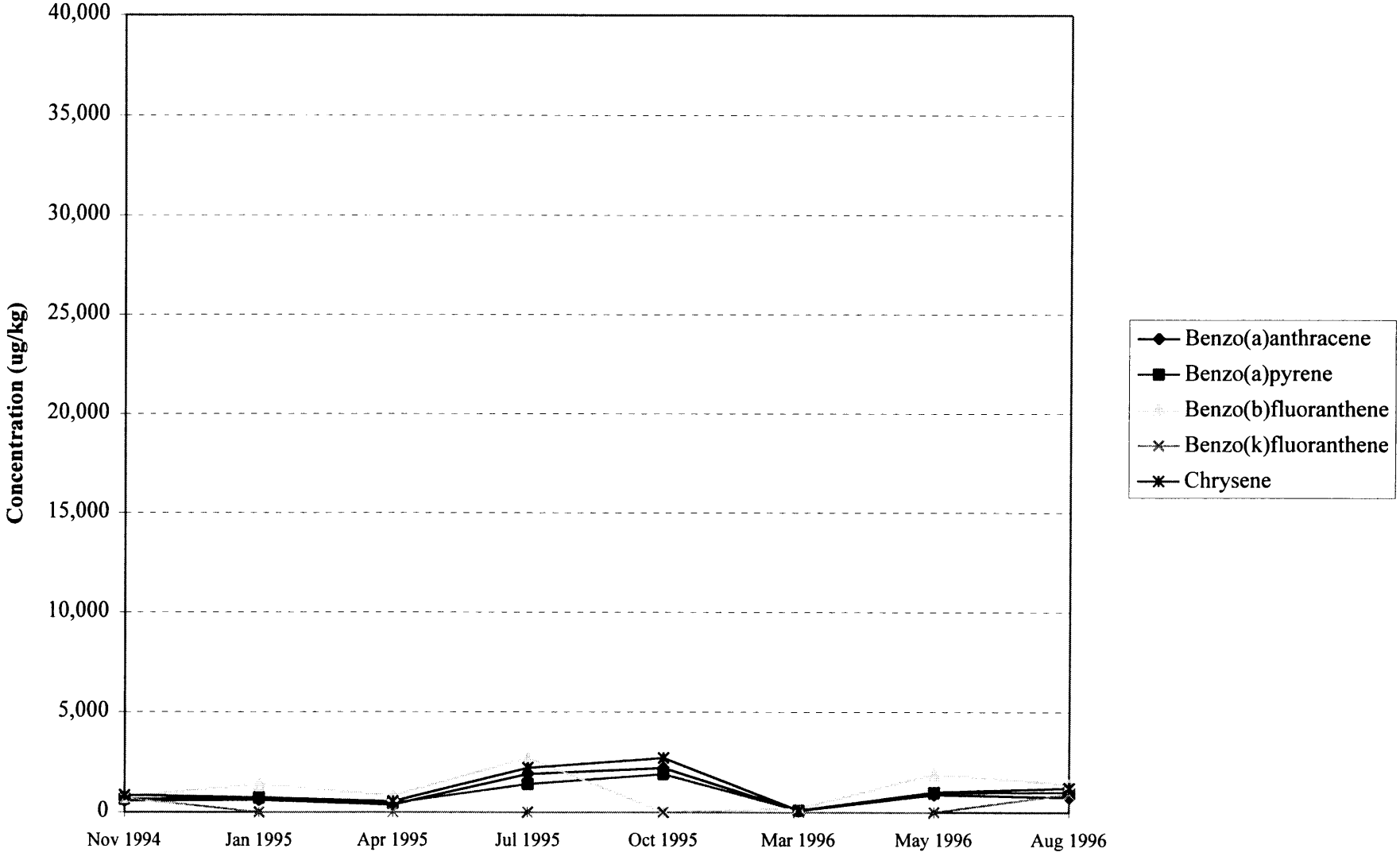
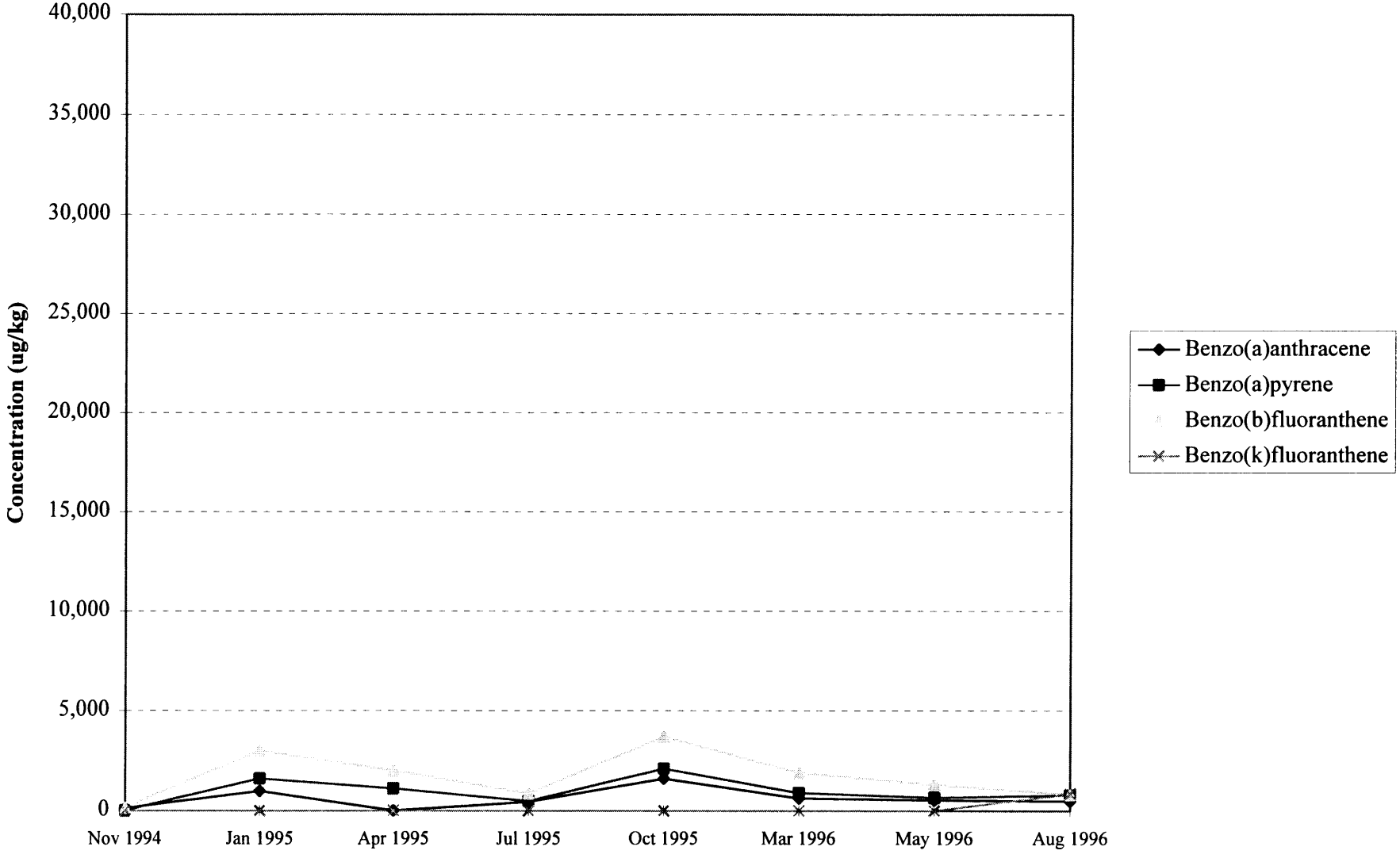


FIGURE 5-2k
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QW03



FIGU . 5-2l

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QW04

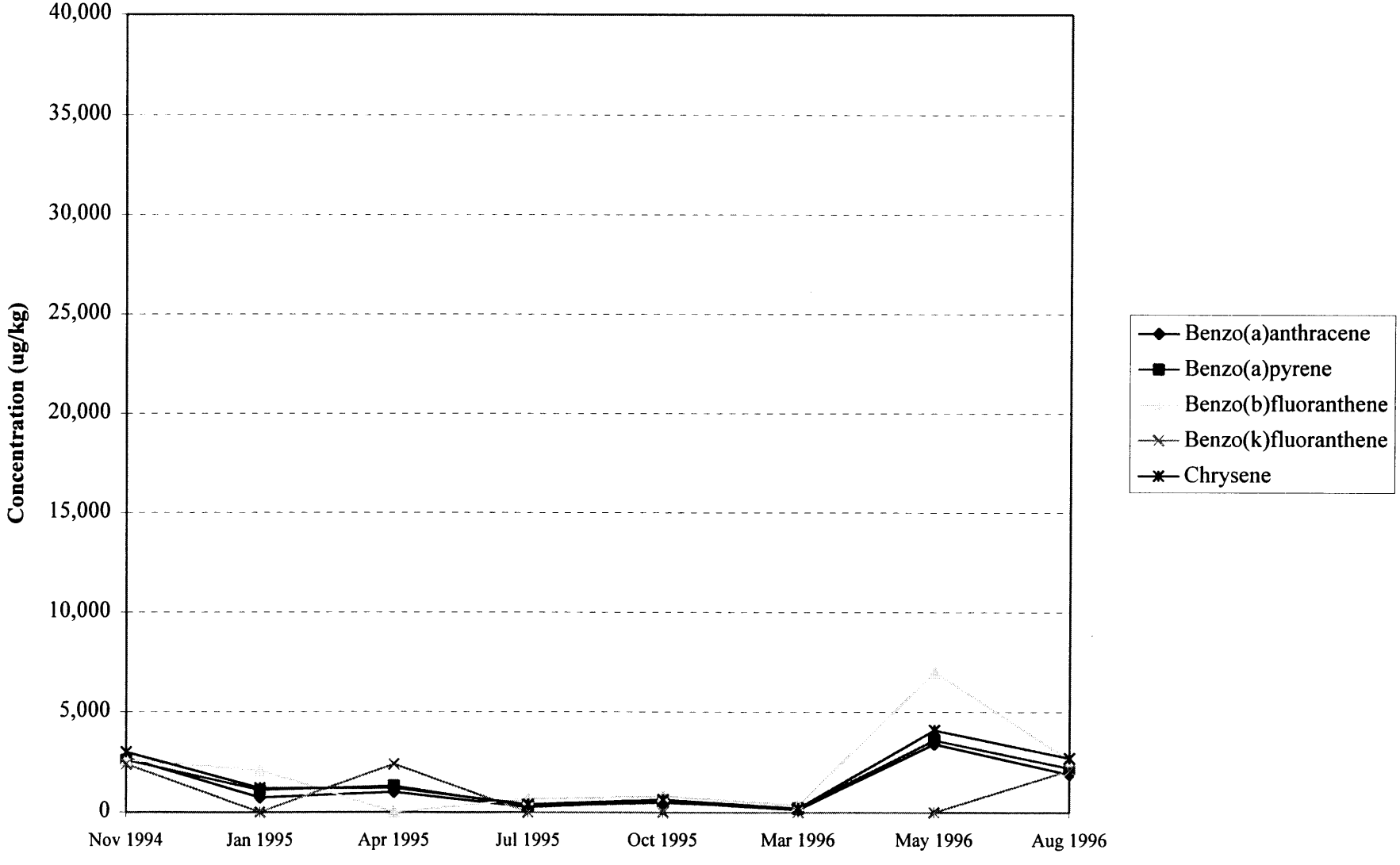
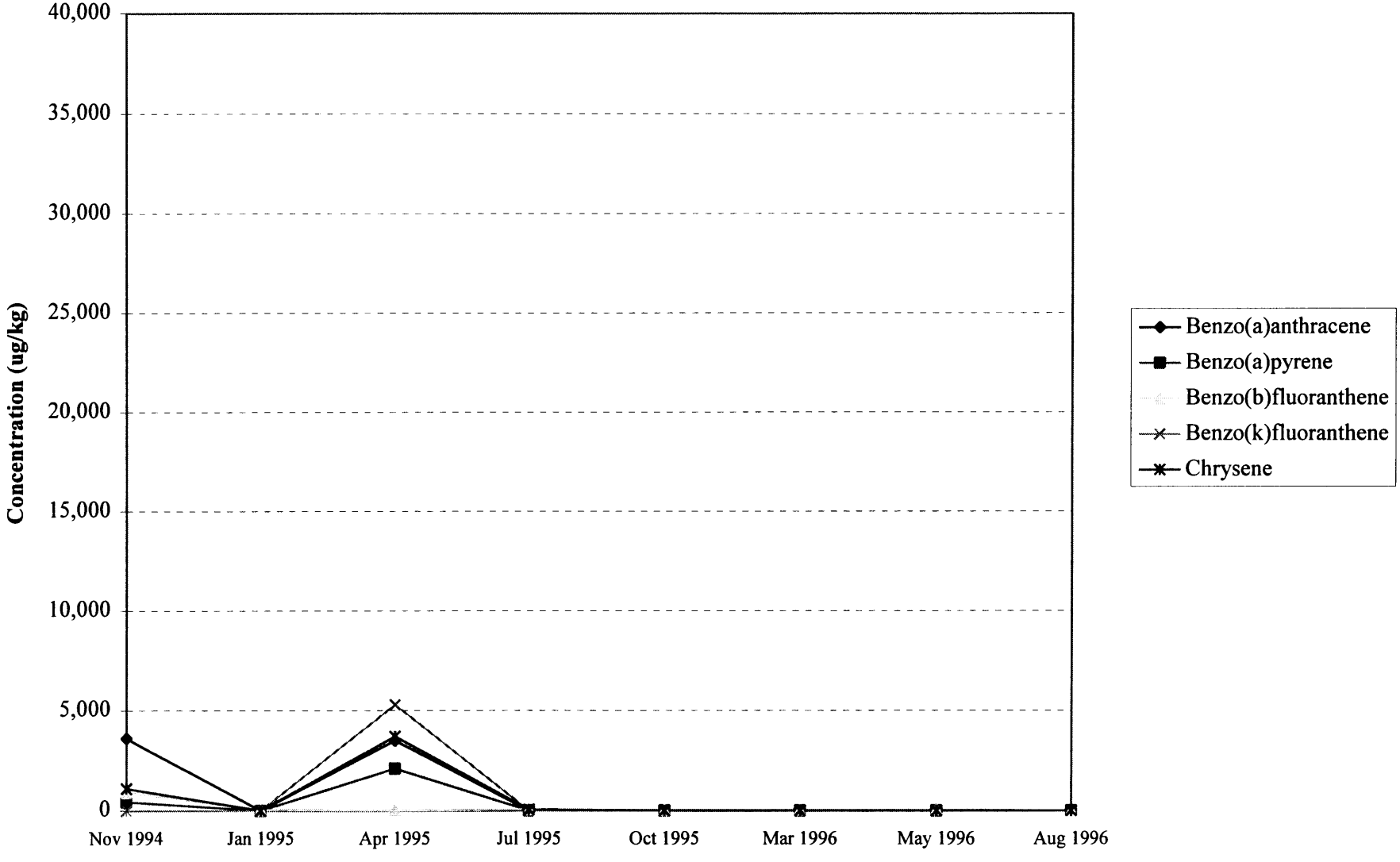


FIGURE 5-2m
TEMPORAL SSEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

QW05



FIGU 5-3a

EAST SOLIDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Qtr1Yr - November 1994

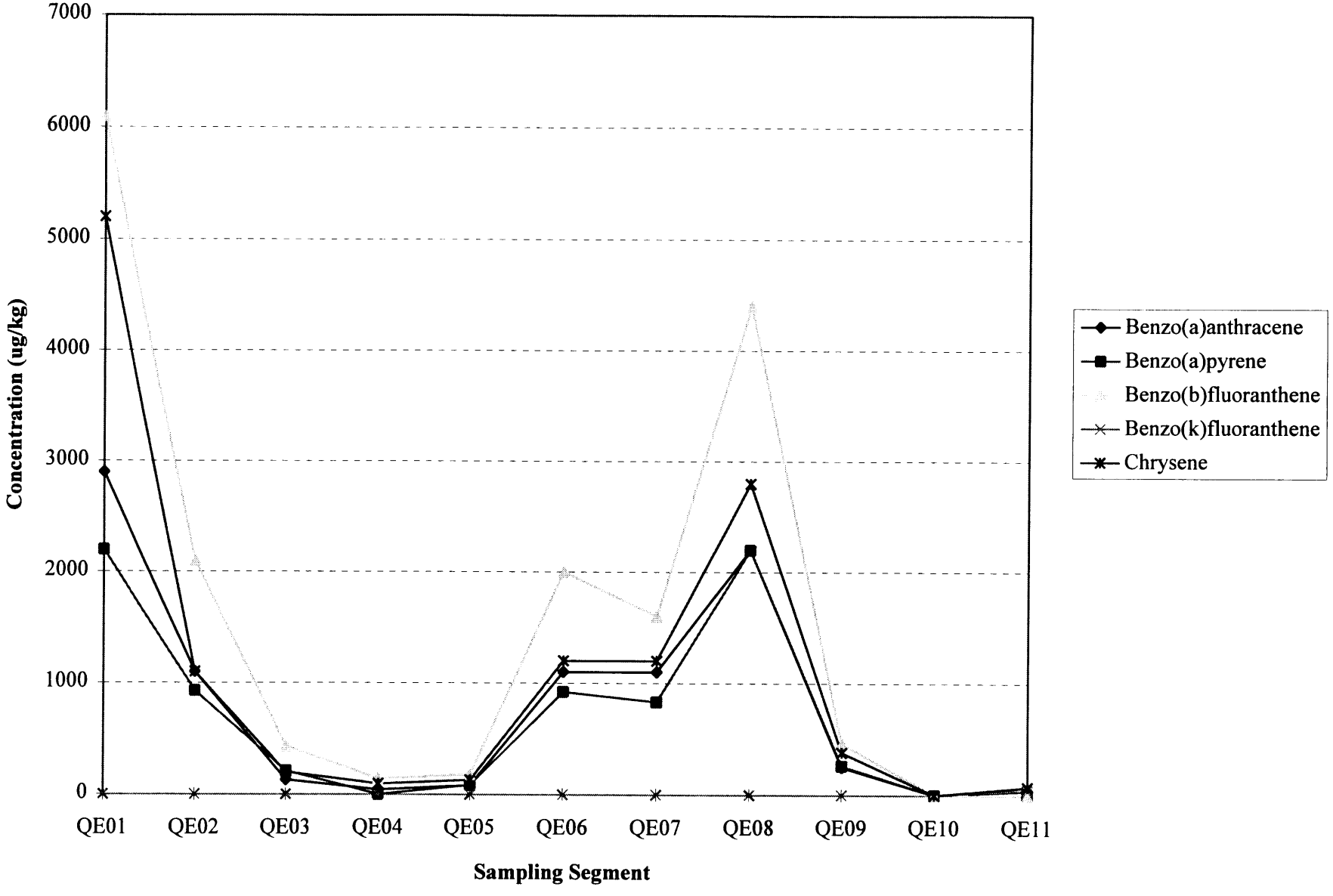
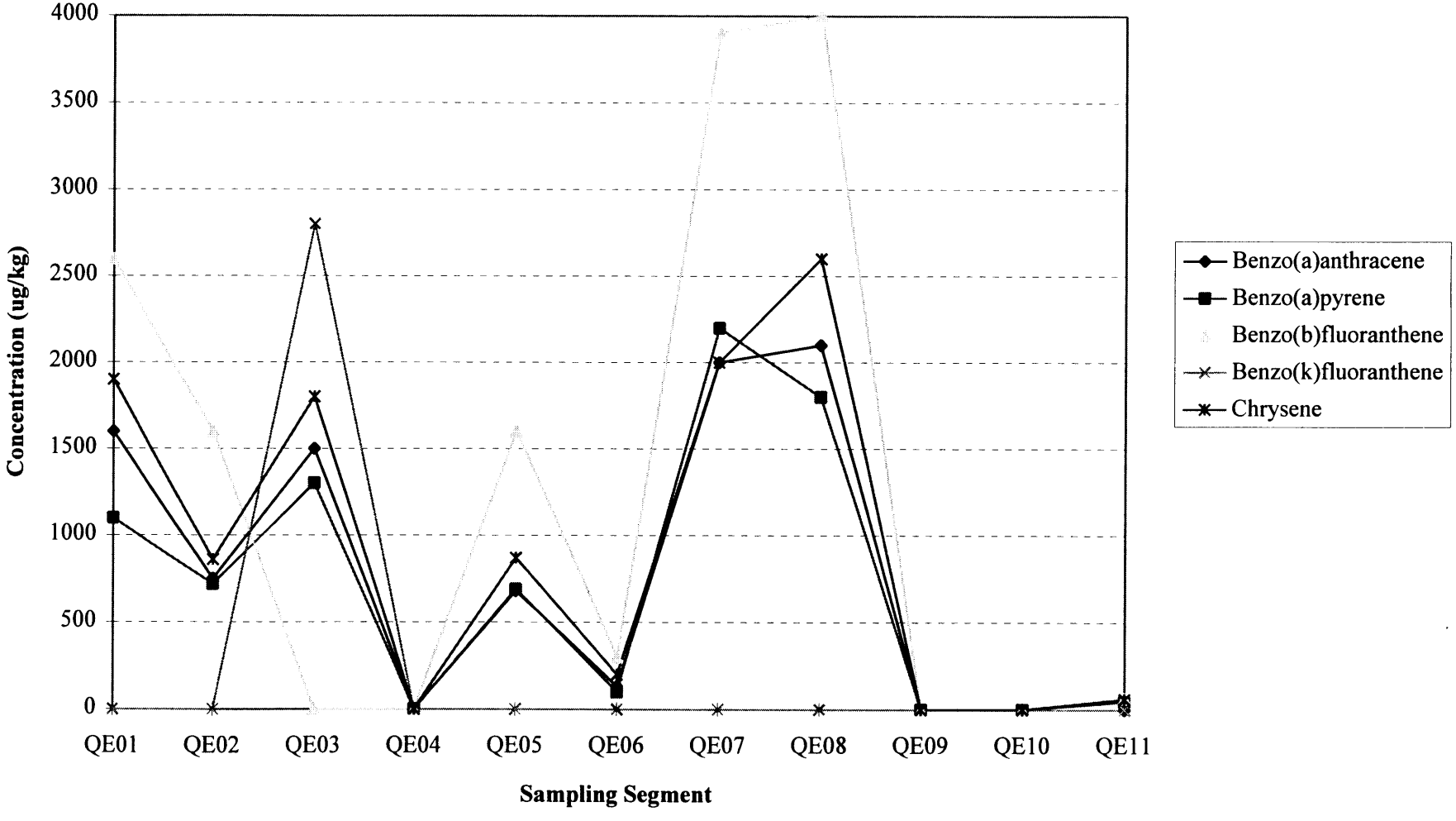


TABLE 5-3b
EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Qtr1Yr - January 1995



FIGL 5-3c

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

3Qtr1Yr - April 1995

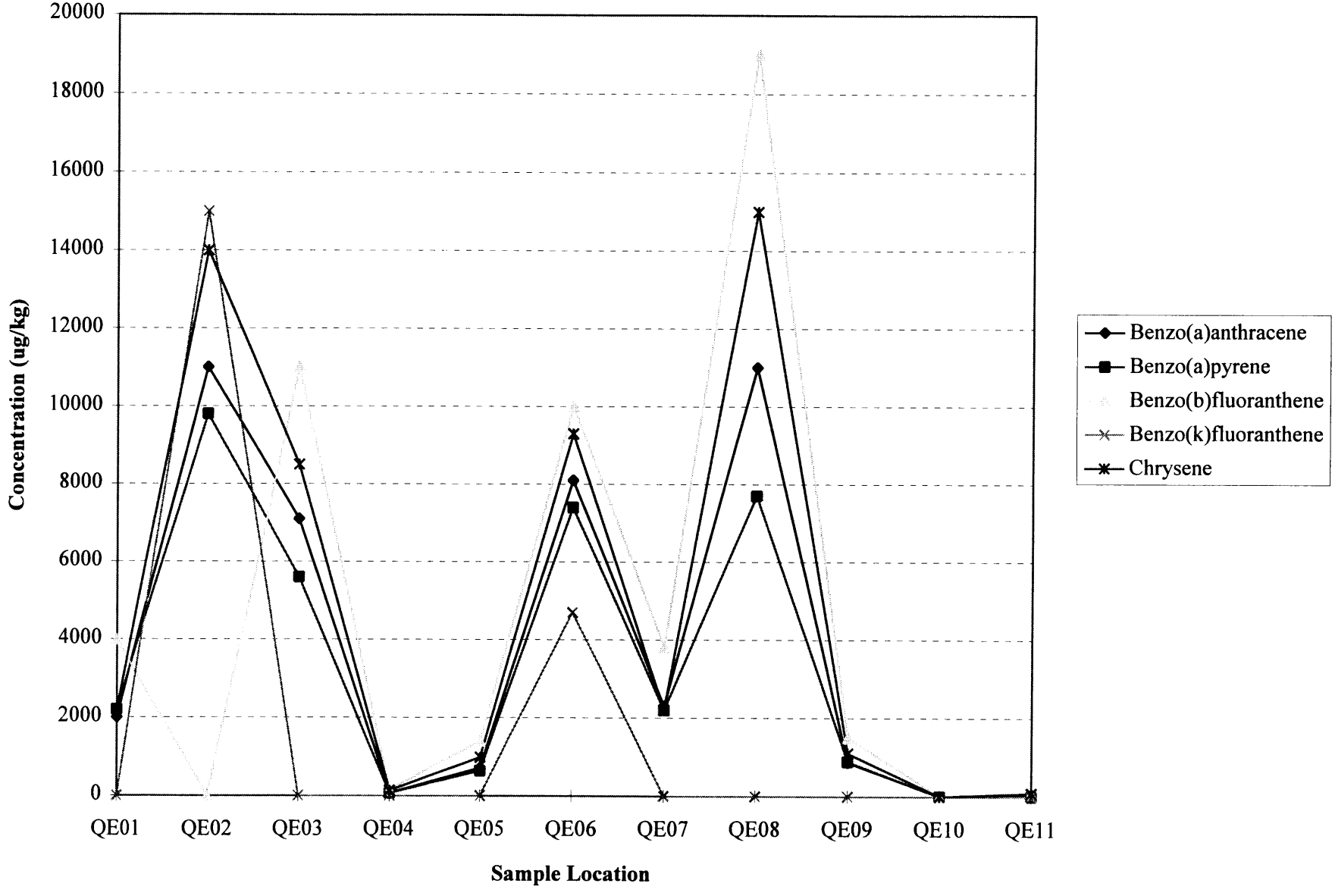
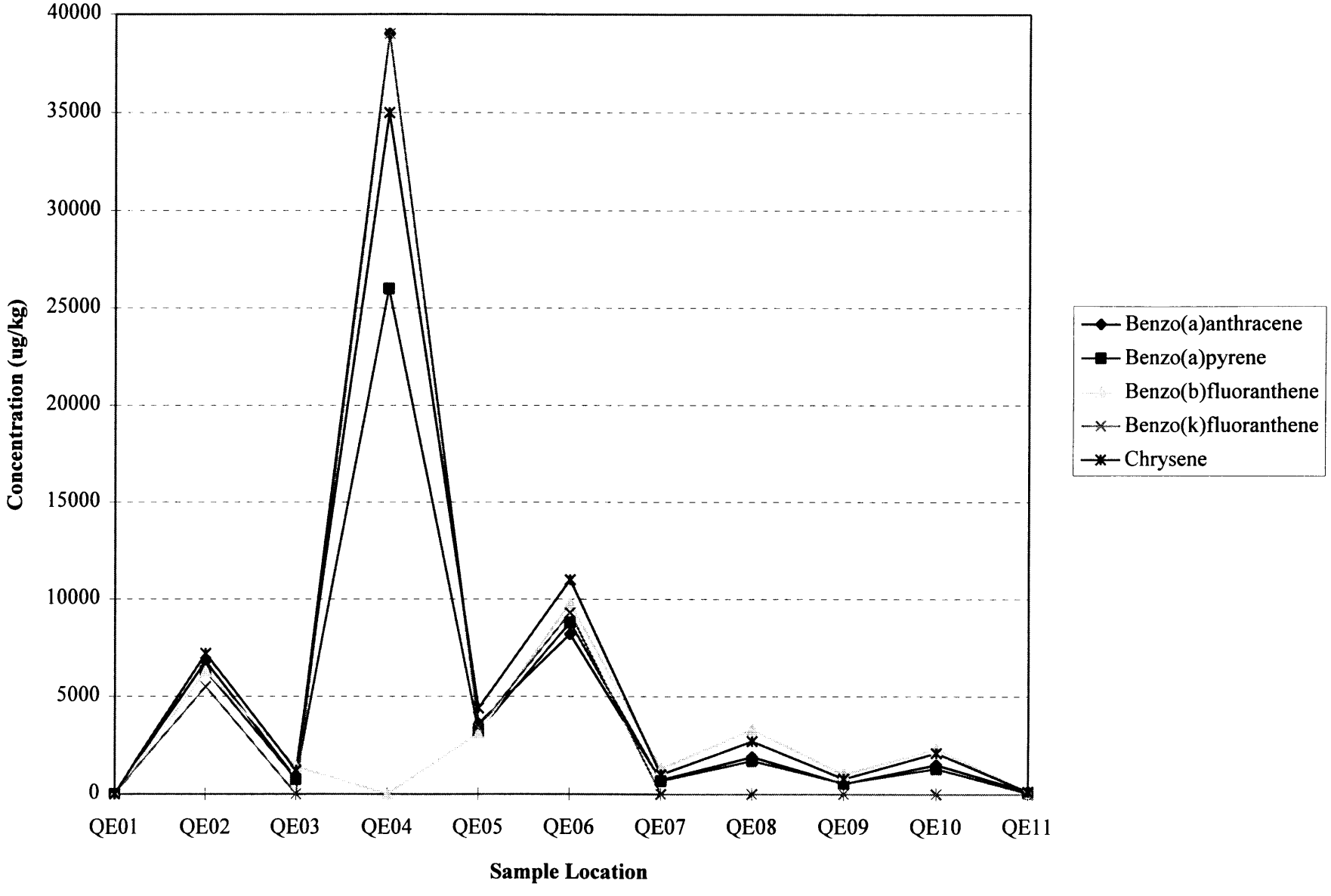


FIGURE 5-3d
EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
4Qtr1Yr - July 1995



FIGL 5-3e

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Qtr2Yr - October 1995

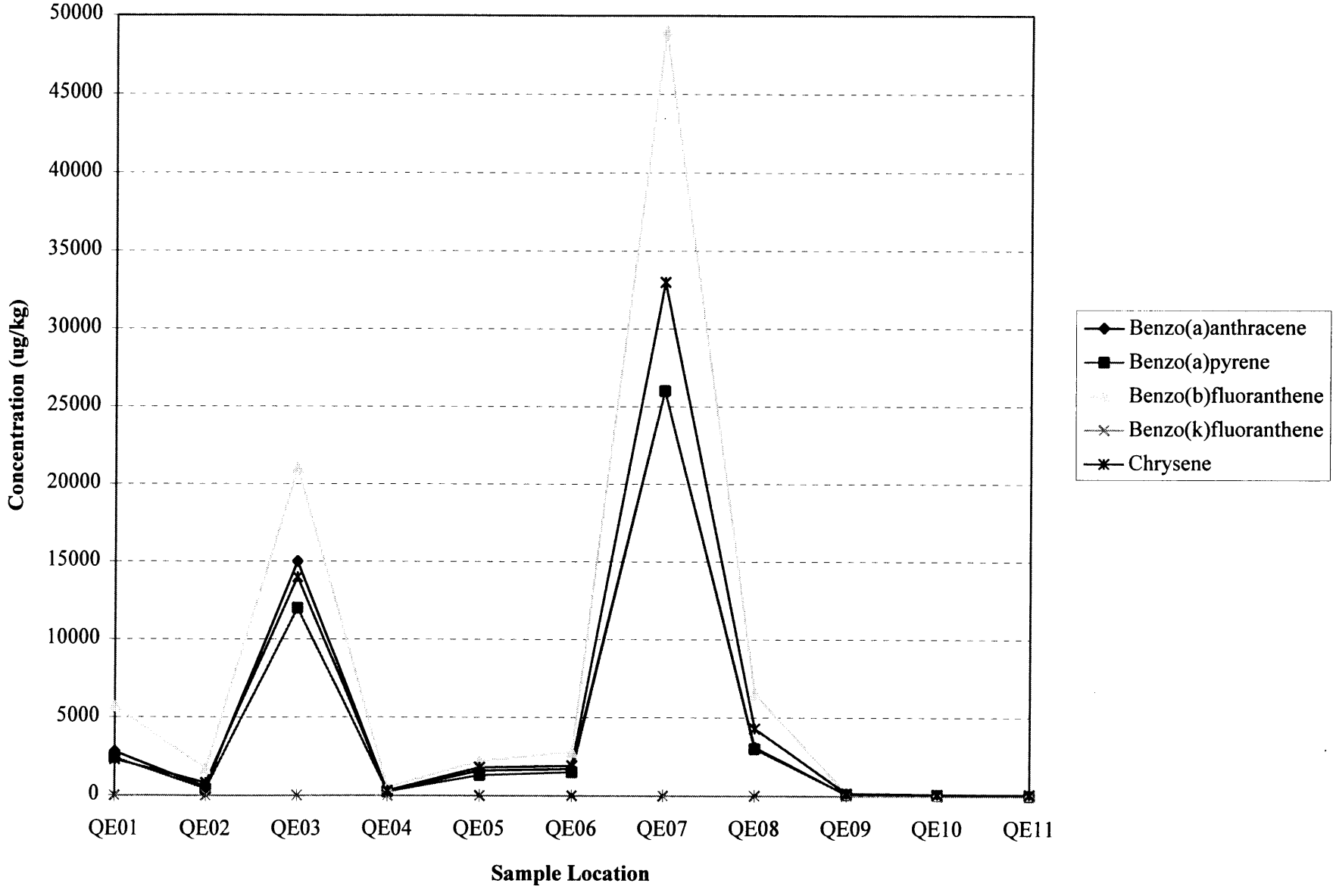


FIGURE 5-3f
EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Qtr2Yr - March 1996

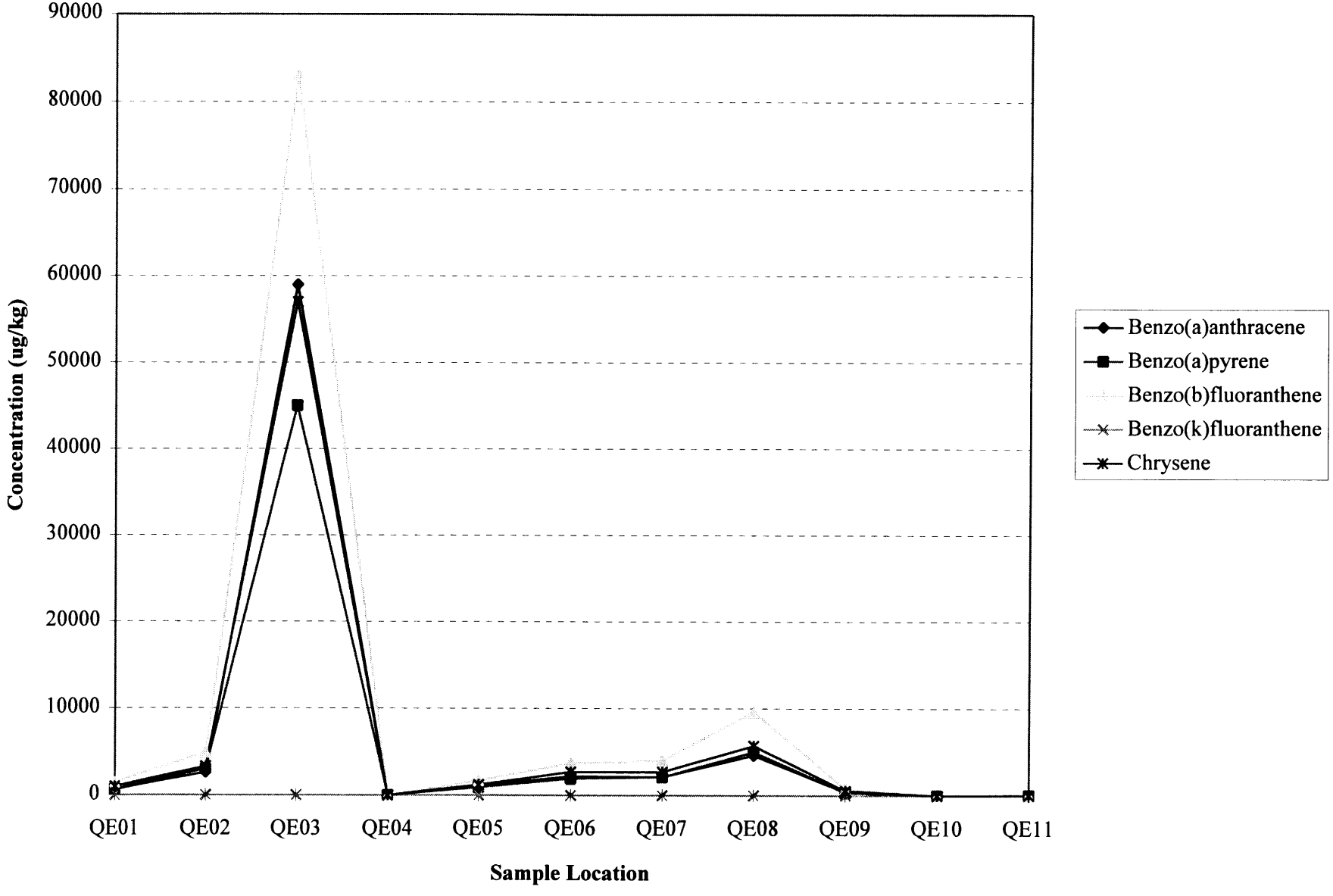


FIGURE 5-3g
EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
3Qtr2Yr - May 1996

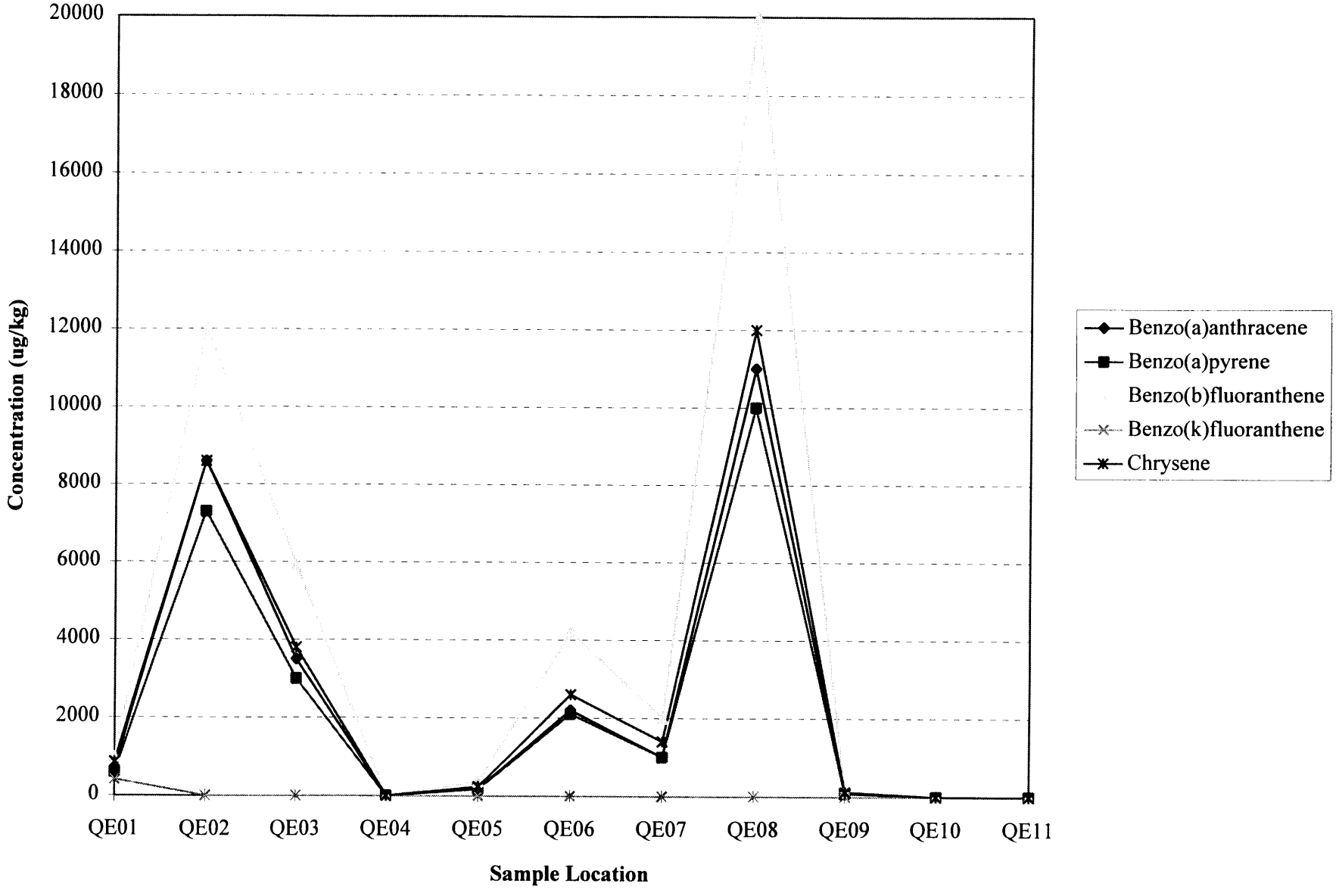


FIGURE 5-3h
EAST SOLDIERCREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
4Qtr2Yr - August 1996

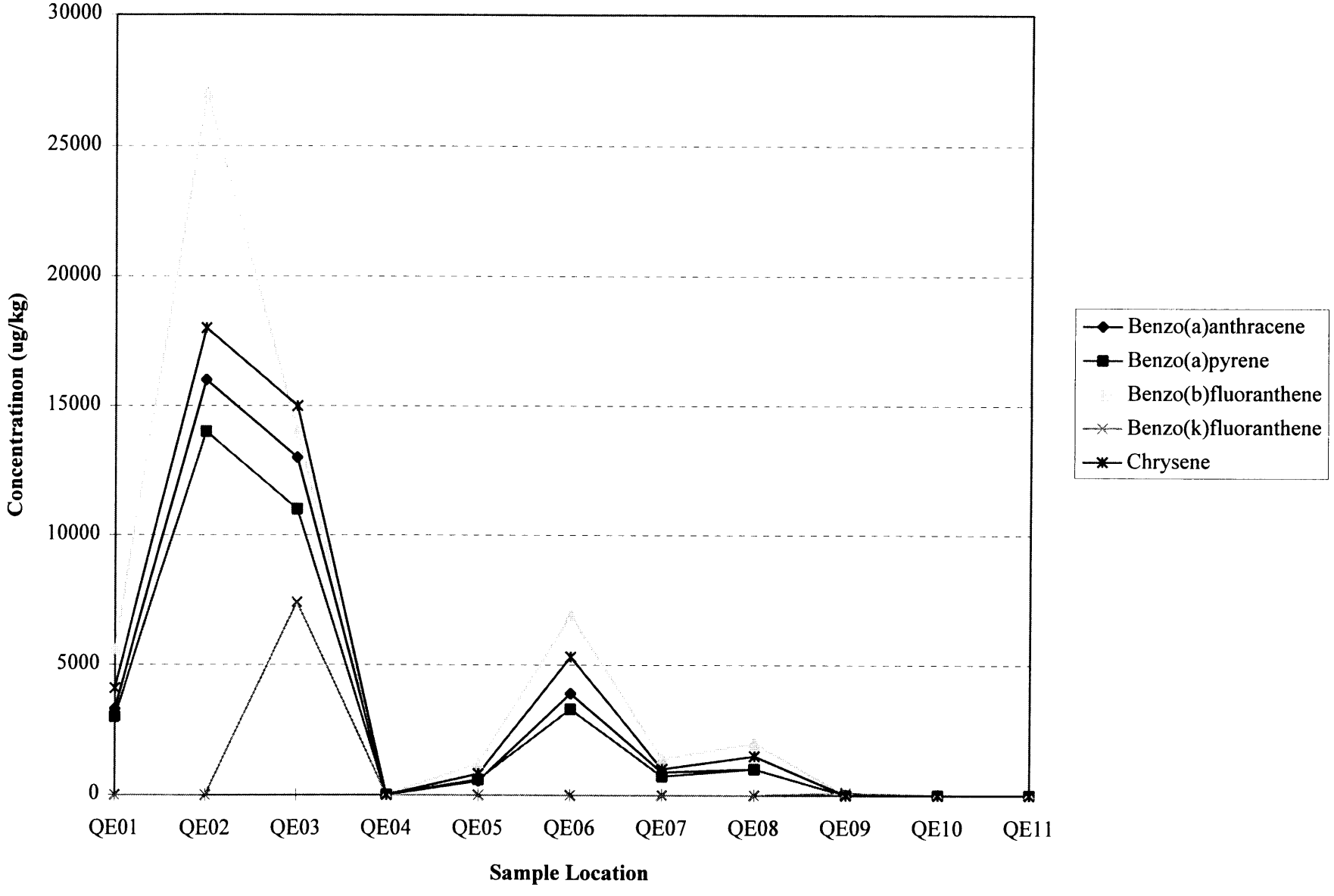
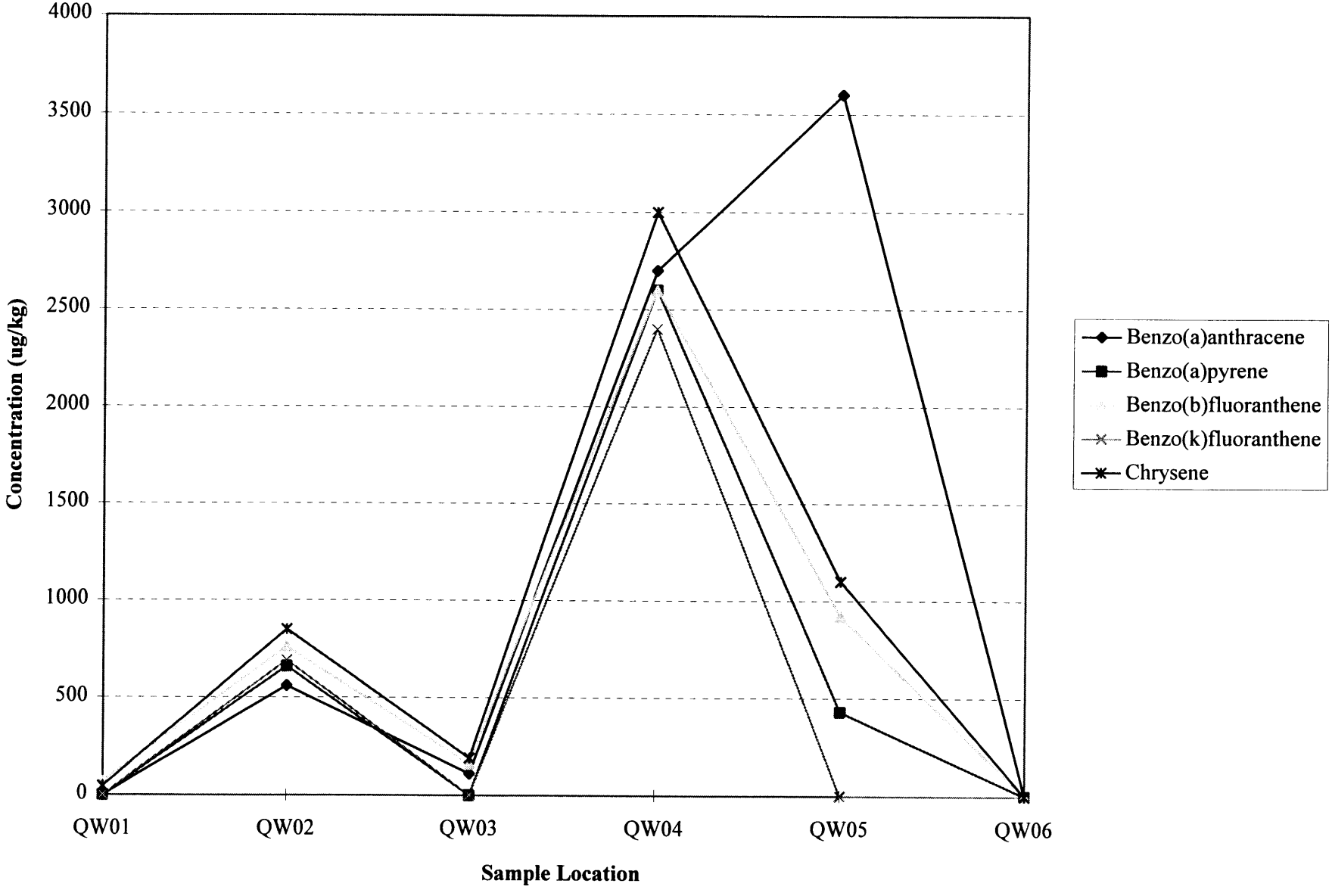


FIGURE 5-4a
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
1Qtr1Yr - November 1994



FIGU. 5-4b

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

2Qtr1Yr - January 1995

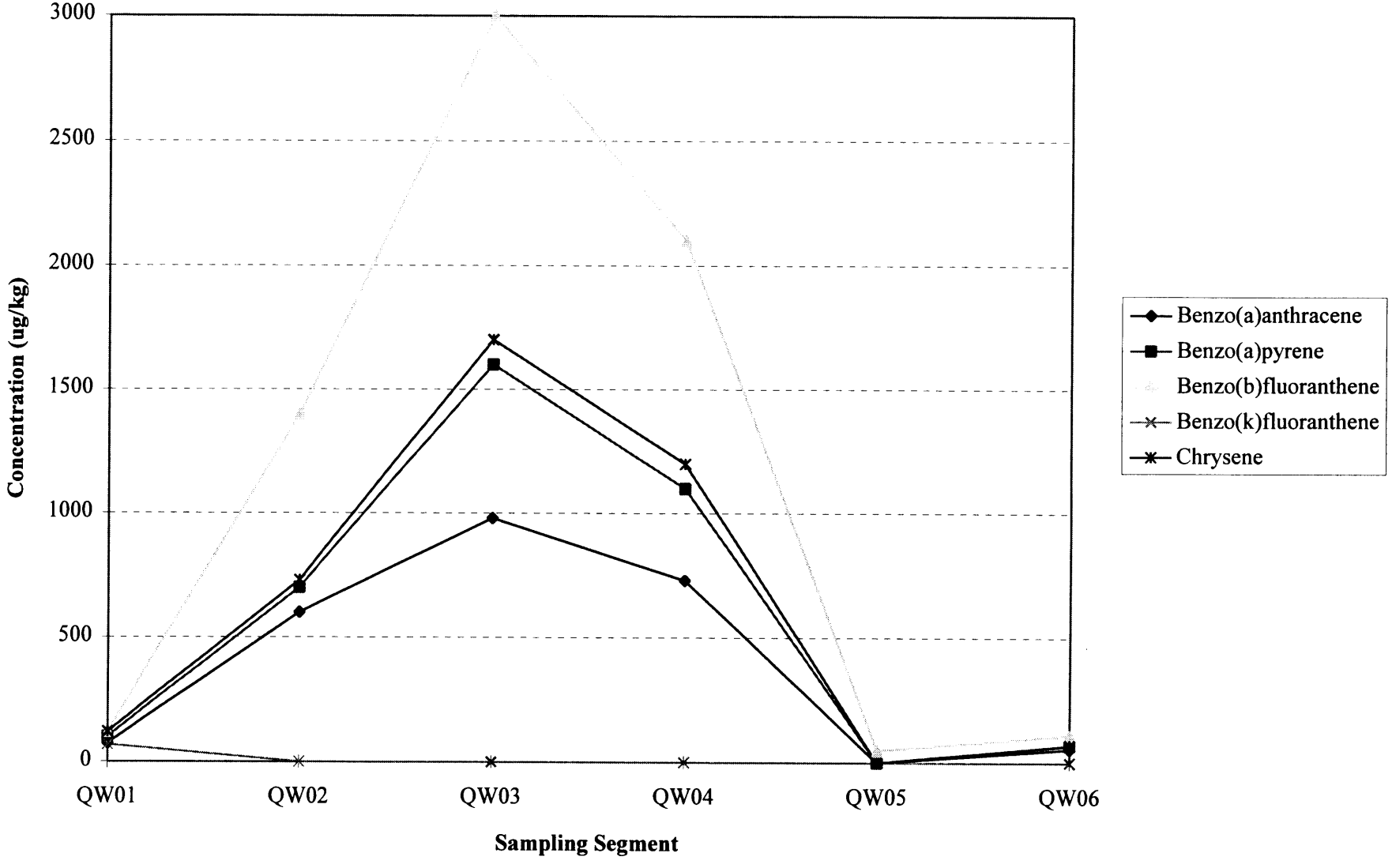
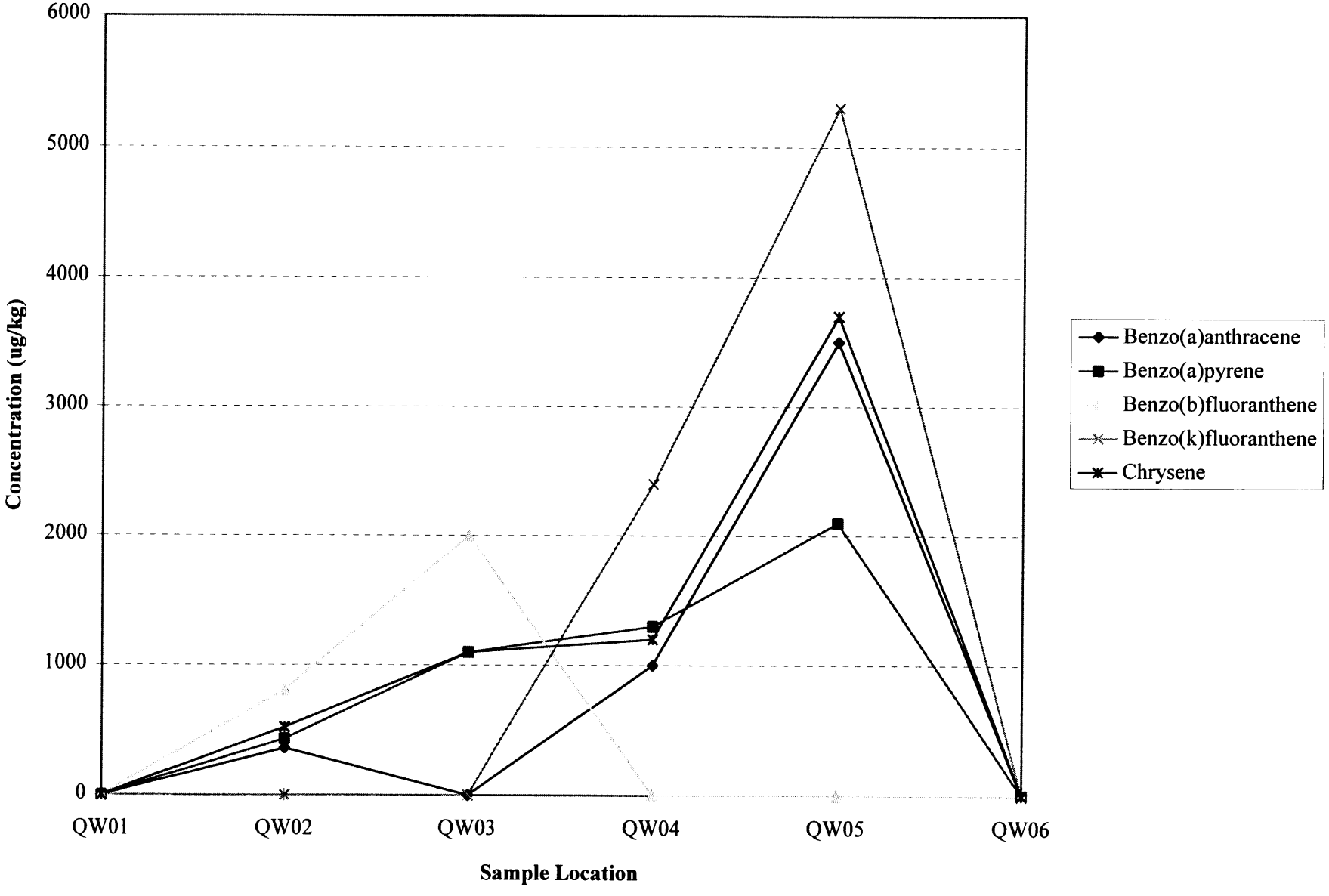


FIGURE 5-4c
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
3Qtr1Yr - April 1995



FIGU. 5-4d

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

4Qtr1Yr - July 1995

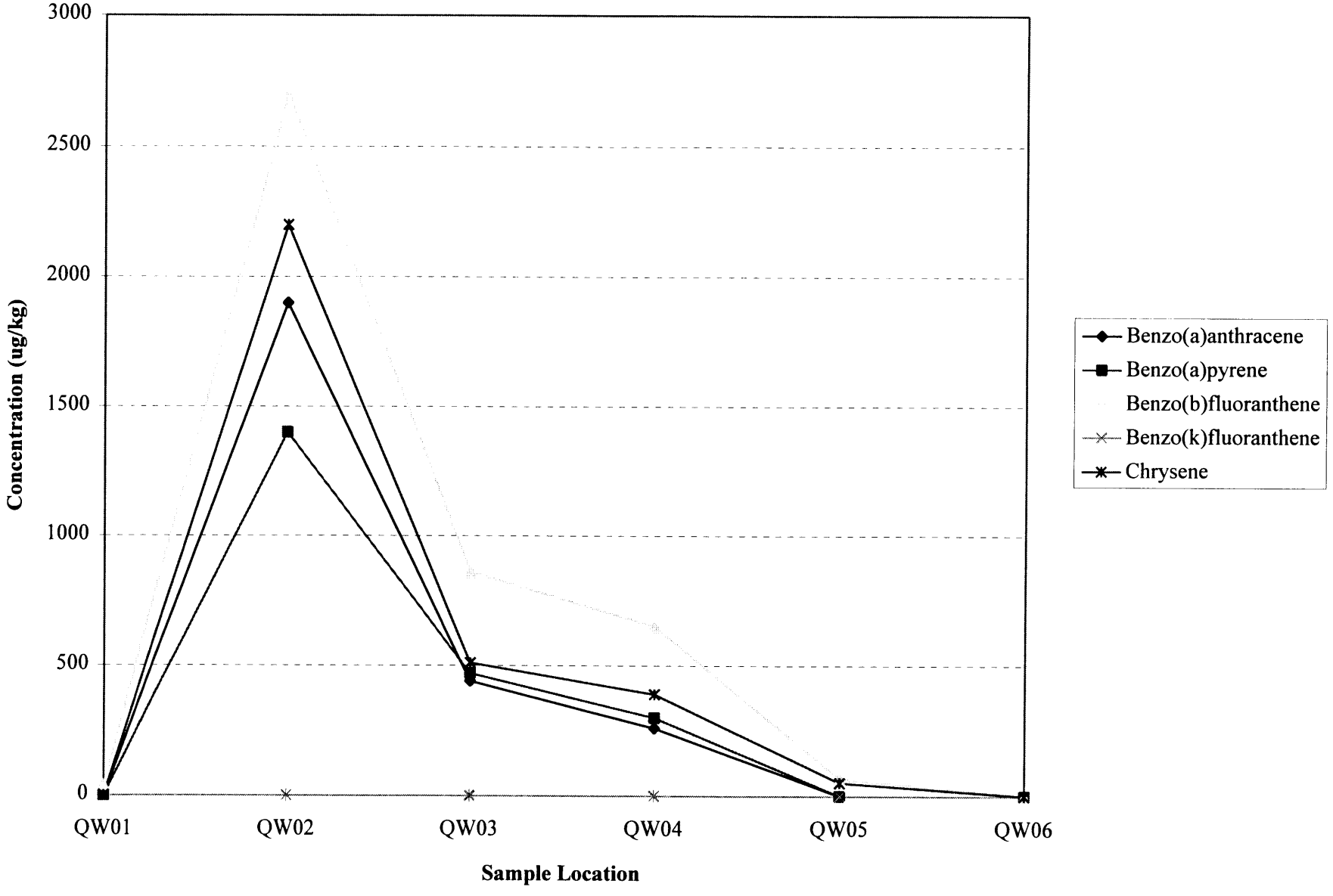
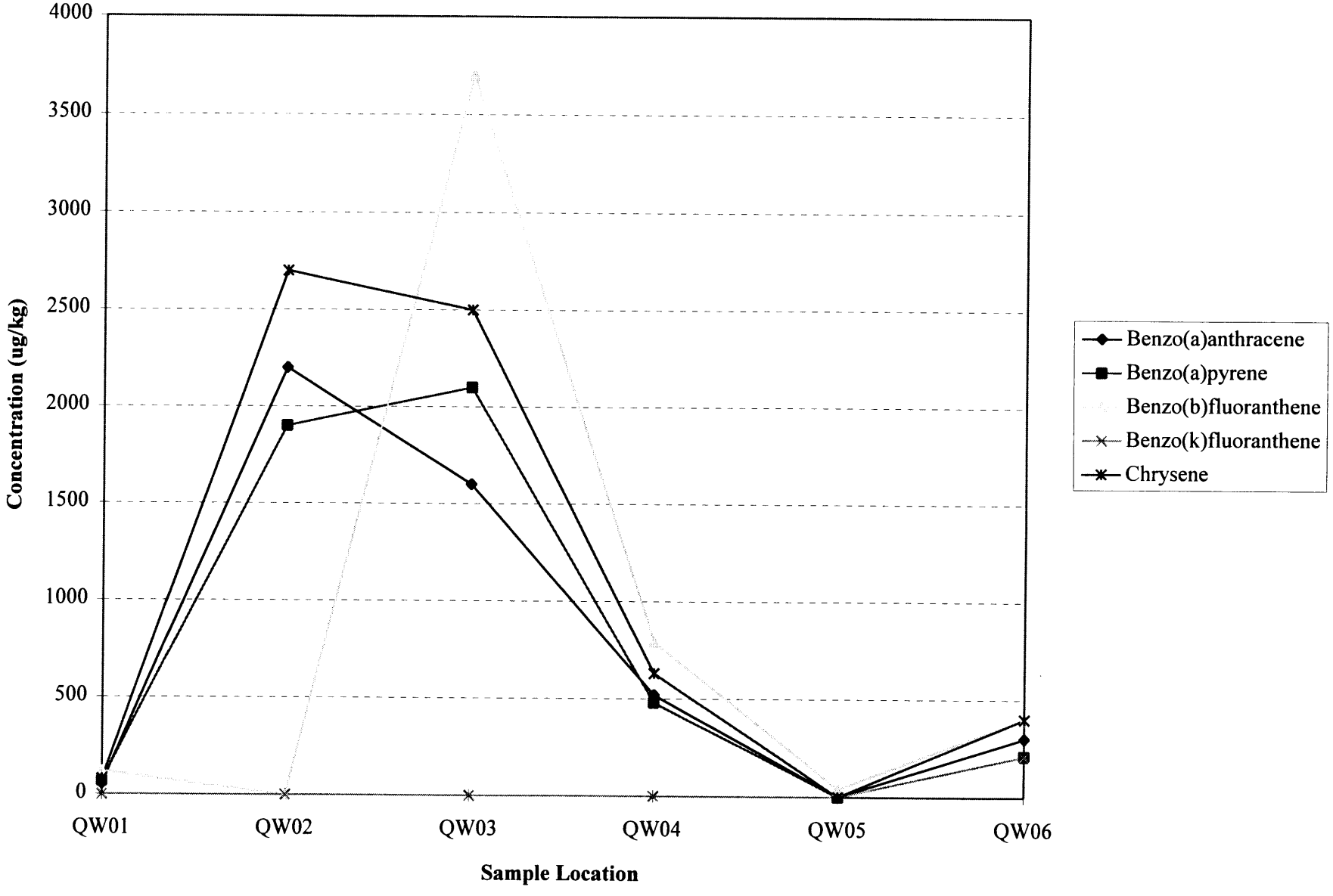


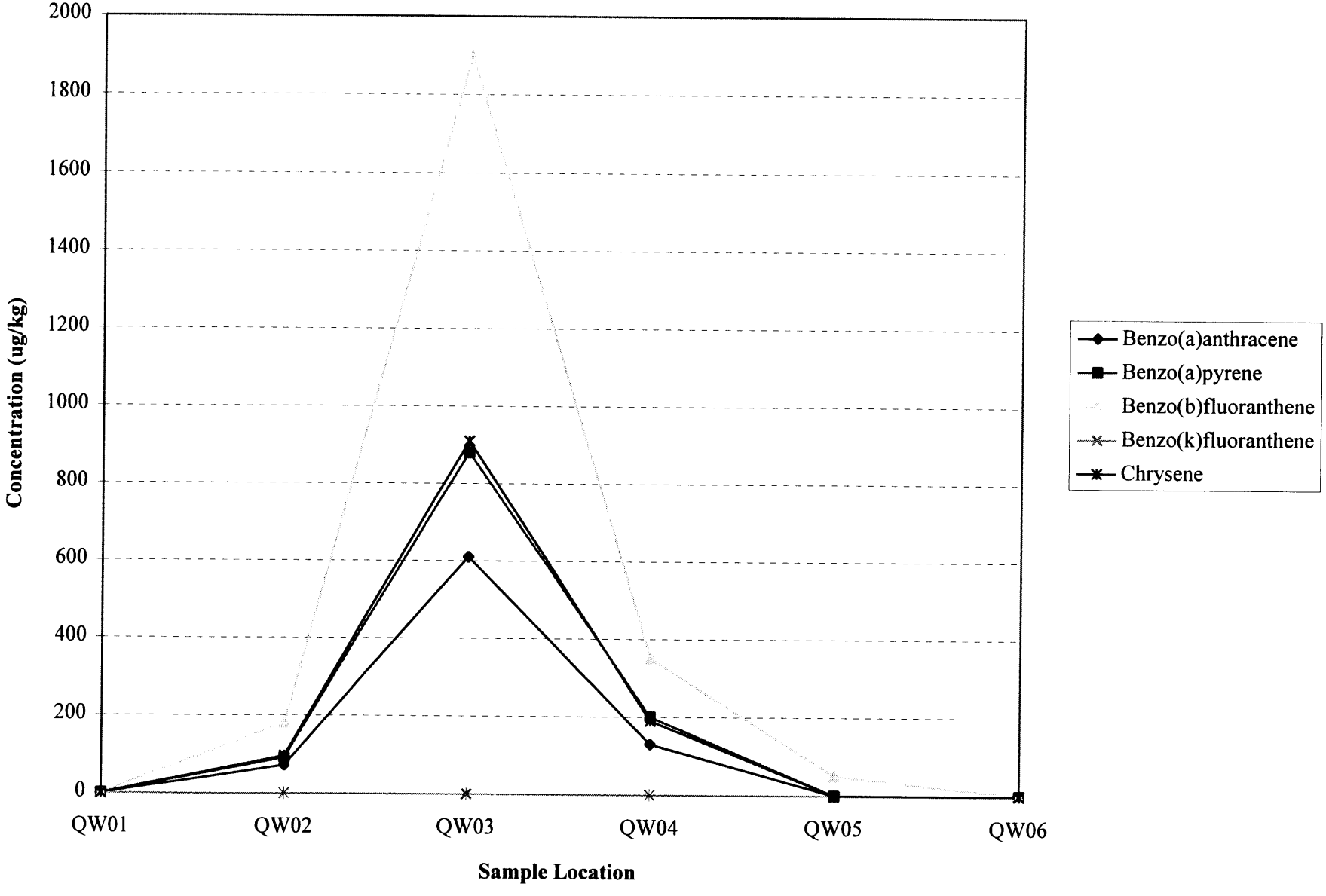
FIGURE 5-4e
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
1Qtr2Yr - October 1995



FIGU 5-4f

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

2Qtr2Yr - March 1996



tinker/d015/annual.dft/mar 1996 Chart 2/mar 1996 Chart 2 6/3/97

FIGURE 5-4g
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
3Qtr2Yr - May 1996

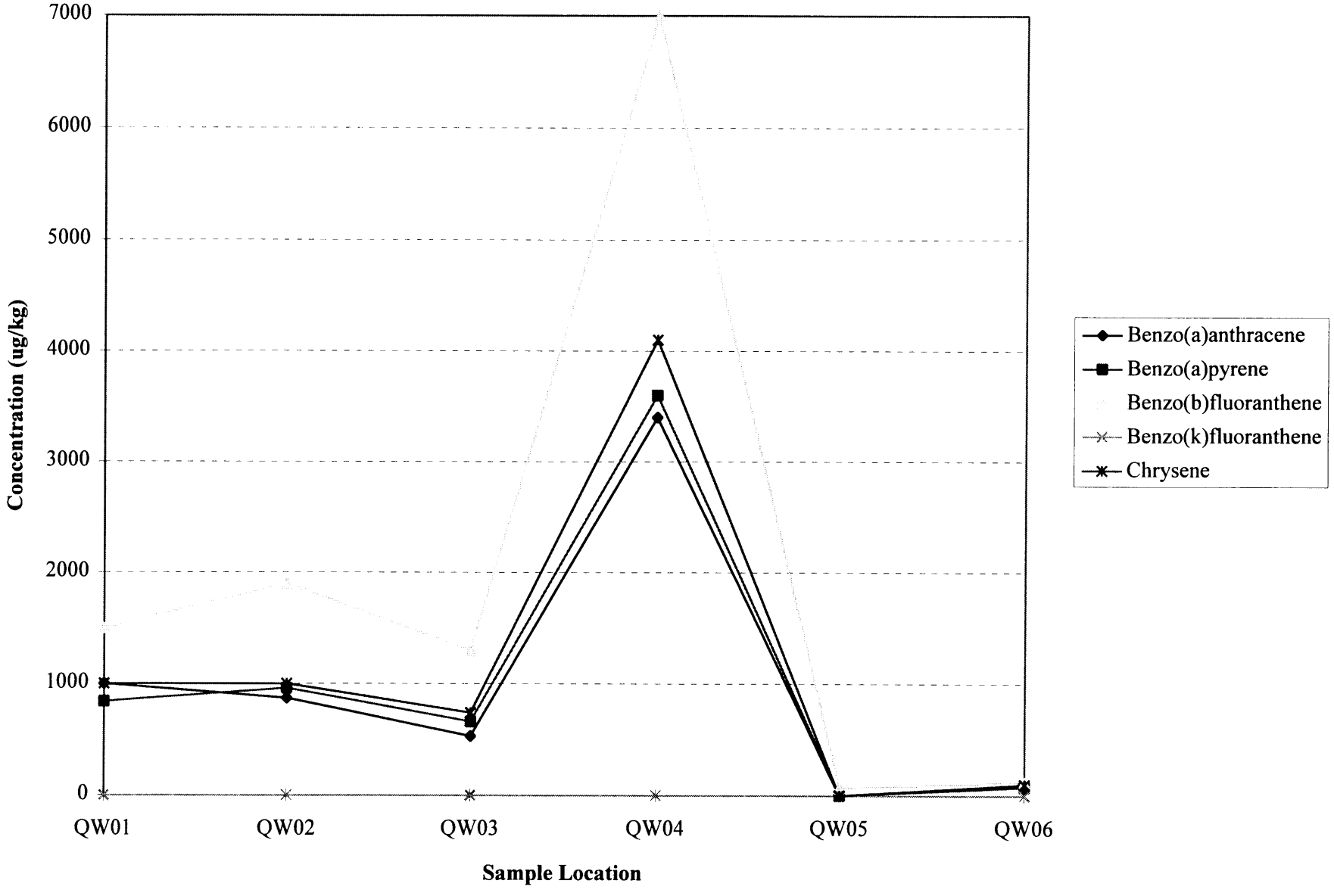
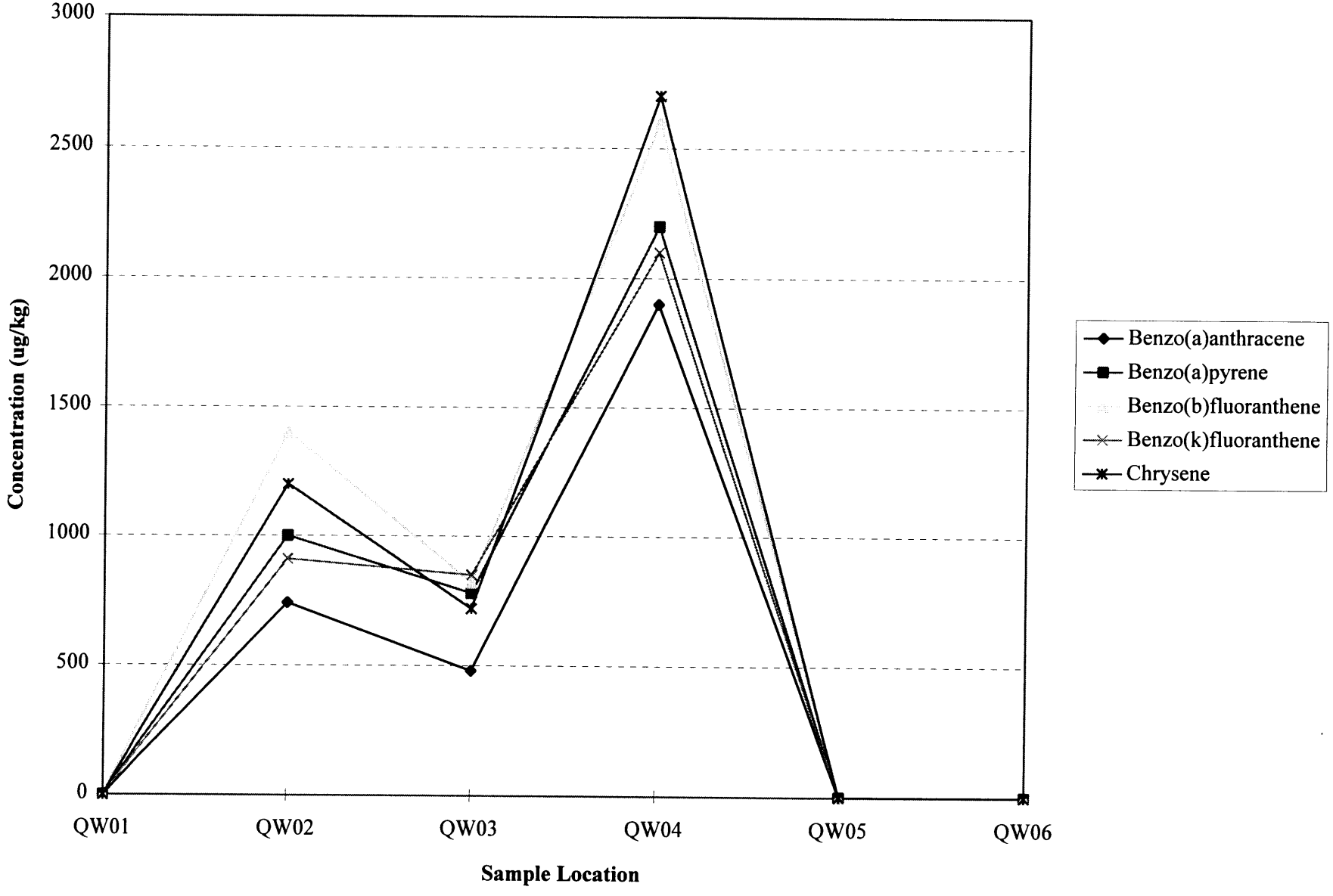


FIGURE 5-4h
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
4Qtr2Yr - Aug 1996



6.0
REVIEW OF GROUNDWATER

The RI investigated groundwater and surface water/groundwater interaction of the Soldier Creek Off-Base Groundwater Operable Unit of the Building 3001/Soldier Creek NPL site. Field work for the investigation was conducted from May 1994 through June 1995. The following discussion summarizes findings of the RI performed by PES (1995).

6.1 GROUNDWATER/SURFACE WATER INTERACTION

Measurements of stream discharge, vertical hydraulic conductivity, and hydrogeologic data were used to determine how East and West Soldier Creeks interact with the near-surface and underlying aquifer zones. Seasonal baseflow into and out of East and West Soldier Creeks, along gaining and losing segments of the creek, was also estimated. To determine the hydraulic interaction between East and West Soldier Creeks and the underlying groundwater flow system, stream discharge was determined at eight gauging stations, six streambed piezometer clusters consisting of three piezometers were installed and six measurements of streambed permeability were completed (PES, 1995).

To examine gains or losses, East and West Soldier Creeks were broken up into segments. Relative gains or losses for each segment of the two creeks were based on low flow data. West Soldier Creek is a gaining stream from September through March. During the months of April through August, West Soldier Creek is a losing stream. East Soldier Creek is generally a losing stream from its headwaters at SE 44th Street to I-40.

Results of the streambed piezometric measurements indicated that East Soldier Creek, just upstream of the confluence with Tributary B, fluctuated from losing to gaining stream between January and April. West Soldier Creek remained a gaining stream from January to April.

Streambed permeability measurements indicated that the hydraulic conditions along East and West Soldier Creeks, within the sediment and surface water quarterly monitoring study area, are dominated by extremely low hydraulic gradients and relatively impermeable substrate.

Influent reaches of the creek were estimated using stream discharge data, the vertical permeability measurement data, and potentiometric surface data from the aquifer. East Soldier Creek surface water stage elevations were above the aquifer potentiometric surface level from the headwater at SE 44th Street to about the confluence with Tributary B, indicating that this portion of the creek loses water, assuming sufficient permeability. Along West Soldier Creek, off-base stage data indicates the creek is losing water to the aquifer, assuming sufficient permeability.

6.2 ANALYTICAL

Figure 6-1 illustrates the location of groundwater monitoring wells near East and West Soldier Creeks sampled during the RI (PES, 1995). These monitoring wells were grouped into three categories based on their location, on-base East Soldier Creek, off-base East Soldier Creek, and on-base West Soldier Creek. No monitoring wells were sampled off-base West Soldier Creek during the RI. Tables 6-1 through 6-3 present the analytes detected in both groundwater and sediment for on-base East Soldier Creek, off-base East Soldier Creek, and on-base West Soldier Creek, respectively. Analysis from the RI and subsequent groundwater monitoring in June, August, and November 1995, and March/April 1996 (Brown and Root, 1996) are compared by region to the maximum sediment results detected during the second year of quarterly monitoring of East and West Soldier Creeks in these tables.

Ten inorganic analytes were detected in both the sediment and groundwater of on-base East Soldier Creek. One pesticide, six semivolatile organic compounds and eleven volatile organic compounds also were detected in both the sediment and groundwater of on-base East Soldier Creek (Table 6-1). Eight inorganic analytes, one semivolatile organic compound, and one volatile organic compound were detected in both sediment and groundwater off-base East Soldier Creek (Table 6-2). Six inorganic analytes were detected in the sediment on-base West Soldier Creek (Table 6-3). One pesticide, four semivolatile organics compounds and three volatile organic compounds also were detected in both sediment and groundwater of on-base West Soldier Creek.

TABLES

TABLE 6-1

COMPARISON OF MAXIMUM SEDIMENT RESULTS WITH GROUNDWATER RESULTS
ON-BASE EAST SOLDIER CREEK

Analyte	Maximum Sediment Result First Year Monitoring	First Year Sediment Sample Location	Maximum Sediment Result Second Year Monitoring	Second Year Sample Sediment Sample Location	23BR Layer 3 PES	23BR Layer 3 Apr 1996	20A Layer 5 Aug 95	20A Layer 5 Nov 95	20A Layer 5 PES	20A Layer 5 Mar 1996	21AR Layer 5 Aug 95	21AR Layer 5 Nov 95	21AR Layer 5 PES	21AR Layer 5 Mar 96	1-68B Layer 5 June 95	1-68B Layer 5 PES	1-68B Layer 5 Apr 96	19A Layer 3&5 Aug 95	19A Layer 3&5 Nov 95	19A Layer 3&5 PES	19A Layer 3&5 Mar 96	1-50BR Layer 3 June 95	1-50BR Layer 3 PES
Inorganics																							
Arsenic	8,400	SC-QE02-SD-301	13,200	SC-QE02-SD-801		4.2B				3.2B								2.9	5.6				
Barium	1,850,000	SC-QE03-SD-101	2,440,000	SC-QE03-SD-601	1,100	642	292	232	280	232	601	553	800	627	89	100	93.7	826	914	1,400	1,050	387	400
Cadmium	415,000	SC-QE09-SD-401	390,000	SC-QE07-SD-701	4	2.4B																	
Chromium	2,040,000	SC-QE08-SD-401	2,920,000	SC-QE03-SD-601	210	472	13.3	9.1			4.3	7	9	7.2*				39.9	49.1	50	52.1	1.3	
Copper	583,000	SC-QE03-SD-301	1,050,000	SC-QE02-SD-801	50		NA	NA			NA	NA			NA			NA	NA				
Lead	363,000	SC-QE09-SD-401	1,210,000	SC-QE02-SD-801	28		1.7				3.1	2.5						2.3					
Nickel	1,220,000	SC-QE02-SD-302	1,420,000	SC-QE02-SD-801	430	322	6.5	5.3			9.8	3.7		27	3.1		2.7B	51.1	59	59	74.9	49	62.0
Selenium	1,400	SC-QE07-SD-201	7,200	SC-QE03-SD-801			4.2			3.8B											3.2B		
Silver	53,200	SC-QE02-SD-201	38,400	SC-QE07-SD-801																		0.73	
Zinc	512,000	SC-QE06-SD-401	545,000	SC-QE02-SD-801	66		NA	NA			NA	NA	12		NA			NA	NA				
Pesticides and PCBs																							
Heptachlor	52,000	SC-QE07-SD-401	7,000	SC-QE07-SD-501																0.01			
Semivolatile Organics																							
1,2-Dichlorobenzene	2,200	SC-QE07-SD-302	3,600	SC-QE02-SD-801																			7
1,3-Dichlorobenzene	100	SC-QE07-SD-302	1800	SC-QE08-SD-702																			
1,4-Dichlorobenzene	280	SC-QE07-SD-302	4100	SC-QE08-SD-702																			8
2-Chloronaphthalene	1,400	SC-QE08-SD-401	2,100	SC-QE08-SD-702																			10
Benzo(g,h,i)perylene			20,000	SC-QE07-SD-501																			
bis(2-Ethylhexyl)phthalate			24	SC-QE07-SD-602						2J											42		
Volatile Organics																							
1,1-Dichloroethane			2.5	SC-QE07-SD-502																			
1,1-Dichloroethene										12D				0.9J							330		
cis-1,2-Dichloroethene																							5
Benzene	5.6	SC-QE02-SD-302																				200	250
Chlorobenzene	18,000	SC-QE08-SD-301	25,000	SC-QE08-SD-702																			
Chloroform	2.5	SC-QE07-SD-202								2							3						
Methylene Chloride	600	SC-QE08-SD-301	25	SC-QE07-SD-701																	24J		
Naphthalene												3.6						290	230	140	130	29	37
Tetrachloroethene	17	SC-QE03-SD-301	33	SC-QE03-SD-802		0.7J	110	120	57	63D	3	60		18				2,700	2,200	2,200	1,500	12	16
Trichloroethene	1.9	SC-QE03-SD-301																					
Vinyl Chloride																							

Notes:
Sediment results reported in ug/kg
Groundwater results reported in ug/L
NA=Not Analyzed
Blank spaces indicate analyte was not detected

TABLE 6-1

COMPARISON OF MAXIMUM SEDIMENT RESULTS WITH GROUNDWATER RESULTS
ON-BASE EAST SOLDIER CREEK

Analyte	Maximum Sediment Result First Year Monitoring	First Year Sediment Sample Location	Maximum Sediment Result Second Year Monitoring	Second Year Sample Sediment Sample Location	1-50BR Layer 3 Apr 96	1-51B Layer 3 June 95	1-51B Layer 3 PES	1-51B Layer 3 Apr 96	1-52B Layer 3 June 95	1-52B Layer 3 PES	1-52B Layer 3 Apr 96	22B Layer 3 June 95	22B Layer 3 PES	22B Layer 3 Apr 96	1-50AR Layer 5 June 95	1-50AR Layer 5 PES	1-50AR Layer 5 Apr 96	1-51AR Layer 5 June 95	1-51AR Layer 5 PES	1-51AR Layer 5 Apr 96	1-52A Layer 5 June 95	1-52A Layer 5 PES	1-52A Layer 5 Apr 96
Inorganics																							
Arsenic	8,400	SC-QE02-SD-301	13,200	SC-QE02-SD-801	3.6B												2.7B						
Barium	1,850,000	SC-QE03-SD-101	2,440,000	SC-QE03-SD-601	461	202	140	189	137	150	179	387	370	382	1,240	1,300	1,340	1,040	1,100	1,210	178	150	191
Cadmium	415,000	SC-QE09-SD-401	390,000	SC-QE07-SD-701										1.5B									
Chromium	2,040,000	SC-QE08-SD-401	2,920,000	SC-QE03-SD-601	2.5B	17.2	14	9B	1.2	7	1.6B	9.1	17	6.7	1.1		1.1B	1.9		1.2B	1.8		14.3
Copper	583,000	SC-QE03-SD-301	1,050,000	SC-QE02-SD-801											NA			NA			NA		
Lead	363,000	SC-QE09-SD-401	1,210,000	SC-QE02-SD-801								2.5											
Nickel	1,220,000	SC-QE02-SD-302	1,420,000	SC-QE02-SD-801	17.9	4.2		5.7B	21	16	18.7B	7	10	5.2	128	140.0	130	4.2	31	39.5	45.9	27	27.8
Selenium	1,400	SC-QE07-SD-201	7,200	SC-QE03-SD-801																			
Silver	53,200	SC-QE02-SD-201	38,400	SC-QE07-SD-801																			
Zinc	512,000	SC-QE06-SD-401	545,000	SC-QE02-SD-801											NA			NA			NA		
Pesticides and PCBs																							
Heptachlor	52,000	SC-QE07-SD-401	7,000	SC-QE07-SD-501																			
Semivolatile Organics																							
1,2-Dichlorobenzene	2,200	SC-QE07-SD-302	3,600	SC-QE02-SD-801											120	320	120	46	89	81			
1,3-Dichlorobenzene	100	SC-QE07-SD-302	1800	SC-QE08-SD-702												10	4J		3	3J			
1,4-Dichlorobenzene	280	SC-QE07-SD-302	4100	SC-QE08-SD-702											47	110	47	27	49	48B			
2-Chloronaphthalene	1,400	SC-QE08-SD-401	2,100	SC-QE08-SD-702	2J																		
Benzo(g,h,i)perylene			20,000	SC-QE07-SD-501				1J												2J			
bis(2-Ethylhexyl)phthalate			24	SC-QE07-SD-602				4J									1JB						
Volatile Organics																							
1,1-Dichloroethane			2.5	SC-QE07-SD-502	2												71			11			2
1,1-Dichloroethene					2																		
cis-1,2-Dichloroethane					36			6									1100			310			
Benzene	5.6	SC-QE02-SD-302			1																		
Chlorobenzene	18,000	SC-QE08-SD-301	25,000	SC-QE08-SD-702	40										730	580	640	280	260	400		4	
Chloroform	2.5	SC-QE07-SD-202				1	4																
Methylene Chloride	600	SC-QE08-SD-301	25	SC-QE07-SD-701				2			1			2B					2.2				2
Naphthalene																							
Tetrachloroethene	17	SC-QE03-SD-301	33	SC-QE03-SD-802	3										96	75	110	40	21	48			
Trichloroethene	1.9	SC-QE03-SD-301			5			1					2.8	1	450	380	560	80	56	110			
Vinyl Chloride																	360			53			

Notes:
Sediment results reported in ug/kg
Groundwater results reported in ug/L
NA=Not Analyzed
Blank spaces indicate analyte was not detected

TABLE 6-1

COMPARISON OF MAXIMUM SEDIMENT RESULTS WITH GROUNDWATER RESULTS ON-BASE EAST SOLDIER CREEK

Analyte	Maximum Sediment Result First Year Monitoring	First Year Sediment Sample Location	Maximum Sediment Result Second Year Monitoring	Second Year Sample Sediment Sample Location	22A Layer 5 June 95	22A Layer 5 PES	22A Layer 5 Apr 96
Inorganics							
Arsenic	8,400	SC-QE02-SD-301	13,200	SC-QE02-SD-801			
Barium	1,850,000	SC-QE03-SD-101	2,440,000	SC-QE03-SD-601	668	580	585
Cadmium	415,000	SC-QE09-SD-401	390,000	SC-QE07-SD-701			.88B
Chromium	2,040,000	SC-QE08-SD-401	2,920,000	SC-QE03-SD-601	1.3		1.3B
Copper	583,000	SC-QE03-SD-301	1,050,000	SC-QE02-SD-801	NA		
Lead	363,000	SC-QE09-SD-401	1,210,000	SC-QE02-SD-801			
Nickel	1,220,000	SC-QE02-SD-302	1,420,000	SC-QE02-SD-801	7.1		4.2
Selenium	1,400	SC-QE07-SD-201	7,200	SC-QE03-SD-801			
Silver	53,200	SC-QE02-SD-201	38,400	SC-QE07-SD-801			
Zinc	512,000	SC-QE06-SD-401	545,000	SC-QE02-SD-801	NA		
Pesticides and PCBs							
Heptachlor	52,000	SC-QE07-SD-401	7,000	SC-QE07-SD-501			
Semivolatile Organics							
1,2-Dichlorobenzene	2,200	SC-QE07-SD-302	3,600	SC-QE02-SD-801			
1,3-Dichlorobenzene	100	SC-QE07-SD-302	1800	SC-QE08-SD-702			
1,4-Dichlorobenzene	280	SC-QE07-SD-302	4100	SC-QE08-SD-702			
2-Chloronaphthalene	1,400	SC-QE08-SD-401	2,100	SC-QE08-SD-702			
Benzo(g,h,i)perylene			20,000	SC-QE07-SD-501			
bis(2-Ethylhexyl)phthalate			24	SC-QE07-SD-602			1JB
Volatile Organics							
1,1-Dichloroethane			2.5	SC-QE07-SD-502			
1,1-Dichloroethene							
cis-1,2-Dichloroethane							
Benzene	5.6	SC-QE02-SD-302					
Chlorobenzene	18,000	SC-QE08-SD-301	25,000	SC-QE08-SD-702			
Chloroform	2.5	SC-QE07-SD-202					
Methylene Chloride	600	SC-QE08-SD-301	25	SC-QE07-SD-701			2B
Naphthalene							
Tetrachloroethene	17	SC-QE03-SD-301	33	SC-QE03-SD-802			
Trichloroethene	1.9	SC-QE03-SD-301					
Vinyl Chloride							

Notes:
Sediment results reported in ug/kg
Groundwater results reported in ug/L
NA=Not Analyzed
Blank spaces indicate analyte was not detected

TABLE 6-2

COMPARISON OF MAXIMUM SEDIMENT RESULTS WITH GROUNDWATER RESULTS OFF-BASE EAST SOLDIER CREEK

Analyte	Maximum Sediment Result First Year Monitoring	First Year Sediment Sample Location	Maximum Sediment Result Second Year Monitoring	Second Year Sample Sediment Sample Location	TOB-11B Layer 3 June 95	TOB-11B Layer 3 PES	TOB-11B Layer 3 Apr 1996	TOB-17B Layer 5 June 95	TOB-17B Layer 5 PES	TOB-17B Layer 5 Apr 1996	TOB-20B Layer 5 June 95	TOB-20B Layer 5 PES	TOB-20B Layer 5 Apr 1996
Inorganics													
Arsenic			5,100	SC-QE11-SD-502									3.8B
Barium	1,860,000	SC-QE10-SD-301	1,490,000	SC-QE11-SD-501	283	160	286	234	620	585	171	800	497
Chromium	831,000	SC-QE11-SD-102	318,000	SC-QE11-SD-501	4.6		1.4B	1.3		1.8B	7.4		12.6
Lead	107,000	SC-QE11-SD-102	82,300	SC-QE11-SD-502							2.6		
Nickel	347,000	SC-QE11-SD-102	124,000	SC-QE11-SD-501	936		1.6B			4.9	8.5	19.6	26.1
Selenium	310	SC-QE10-SD-103	260	SC-QE11-SD-601				4.3					
Silver	19400	SC-QE11-SD-102	5,900	SC-QE11-SD-501		15							
Zinc	268,000	SC-QE11-SD-101	113,000	SC-QE11-SD-502	NA	9		NA			NA		
Semivolatile Organics													
bis (2-Ethylhexyl)phthalate			2,500	SC-QE11-SD-602									1J
Volatile Organics													
Methylene Chloride			3.5	SC-QE10-SD-502			3B			1			

Notes:
Sediment results reported in ug/kg
Groundwater results reported in ug/L
NA=Not Analyzed
Blank spaces indicate analyte was not detected

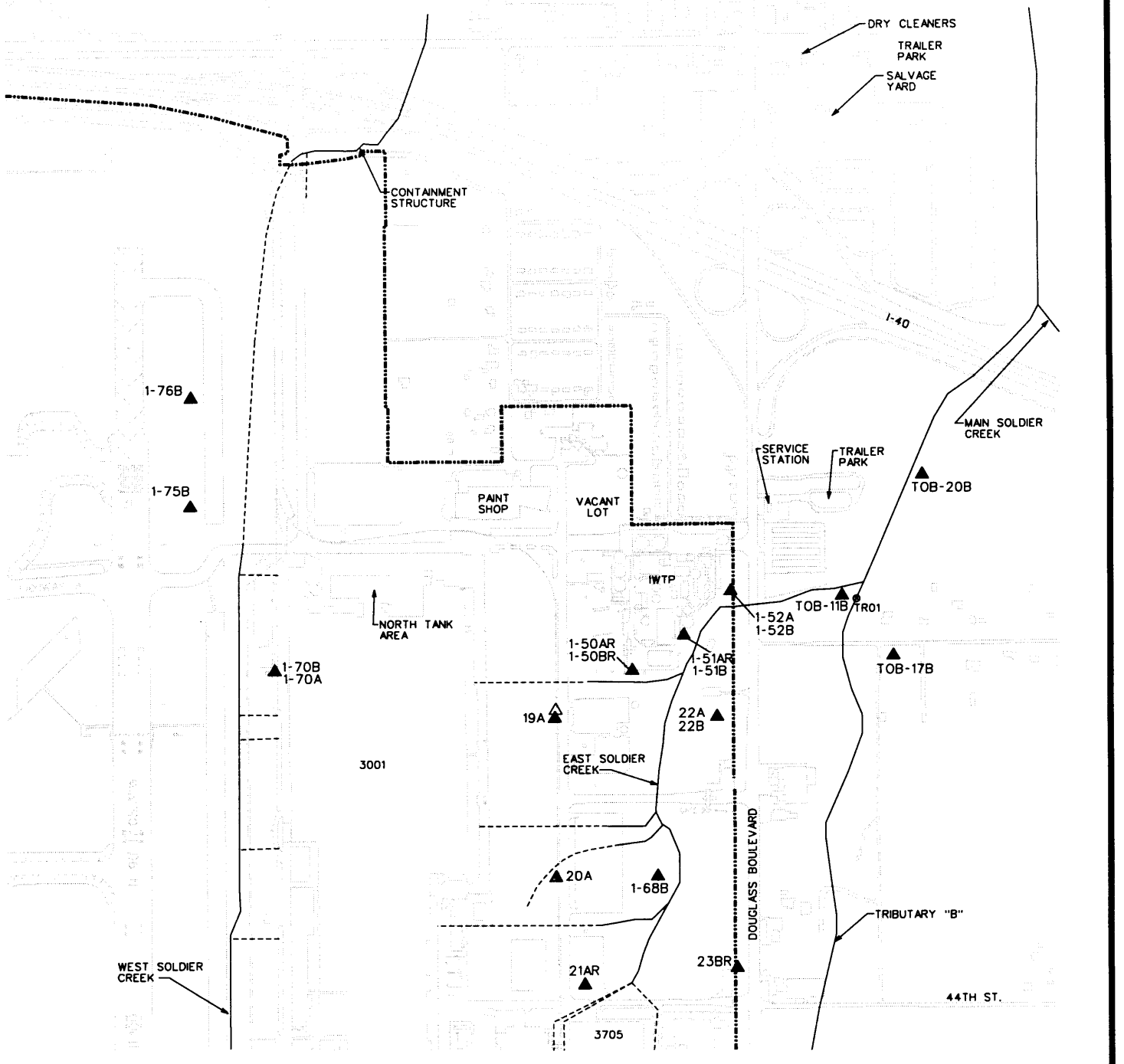
TABLE 6-3

COMPARISON OF MAXIMUM SEDIMENT RESULTS WITH GROUNDWATER RESULTS ON-BASE WEST SOLDIER CREEK

Analyte	Maximum Sediment Result First Year Monitoring	First Year Sediment Sample Location	Maximum Sediment Result Second Year Monitoring	Second Year Sample Sediment Sample Location	1-70B Layer 1 Aug 95	1-70B Layer 1 Nov 95	1-70B Layer 1 PES	1-70B Layer 1 Apr 96	1-75B Layer 1 Aug 95	1-75B Layer 1 Nov 95	1-75B Layer 1 PES	1-75B Layer 1 Apr 96	1-70A Layer 3 Aug 95	1-70A Layer 3 Nov 95	1-70A Layer 3 PES	1-70A Layer 3 Apr 96	1-76B Layer 3 Aug 95	1-76B Layer 3 Nov 95	1-76B Layer 3 PES	1-76B Layer 3 Apr 96
Inorganics																				
Arsenic			9,600	SC-QW07-SD-703				3.9B												
Barium	4,700,000	SC-QW04-SD-403	5,560,000	SC-QW07-SD-803	49	46.6	53	49.3	568	484	490	509	189	170	200	182	2,430	4,070	3,700	3,210
Cadmium			306,000	SC-QW03-SD-502								0.54B								
Chromium	3,210,000	SC-QW04-SD-402	5,140,000	SC-QW03-SD-502	19.1	23	20	21.2	44.8	141		18.8	15.5	23.4	18	8	2.8	1.6		3.1B
Lead	746,000	SC-QW04-SD-402	616,000	SC-QW03-SD-502		1.6			1.6	2.3			2.1	2.2			2.2	1.5		
Nickel	3,160,000	SC-QW03-SD-201	8,790,000	SC-QW03-SD-502	10.9	26.0	11	44.9	1100	1,090	220	514	153.0	153	19	106	4.1	2.9		5.9
Selenium	12,000	SC-QW03-SD-201	4,370,000	SC-QW01-SD-503	5.2				5.1				4.0			1.4B				
Silver	205,000	SC-QW03-SD-201	245,000	SC-QW03-SD-502				3.2B			7.2	1.4B								
PCBs and Pesticides																				
Hepatchlor								0.11												
Semivolatile Organics																				
1,2-Dichlorobenzene	570	SC-QW04-SD-202	1700	SC-QW04-SD-703			8	12												
1,3-Dichlorobenzene			150	SC-QW04-SD-703				14												
1,4-Dichlorobenzene	210	SC-QW04-SD-202	300	SC-QW04-SD-703	11		10	12												
bis(2-Ethylhexyl)phthalate			22000	SC-QW04-SD-503								2JB								
Volatile Organics																				
1,1-Dichloroethane												69								
cis-1,2-Dichloroethene								3100				370				30J				
Methylene Chloride			5.5	SC-QW03-SD-502				1100								50J				
Tetrachloroethene	16	SC-QW04-SD-102	89	SC-QW03-SD-501	7,700	9,400	2,400	7,900						71	60	31J				
Trichloroethene	77	SC-QW04-SD-102	16	SC-QW03-SD-502	140,000	200,000	160,000	5,000,000D	1,500	990	2,000	1,700	1,300	1,500	1,440	1,300				
Vinyl Chloride	15	SC-QW04-SD-202																		

Notes:
Sediment results reported in ug/kg
Groundwater results reported in ug/L
NA=Not Analyzed
Blank spaces indicate analyte was not detected

FIGURES



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- 1-76B▲ MONITORING WELL LOCATION

N

800 0 800 1600

SCALE FEET

20 MAY 97 07:28:09 k:\tinker\dgn\soldq-08.dgn

Designed By: D.D.N.	TINKER AIR FORCE BASE	
Drawn By: J.W.B.	OKLAHOMA CITY, OKLAHOMA	
Checked By: D.D.N.	TITLE: WELL LOCATION MAP	
Submitted By:	PROJECT NUMBER F96515	DATE MAY 1997
		FIG. NO. 6-1

7.0
CONCLUSIONS

The following discussion presents a summary of screening criteria exceedances during the second year of quarterly monitoring. BHRA 10^{-6} screening criteria were exceeded by six semivolatile (SVOCs) classified as polyaromatic hydrocarbons (PAHs) (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and indeno(1,2,3-cd)pyrene), HHRA I 10^{-6} screening criteria were exceeded by two pesticides (aldrin and heptachlor) and six SVOCs (benzidine, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), and HHRA I 10^{-5} screening criteria were exceeded by one pesticide (heptachlor), and one SVOC (benzo(a)pyrene) in sediment samples. Based on the ROD, exceedance of these 10^{-5} and 10^{-6} screening criteria may potentially indicate a need to evaluate if the exposure is unacceptable.

Sediment analyte concentrations from the second year of quarterly monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA I. However, at location QW03 the non-carcinogenic screening criteria for aroclor 1254 was exceeded.

Due to the sampling methodology, care must be taken when drawing inferences on temporal trends of compound concentrations. However, several trends in the detected analytes from sediment samples appear to be present.

- The detected PAH concentrations in the sediment appear to follow the same trend (e.g., an increase in one PAH compound is associated with increases in the other detected PAH compounds).

- The sampling quarter with the highest concentration of the PAH concentrations in the sediment varies between the sampling segments. This relationship suggests that multiple origins for PAHs could exist.

- Analyte concentrations are seen to decrease off-base as compared to on-base.

Surface water analyte concentrations from the second year of quarterly monitoring did not exceed any of the screening criteria set forth in the BHRA and the HHRA I.

The results of the HHRA II were compared to those presented in the HHRA I. The results of the comparison between the HHRA I and HHRA II showed no dramatic changes. Although the non-carcinogenic screening criteria was exceeded by one sample on-base West Soldier Creek, under the worker scenario, the exceedance does not trigger an unacceptable non-carcinogenic hazard. Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

8.0
REFERENCES

Black and Veatch Waste Science Technology (B&V). 1993a. Baseline Risk Assessment for Tinker Air Force Base, Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK.

Black and Veatch Waste Science Technology (B&V). 1993b. Record of Decision for Tinker Air Force Base, Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK.

Black and Veatch Waste Science Technology (B&V). 1993c. Final Remedial Investigation Report, Tinker Air Force Base, Soldier Creek, RI/FS. Report for Tinker Air Force Base, Oklahoma City, OK.

Brown and Root. 1996. Basewide Environmental Monitoring and Well Sampling and Water Level Measurements. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January 1996.

Bureau of National Affairs (BNA). 1994. Oklahoma Groundwater Quality Standards. Bureau of National Affairs.

NUS Corporation (NUS). 1989. Final Storm Sewer Investigation for Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK. October 1989.

Parsons Engineering Science (PES). 1995. Tinker Air Force Base Soldier Creek/Off-Base Groundwater Operable Unit Remedial Investigation. Internal Draft. Report for Tinker Air Force Base, Oklahoma City, OK. July 1995.

United States Department of Health and Human Services (USDHHS). 1990. Toxicological Profiles for Polycyclic Aromatic Hydrocarbons. Publication Number PB91-181537. December 1990.

United States Environmental Protection Agency (EPA). 1992. Test Methods for Evaluating Solid Waste. SW-846, Revision 1. July 1992.

United States Environmental Protection Agency (EPA). 1994a. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. February 1994 Revision.

United States Environmental Protection Agency (EPA). 1994b. Drinking Water Regulations and Health Advisories, EPA 822-R-94-001. U.S. EPA Office of Water. May 1994.

United States Geological Survey (USGS). 1984. Techniques of Water-Resources Investigations of the United States Geological Survey, Discharge Measurements at Gaging Stations. Book 3, Chapter A8.

Woodward-Clyde Federal Services (WCFS). 1994. Final Workplans for Long-Term Monitoring and Ecological Assessment of Soldier Creek Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1994.

Woodward-Clyde Federal Services (WCFS). 1996a. First Quarter Second Year Sampling Report, October 1995 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January 1996.

Woodward-Clyde Federal Services (WCFS). 1996b. Second Quarter Second Year Sampling Report, March 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1996.

Woodward-Clyde Federal Services (WCFS). 1996c. Third Quarter Second Year Sampling Report, May 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. September 1996.

Woodward-Clyde Federal Services (WCFS). 1996d. Fourth Quarter Second Year Sampling Report, August 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. November 1996.

Woodward-Clyde Federal Services (WCFS). 1997b. Final Quarterly Monitoring Annual Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. April 1997.

Woodward-Clyde Federal Services (WCFS). 1997b. Final Ecological Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. April 1997.

TABLE OF CONTENTS

Section			Page
EXECUTIVE SUMMARY			ES-1
1.0	INTRODUCTION		1-1
	1.1	SITE DESCRIPTION	1-2
	1.2	SITE OPERATIONS AND REGULATORY HISTORY	1-3
	1.3	SITE PHYSICAL SETTING	1-4
	1.4	OBJECTIVES OF THE HUMAN HEALTH RISK ASSESSMENT	1-6
2.0	CHEMICALS OF CONCERN		2-1
	2.1	CHEMICALS EVALUATED AS POTENTIAL COCS	2-1
	2.2	CHEMICALS EXCLUDED FROM THE RISK ASSESSMENT	2-2
	2.3	COC SELECTION PROCESS	2-2
		2.3.1 Chemicals Not Detected	2-2
		2.3.2 Chemicals Detected at Low Frequency	2-4
		2.3.3 Essential Nutrients	2-5
		2.3.4 Chemicals Present at Background Concentration	2-6
		2.3.5 Chemicals Considered as Laboratory Contaminants	2-8
	2.4	CHEMICALS OF CONCERN	2-8
3.0	EXPOSURE ASSESSMENT		3-1
	3.1	IDENTIFICATION OF POTENTIAL RECEPTOR POPULATIONS	3-1
	3.2	EVALUATION OF POTENTIAL EXPOSURE PATHWAYS	3-2
		3.2.1 Identification of Potential Sources of Chemical Release	3-3
		3.2.2 Identification of Potential Exposure Points and Exposure Routes	3-4
	3.3	RECEPTOR POPULATIONS NOT INCLUDED IN THE RISK ASSESSMENT	3-5
	3.4	EVALUATION OF POTENTIAL EXPOSURE PARAMETERS	3-6
		3.4.1.1 Life Span	3-7
		3.4.1.2 Exposure Duration	3-7
		3.4.1.3 Exposure Frequency	3-7

Section			Page
	3.4.1.4	Exposure Time	3-8
	3.4.1.5	Sediment Ingestion Rate	3-8
	3.4.1.6	Body Weight	3-8
	3.4.1.7	Skin Surface Area	3-9
	3.4.1.8	Dermal Sediment Adherence	3-9
	3.4.1.9	Dermal Absorption Factor	3-9
	3.4.1.10	Surface Water Ingestion Rate	3-9
	3.4.1.11	Permeability Constant	3-10
3.5	ESTIMATION OF EXPOSURE POINT CONCENTRATION		3-10
3.6	CALCULATION OF DAILY CHEMICAL INTAKES		3-12
4.0	TOXICITY ASSESSMENT		4-1
4.1	TOXICITY ASSESSMENT OF NONCARCINOGENIC EFFECTS		4-1
4.2	TOXICITY ASSESSMENT OF CARCINOGENIC EFFECTS		4-3
4.3	SOURCES OF CRITICAL TOXICITY VALUES		4-5
5.0	CHARACTERIZATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS		5-1
5.1	PROCEDURE FOR CALCULATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS		5-1
5.2	SUMMARY OF POTENTIAL NONCARCINOGENIC HEALTH HAZARD AND CANCER RISKS		5-2
6.0	REMEDIAL ACTION OBJECTIVES		6-1
7.0	UNCERTAINTY ANALYSIS		7-1
7.1	DATA COLLECTION AND EVALUATION		7-1
	7.1.1	Data Collection	7-1
	7.1.1.1	Sampling	7-2
	7.1.1.2	Analysis	7-2
	7.1.2	Data Evaluation	7-2
7.2	EXPOSURE ASSESSMENT		7-3

TABLE OF CONTENTS

Section			Page
	7.2.1	Exposure Point Concentrations	7-3
	7.2.2	Exposure Scenarios	7-4
7.3	TOXICITY ASSESSMENT		7-5
	7.3.1	Uncertainties Associated with Critical Toxicity Values	7-5
	7.3.1.1	Uncertainties Associated with the Use of Surrogates	7-6
7.4	RISK CHARACTERIZATION		7-6
7.5	REMEDIAL ACTION OBJECTIVES		7-6
8.0	TRENDS		8-1
8.1	AREA 1: ON-BASE WEST SOLDIER CREEK		8-1
8.2	AREA 2: OFF-BASE WEST SOLDIER CREEK		8-3
8.3	AREA 3: ON-BASE EAST SOLDIER CREEK		8-4
8.4	AREA 4: OFF-BASE EAST SOLDIER CREEK		8-6
9.0	SUMMARY AND CONCLUSION		9-1
10.0	REFERENCES		10-1

LIST OF TABLES

TABLE 2-1	Sampling Locations In Each Stream Segment
TABLE 2-2	Chemicals Not Detected In On-base West Soldier Creek Surface Water
TABLE 2-3	Chemicals Not Detected In Off-base West Soldier Creek Surface Water
TABLE 2-4	Chemicals Not Detected In On-base East Soldier Creek Surface Water
TABLE 2-5	Chemicals Not Detected In Off-base East Soldier Creek Surface Water
TABLE 2-6	Chemicals Not Detected In On-base West Soldier Creek Sediments
TABLE 2-7	Chemicals Not Detected In Off-base West Soldier Creek Sediments
TABLE 2-8	Chemicals Not Detected In On-base East Soldier Creek Sediments
TABLE 2-9	Chemicals Not Detected In Off-base East Soldier Creek Sediments
TABLE 2-10	Chemicals Detected At Low Frequency And Concentration On-base East Soldier Creek Surface Water
TABLE 2-11	Chemicals Detected At Low Frequency And Concentration On-base West Soldier Creek Sediments
TABLE 2-12	Chemicals Detected At Low Frequency And Concentration On-base East Soldier Creek Sediments
TABLE 2-13	Essential Nutrients Excluded As Potential COCs On-base West Soldier Creek Surface Water
TABLE 2-14	Essential Nutrients Excluded As Potential COCs Off-base West Soldier Creek Surface Water
TABLE 2-15	Essential Nutrients Excluded As Potential COCs On-base East Soldier Creek Surface Water
TABLE 2-16	Essential Nutrients Excluded As Potential COCs Off-base East Soldier Creek Surface Water
TABLE 2-17	Essential Nutrients Excluded As Potential COCs On-base West Soldier Creek Sediments
TABLE 2-18	Essential Nutrients Excluded As Potential COCs Off-base West Soldier Creek Sediments
TABLE 2-19	Essential Nutrients Excluded As Potential COCs On-base East Soldier Creek Sediments
TABLE 2-20	Essential Nutrients Excluded As Potential COCs Off-base East Soldier Creek Sediments
TABLE 2-21	Chemicals Detected At Background Levels On-base West Soldier Creek Surface Water

LIST OF TABLES

TABLE 2-22	Chemicals Detected At Background Levels In Off-base West Soldier Creek Surface Water
TABLE 2-23	Chemicals Detected At Background Levels On-base East Soldier Creek Surface Water
TABLE 2-24	Chemicals Detected At Background Levels In Off-base East Soldier Creek Surface Water
TABLE 2-25	Chemicals Detected At Background Levels On-base West Soldier Creek Sediments
TABLE 2-26	Chemicals Detected At Background Levels Off-base West Soldier Creek Sediments
TABLE 2-27	Chemicals Detected At Background Levels On-base East Soldier Creek Sediments
TABLE 2-28	Chemicals Detected At Background Levels Off-base East Soldier Creek Sediments
TABLE 2-29	Chemicals Of Concern On-base West Soldier Creek Surface Water
TABLE 2-30	Chemicals Of Concern Off-base West Soldier Creek Surface Water
TABLE 2-31	Chemicals Of Concern On-base East Soldier Creek Surface Water
TABLE 2-32	Chemicals Of Concern Off-base East Soldier Creek Surface Water
TABLE 2-33	Chemicals Of Concern On-base West Soldier Creek Sediments
TABLE 2-34	Chemicals Of Concern Off-base West Soldier Creek Sediments
TABLE 2-35	Chemicals Of Concern On-base East Soldier Creek Sediments
TABLE 2-36	Chemicals Of Concern Off-base East Soldier Creek Sediments
TABLE 3-1	Exposure Parameters Dermal Contact With Sediments
TABLE 3-2	Exposure Parameters Ingestion Of Sediments
TABLE 3-3	Exposure Parameters Dermal Contact With Surface Water
TABLE 3-4	Exposure Parameters Ingestion Of Surface Water
TABLE 3-5	Exposure Point Concentrations On-base West Soldier Creek Surface Water (Current And Future Scenarios)
TABLE 3-6	Exposure Point Concentrations Off-base West Soldier Creek Surface Water (Current And Future Scenarios)
TABLE 3-7	Exposure Point Concentrations On-base East Soldier Creek Surface Water (Current And Future Scenarios)
TABLE 3-8	Exposure Point Concentrations Off-base East Soldier Creek Surface Water (Current And Future Scenarios)
TABLE 3-9	Exposure Point Concentrations On-base West Soldier Creek Sediments (Current Scenario)
TABLE 3-10	Exposure Point Concentrations On-base West Soldier Creek Sediments (Future Scenario)

LIST OF TABLES

TABLE 3-11	Exposure Point Concentrations Off-base West Soldier Creek Sediments (Current And Future Scenarios)
TABLE 3-12	Exposure Point Concentrations On-base East Soldier Creek Sediments (Current Scenario)
TABLE 3-13	Exposure Point Concentrations On-base East Soldier Creek Sediments (Future Scenario)
TABLE 3-14	Exposure Point Concentrations Off-base East Soldier Creek Sediments
TABLE 4-1	Critical Toxicity Values
TABLE 4-2	USEPA Weight-Of-Evidence Carcinogenic Classification Of Chemicals
TABLE 5-1	Noncarcinogenic Health Hazards And Carcinogenic Risks Associated With Surface Water And Sediments In Soldier Creek (Current Scenario)
TABLE 5-2	Noncarcinogenic Health Hazards And Carcinogenic Risks Associated With Surface Water And Sediments In Soldier Creek (Current Scenario)
TABLE 6-1	Risk-based Cleanup Levels For Chemicals Of Concern In Sediments
TABLE 6-2	Risk-based Indicators Of Water Quality For Chemicals Of Concern In Surface Water
TABLE 7-1	Summary Of Uncertainties Associated With Risk Assessment For Soldier Creek
TABLE 8-1	Comparison Of First Year And Second Year Noncarcinogenic Health Hazards And Carcinogenic Risks Associated With Surface Water And Sediments In Soldier Creek (Current Base Worker Scenario)
TABLE 8-2	Comparison Of First Year And Second Year Noncarcinogenic Health Hazards And Carcinogenic Risks Associated With Surface Water And Sediments In Soldier Creek (Future Base Worker Scenario)

LIST OF TABLES

TABLE 8-3 Comparison Of First Year And Second Year Noncarcinogenic Health Hazards And Carcinogenic Risks Associated With Surface Water And Sediments In Soldier Creek (Current And Future Off-base Residential Scenario)

LIST OF FIGURES

FIGURE 1-1	Soldier Creek Long-Term Monitoring And Ecological Assessment Site Vicinity
FIGURE 1-2	Soldier Creek Quarterly Monitoring Sampling Locations
FIGURE 3-1	Site Conceptual Exposure Model - East And West Soldier Creek Tinker Air Force Base, Oklahoma City, Oklahoma

List Of Appendixes

ATTACHMENT A	Risk Calculations

An evaluation of potential risks associated with Soldier Creek surface water and sediments was previously performed by Black & Veatch Waste Science Technology (B&V 1993) and Woodward-Clyde Federal Services (WCFS 1996). Soldier Creek sediments and surface water continue to be sampled as part of the long-term monitoring of Soldier Creek. The purpose of this risk assessment (RA) is to provide estimates on potential current and future risks based on current surface water and sediment contaminant concentrations, to compare the results with those of WCFS to see if previous conclusions are still valid, to evaluate any potential trends associated with estimated risks, and to develop cleanup goals for stream sediments and surface water that are protective of human populations.

This RA was performed using guidelines provided in the Risk Assessment Guidance for Superfund - Part A [United States Environmental Protection Agency (USEPA) 1989a] and Part B (USEPA 1991b), Exposure Factors Handbook (USEPA 1989b), Standard Default Exposure Factors (USEPA 1991a), Dermal Exposure Assessment: Principles and Applications (USEPA 1992a), and USEPA Supplemental Region IV Risk Assessment Guidance (USEPA 1991d). Environmental data obtained from surface water and sediment samples collected by WCFS in the four quarterly sampling events of 1996 were used in this RA. In addition, the RA made use of recent USEPA databases, including the Integrated Risk Information System (IRIS; USEPA 1996b), Health Effects Assessment Summary Tables (HEAST; USEPA 1992d and 1994), USEPA Region III Risk-based Concentration Table (USEPA Region III 1996c) and Drinking Water Regulation and Health Advisories (USEPA February 1996a).

Based on differences in contaminant sources and exposed populations, the following four stream segments were evaluated in this risk assessment:

- West Soldier Creek, on-base
- West Soldier Creek, off-base
- East Soldier Creek, on-base

- East Soldier Creek, off-base

The chemicals of concern (COCs) identified include metals, PCBs, chlorinated pesticides, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). An evaluation of potential health risks was performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios are consistent with the RA previously completed for Tinker AFB by WCFS include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-base portions of the creeks; and

- Residents wading or swimming in the off-base portion of West and East Soldier Creeks. (Swimming was only evaluated for the child scenario for East Soldier Creek; all other scenarios assume wading only).

Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that potential cancer risks and noncarcinogenic health hazards for all scenarios are below or within the USEPA advisory range of 10^{-6} to 10^{-4} and 1.0, respectively. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or noncarcinogenic hazard for any on-base or off-base populations under current or future stream use conditions.

The results of this current RA were compared to those from the previous Baseline RA prepared by WCFS (WCFS 1997). In general, no dramatic changes between the first year WCFS RA and the second year WCFS RA were identified during the trend analysis. Therefore, no firm statement can be made regarding trends at Soldier Creek based on these results. The differences in estimated noncarcinogenic adverse health effects and carcinogenic risks are due to changes in contaminant concentrations and chemicals which were detected in the sediments and surface water. These differences are not unexpected because the stream is a dynamic system affected by such factors as precipitation levels and variations in the discharge outfalls along its length.

Despite the dynamics of the Soldier Creek system, neither RA indicated any unacceptable adverse health effects or cancer risks associated with exposure to West or East Soldier Creeks for any on-base or off-base population under current or future stream use conditions. Consequently, no remedial action appears to be warranted based on risks to human health.

As part of the risk assessment, a set of cleanup goals was developed to identify health-protective levels for each COC. Although remediation does not appear to be warranted at the present time (based on risk to human health), the cleanup goals provide a set of "action criteria" should remedial action be required in the future.

1.0
INTRODUCTION

The purpose of an RA, as defined by USEPA, is to "provide a framework for developing the risk information necessary to assist decision-making at remedial sites" [Risk Assessment Guidance for Superfund (RAGS); USEPA 1989a]. As such, this document specifically addresses potential risks associated with exposure to surface water and sediment from portions of East and West Soldier Creek that may have been impacted by contaminant releases from Tinker Air Force Base (AFB).

The organization of this RA follows the basic structure presented in the RAGS. In addition, sections have been included on trend analysis from the previous WCFS RA and the development of Remedial Action Objectives (RAOs). The individual sections of this RA consist of the following:

- A discussion of pertinent site background information
- Identification of site-specific COCs for each of the four stream segments under investigation
- An exposure assessment that identifies potentially exposed populations and the exposure parameters used to quantify chemical uptake by those populations
- An assessment of the toxic properties of the chemicals of concern
- An estimation of the potential cancer risks and noncarcinogenic health hazards for exposed populations
- Development of RAOs for those COCs estimated to pose an unacceptable risk or hazard to potentially exposed populations

- An analysis of uncertainties associated with each of the steps of the risk assessment, and the likely impact of these uncertainties on the results and conclusions of the risk assessment

- Risk trend analysis

- Conclusions and recommendations

1.1 SITE DESCRIPTION

As illustrated on **Figure 1-1**, Tinker Air Force Base (AFB) is located within the corporate limits of Oklahoma City, Oklahoma, approximately seven miles east-southeast of Oklahoma City's metropolitan area. The Base is bounded by Midwest City on the north, Del City on the northwest, and Oklahoma City on the east, south, and southwest. The boundaries of Tinker AFB are defined by Sooner Road to the west, Douglas Boulevard to the east, Southeast 29th Street to the north, and Southeast 74th Street to the south. Midwest City and Del City are heavily populated with residential and commercial areas. The area under Oklahoma City jurisdiction is lightly developed residential. Tinker AFB lies within an area representing a transition from residential and industrial/commercial land use on the north and west to agricultural land use to the east and south.

The principal surface water drainage ways for Tinker AFB are the Crutcho, Kuhlman, and Soldier Creeks (**Figure 1-2**). The main portion of Soldier Creek is located to the east of Tinker AFB, flowing to the north from its headwaters near Southwest 59th Street to its confluence with Crutcho Creek. Two tributaries (West and East Soldier Creek) originate on the Base. For the purpose of this RA, the tributary of Soldier Creek east of Building 3001 is named East Soldier Creek and the tributary west of Building 3001 is named West Soldier Creek. East Soldier Creek flows northward from its origin north of Building 3705, along the east side of Building 3001, past the Industrial Wastewater Treatment Plant (IWTP), to its confluence with Soldier Creek approximately one mile downstream. West Soldier Creek originates on the west side of Building 3001 and flows northward to its confluence with Soldier Creek approximately two miles downstream.

As identified in the Work Plan (WCFS 1994), the current scope of investigation includes those portions of East and West Soldier Creeks from their points of origin extending to their intersection with Interstate 40 north of the Base. Study area boundaries were identified based on the Remedial Investigation (RI) (B&V 1993). Data from the RI indicated that a contaminant concentration gradient exists to a point south (upstream) of the study boundary. The study area boundary was established based on the following criteria:

- Limits of measurable levels of contaminants (as compared to background locations)
- Area of such size that a definitive assessment could be performed
- Allowance for source identification

Because the contaminants and contaminant sources for East Soldier Creek differ from West Soldier Creek, these streams are evaluated separately. In addition, on-base stream segments of both streams are evaluated separately from their off-base segments due to differences in potentially exposed populations. Stream segments and exposure scenarios evaluated in this RA are the same as those used in the RA from 1996 (WCFS 1996). Based on this approach, the following four stream segments are evaluated separately in this RA:

- West Soldier Creek, on-base
- West Soldier Creek, off-base
- East Soldier Creek, on-base
- East Soldier Creek, off-base

1.2 SITE OPERATIONS AND REGULATORY HISTORY

Tinker AFB is an active military industrial facility responsible for the maintenance of a wide variety of military aircraft. Tinker AFB was activated in March of 1942 under the name of Midwest Air Depot. During World War II, the depot was responsible for reconditioning, modifying, and modernizing aircraft, vehicles, and equipment. The primary mission has not

changed. Tinker AFB is still a major industrial complex for overhauling modifying and repairing military aircraft engines and accessory items.

As part of the overall Air Force Installation Restoration Program (IRP), Tinker AFB began investigation of previously used disposal sites in 1981 (USEPA 1988). A Base-wide sampling program was conducted in 1983. Analytical results from the sampling program indicated trichloroethene was present in the groundwater. Remedial investigations were conducted by Tinker AFB through the Tulsa District Corps of Engineers (COE) from 1986 to 1989 to determine the nature and extent of groundwater contamination in the building complex area. These investigations determined that chromium, in addition to trichloroethene, was a contaminant of concern in groundwater. On July 22, 1987, the Building 3001 site and the Soldier Creek site were added to the National Priorities List (NPL). In 1990 and 1991, B&V conducted a Phase I and Phase II Remedial Investigation/Feasibility Study (RI/FS) to determine the extent of sediment and surface water contamination along East, West, and Main Soldier Creek. As part of the RI, B&V performed a baseline human health risk assessment and concluded that sediment and surface water in Soldier Creek did not pose an unacceptable risk to human health (B&V 1993). WCFS did a subsequent risk assessment and again found that the sediment and surface water in Soldier Creek posed no unacceptable risk to human health (WCFS 1996). Since submission of the RI/FS, Tinker AFB has reduced or eliminated releases from several outfalls, including the IWTP outfall, which was closed in April of 1996.

1.3 SITE PHYSICAL SETTING

Tinker AFB is located in an area characterized by gently rolling hills, broad flat plains, and well-entrenched main streams. Ground level ranges from 1,210 feet above sea level on the northwest side of the Base to about 1,320 feet at the southeast corner of the Base above mean sea level (Radian 1985). Historic data from the Tinker AFB weather station indicate that the average annual precipitation at Tinker AFB is approximately 34 inches per year. Rainfall occurs in a distinct, seasonal pattern ranging from a high of 5.8 inches in May to a low of 1.2 inches in January (Parsons 1995).

Soldier Creek and its tributaries receive surface runoff from approximately 9,000 acres. Surface runoff produces periods of high and low stream flow based on the annual precipitation cycle. Areas on Tinker AFB that contribute runoff or discharge to Soldier Creek and its tributaries include the easternmost runway areas and the Building 3001 complex. The Building 3001 complex consists of an aircraft overhaul and modification complex to support the mission of the Oklahoma City Air Logistics Center.

The IWTP, located in the northeastern portion of the Base, received industrial process discharge waters from the Building 3001 complex and other buildings and operations in the area through a series of underground lines. At the plant, these waters were treated and discharged to East Soldier Creek under a National Pollutant Discharge Elimination System (NPDES) permit. IWTP is currently used as a pretreatment facility which no longer discharges to East Soldier Creek on a regular basis. However, the IWTP is still permitted for use in case of emergency.

A sanitary wastewater treatment facility also discharged to East Soldier Creek under the same permit as the IWTP. Sanitary waste currently discharges directly to the Oklahoma City POTW.

A storm sewer investigation was conducted by NUS Corporation (1989) to characterize the sources of the outfalls to Soldier Creek from Tinker AFB. This study identified the following four categories of waste discharge:

- Process discharge, such as cooling tower blowdown
- Low volume sources, such as oils derived from compressors, vacuum pumps and fume handling systems that enter the storm sewer system
- Inappropriate disposal of wastes, such as solvents and lubricating oils, into floor drains catch basins, etc. This is believed to represent the primary source of contamination to Soldier Creek

- Cross-contamination between waste systems and the storm sewers due to improper connections or broken lines

Discharges from the various Tinker AFB outfalls are thought to represent semicontinuous sources to both East and West Soldier Creeks. Studies by Parsons indicate that the relative contribution of the outfalls bear little, if any, correlation to the annual precipitation cycle (Parsons 1995). Thus, it is likely the Tinker AFB outfalls will have year-round influence on surface water quality, while site runoff is more likely to influence surface water in a seasonal fashion.

1.4 OBJECTIVES OF THE HUMAN HEALTH RISK ASSESSMENT

An evaluation of risks associated with Soldier Creek surface water and sediments was previously performed by WCFS (1996). The purpose of this RA is to provide information on potential current and future risks based on current contaminant levels, and then compare the results with those of the previous WCFS RA (1996) to see if the previous conclusions are still valid. This RA used the same exposure values and assumptions as the previous risk assessment so that a direct comparison of results could be made. Finally, this RA developed cleanup goals for stream sediments that are protective of human populations.

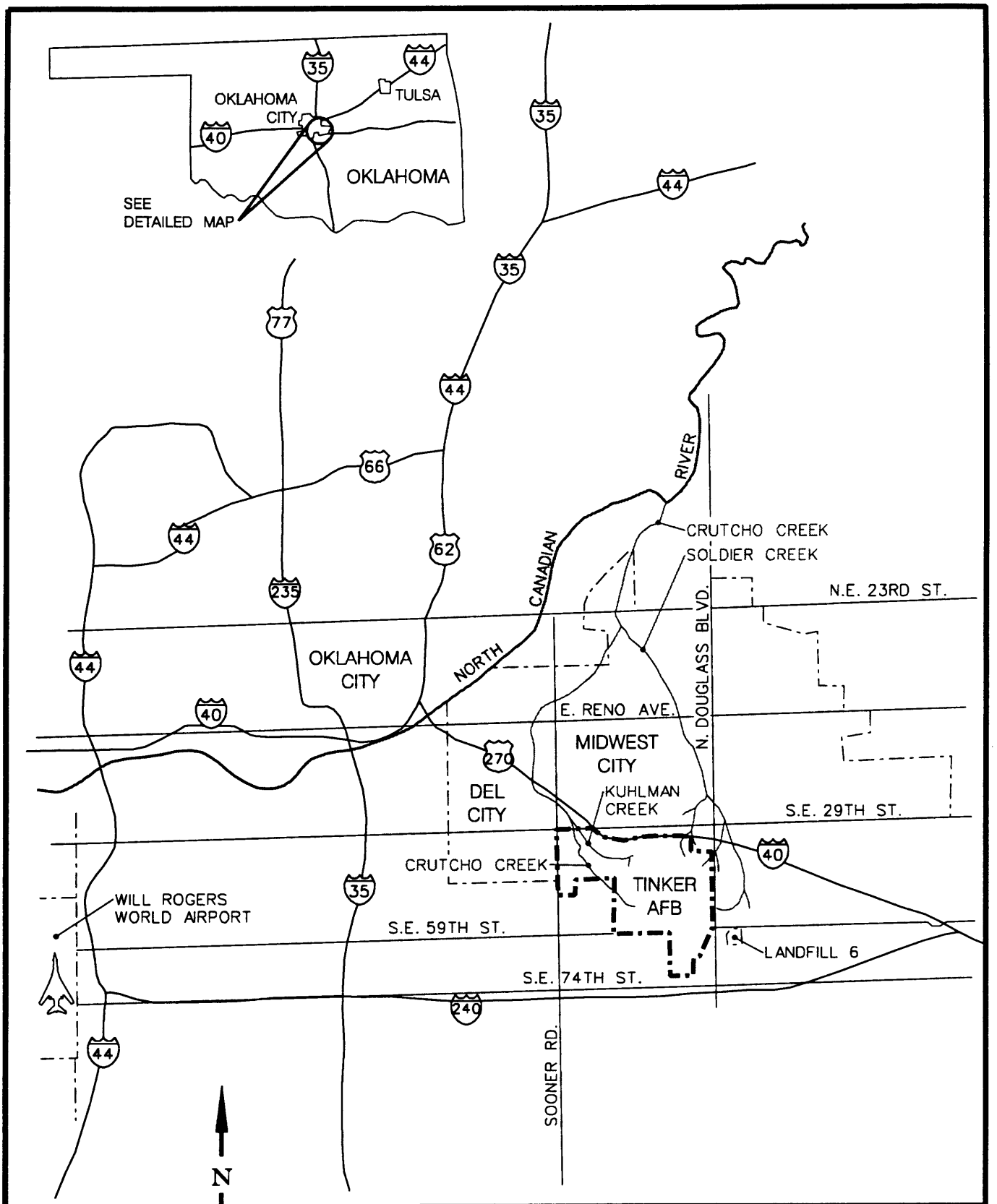
As mentioned previously, development of quantitative risk estimates for potentially exposed populations is based on guidance provided in the RAGS. In addition, a variety of factors are used to characterize and quantify potential health risks, including:

- Chemical fate and transport characteristics
- Basic toxicology information
- Site-specific information relative to potentially exposed populations, exposure routes, exposure point concentrations, and general site conditions

USEPA guidance documents used to conduct the RA include RAGS, the Exposure Factors Handbook (1989b), Standard Default Exposure Factors (1991a), Health Effects Assessment Summary Tables (HEAST 1992-1994), Integrated Risk Information System on-line database

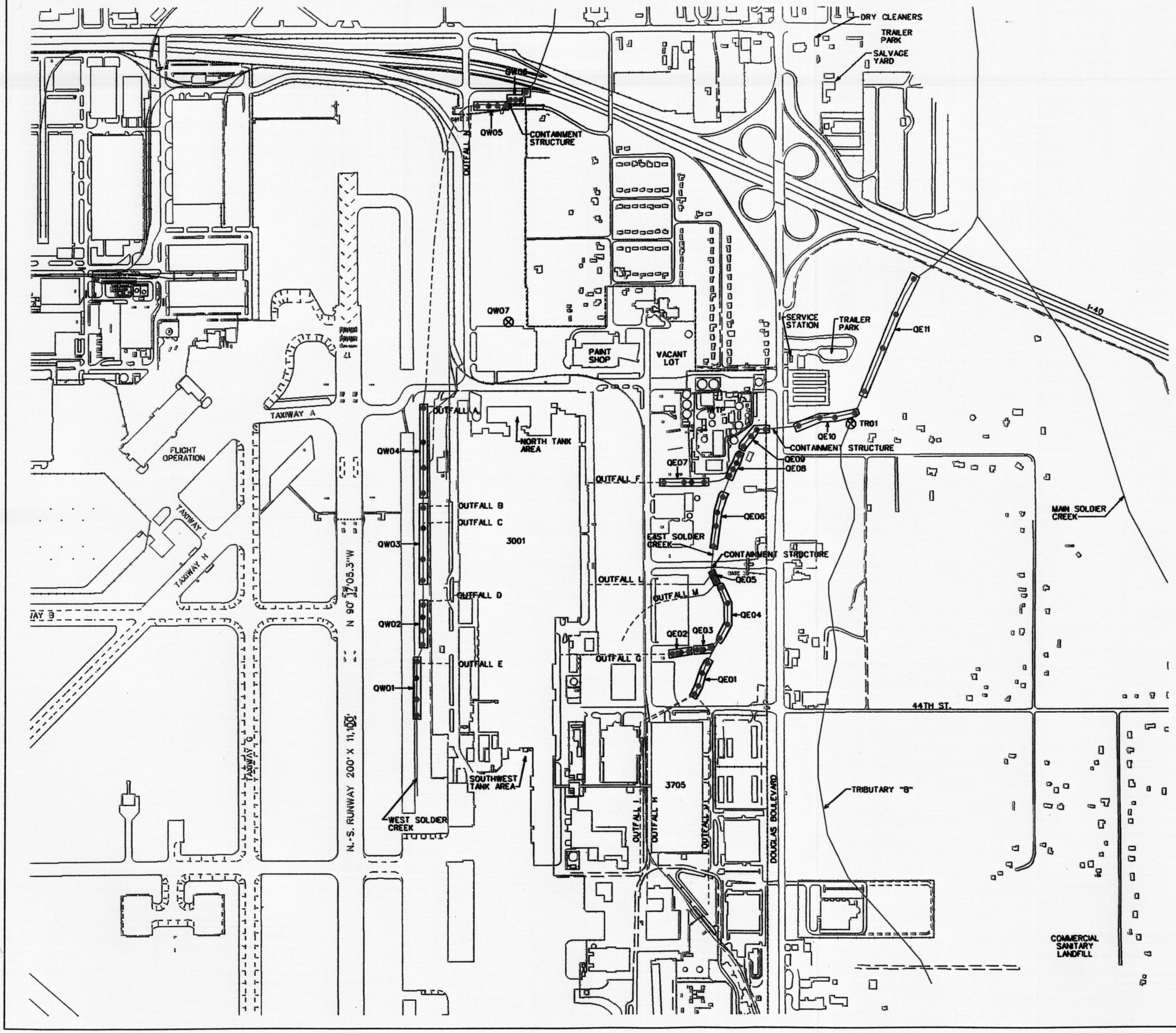
(IRIS 1996b), Dermal Exposure Assessment: Principles and Applications (1992a) and Risk Assessment Guidance for Superfund Part B, Development of Risk-based Preliminary Remediation Goals (1991b).

FIGURES



MCS FILE: SITEMAP

Designed By: D.D.N.	TINKER AIR FORCE BASE		
Drawn By: T.R.F.	OKLAHOMA CITY, OKLAHOMA		
Checked By: D.J.K.	TITLE: **TINKER AIR FORCE BASE VICINITY MAP**		
Submitted By:	PROJECT NUMBER **F95511**	DATE **JAN 97**	FIG. NO. 1-1



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B AND QW07
- • 1ST QUARTER SAMPLE LOCATION
- • 2ND QUARTER SAMPLE LOCATION
- • 3RD QUARTER SAMPLE LOCATION
- • 4TH QUARTER SAMPLE LOCATION

N

800 0 800 1600

SCALE FEET

MCS FILE: SOLDQ-01-RF-CTAB81

Designed By: D.D.N.	TINKER AIR FORCE BASE		
	OKLAHOMA CITY, OKLAHOMA		
Drawn By: T.R.F.	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING LOCATIONS		
Checked By: D.J.K			
Submitted By:	PROJECT NUMBER F96515	DATE JAN 1997	FIG. NO. 1-2

2.0
CHEMICALS OF CONCERN

The purpose of the RA was to evaluate the potential human health risks associated with the site under the no-action alternative (i.e., in the absence of remedial and corrective action). The first step in this evaluation was the selection process used to identify a group of chemicals of concern (COCs). This group of chemicals, although a subset of all chemicals detected on-site, represents those chemicals posing the greatest potential health risks at the site. Thus, the quantification of potential health risks posed by the site can be focused on the COCs without significantly underestimating the total risk. The basic approach used to develop COCs in this report was similar to that used in the RA performed by WCFS (1996). Separate lists of COCs have been generated for sediments and surface water for each of the stream segments being investigated, using USEPA selection criteria. The following sections present the COC selection process.

2.1 CHEMICALS EVALUATED AS POTENTIAL COCS

The identification of COCs was based on an evaluation of chemical data from surface water and sediment samples collected by Woodward-Clyde in the quarterly sampling events of 1996. **Table 2-1** lists the sampling locations associated with each investigation area. A total of four classes of chemicals were evaluated:

- Volatile organic compounds (46 analytes)
- Semivolatile organic compounds (91 analytes)
- PCBs/Pesticides (27 analytes)
- Metals (24 analytes)

The numbers in parentheses denote the number of analytes within each class of chemicals for which analyses were performed. (The number of analytes for surface water varied slightly from those listed above for sediments.)

2.2 CHEMICALS EXCLUDED FROM THE RISK ASSESSMENT

Although the analytical results identified a number of chemicals present in sediment and surface water samples from Soldier Creek, not all of these chemicals are likely to pose risks to human health. Therefore, it is appropriate to systematically exclude selected chemicals from the RA so that the quantitative risk characterization can effectively focus on only those chemicals posing the greatest potential health risks. The RAGS (USEPA 1989a) describes several procedures to reduce the number of chemicals to be considered. Chemicals can be systematically excluded for any of the following reasons:

- The compound was not detected in any sample
- The compound was found at a low frequency and concentration
- The compound was found at background levels
- The compound has a low inherent toxicity or is an essential element
- The compound was identified as a laboratory contaminant

The rationale for excluding chemicals meeting any of these criteria is that their contribution to the incremental health risks posed by the site is negligible.

The following sections present the COC selection process and final lists of COCs for surface water and sediments from East and West Soldier Creek.

2.3 COC SELECTION PROCESS

2.3.1 Chemicals Not Detected

Chemicals not detected in a specific stream segment and medium (surface water or sediment) were excluded from the medium-specific COC list for that stream segment. The following tables list chemicals excluded from the COC list because they were not detected:

- **Table 2-2** lists a total of 160 chemicals for which analyses were performed, but were not detected in the surface water in the on-base portion of West Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-3** lists a total of 163 chemicals for which analyses were performed, but were not detected in the surface water in the off-base portion of West Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-4** lists a total of 140 chemicals for which analyses were performed, but were not detected in the surface water in the on-base portion of East Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-5** lists a total of 158 chemicals for which analyses were performed, but were not detected in the surface water in the off-base portion of East Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-6** lists a total of 115 chemicals for which analyses were performed, but were not detected in the sediments in the on-base portion of West Soldier Creek. These chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-7** lists a total of 146 chemicals for which analyses were performed, but were not detected in the sediments in the off-base portion of West Soldier Creek. These chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-8** lists a total of 101 chemicals for which analyses were performed, but were not detected in the sediments in the on-base portion of East Soldier

Creek. As a result, these chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-9** lists a total of 136 chemicals for which analyses were performed, but were not detected in the sediments in the off-base portion of East Soldier Creek. As a result, these chemicals were excluded from the sediment COC list for this stream segment.

2.3.2 Chemicals Detected at Low Frequency

Chemicals detected with low frequency and low concentration do not indicate a clear pattern of contamination. Moreover, the potential health risks that may be associated with low detection-frequency compounds are expected to be much lower compared with more prevalent chemicals based on the potential for more frequent human exposure. In accordance with the RAGS (USEPA 1989a), a frequency of 5 percent was used as the assessment criterion (i.e., chemicals were excluded as potential COCs if they were present $\leq$ 5 percent of all samples). Additionally, all chemicals detected in 5 percent (or less) of the samples were compared to USEPA Region III Risk-based Concentrations (RBCs) (USEPA 1996c). If the maximum detected concentration exceeded the RBC for industrial soils, the chemical was retained as a COC. If the maximum concentration was below the EPA Region III RBC, the chemical was excluded as a potential COC.

Because of the limited number of surface water samples collected from the on-base and off-base portions of West Soldier Creek and the off-base portion of East Soldier Creek, no chemicals could be excluded from the COC list on the basis of low frequency of detection for these three areas. Additionally, the off-base segments for both the West and East Soldier Creek sediments also had a limited number of samples; thus, no chemicals were excluded from the COC list based on low frequency of detection criterion. The following tables list chemicals that were excluded as potential COCs based on the low frequency and low concentration criteria.

- **Table 2-10** lists a total of 9 chemicals detected at low frequency and at low concentrations in surface water samples collected from the on-base portion of

East Soldier Creek. These chemicals were excluded from the surface water COC list for that stream segment.

- **Table 2-11** lists a total of 13 chemicals detected at low frequency and at low concentrations in sediments collected from the on-base portion of West Soldier Creek. These chemicals were excluded from the sediment COC list for that stream segment.

- **Table 2-12** lists a total of 24 chemicals detected at low frequency and at low concentrations in sediments collected from the on-base portion of East Soldier Creek. These chemicals were excluded from the sediment COC list for that stream segment.

2.3.3 Essential Nutrients

Chemicals that are essential nutrients may be excluded from consideration when they are present at relatively low levels (i.e., levels that are likely to produce beneficial rather than toxic effects) (USEPA 1989a). Comparisons were made between the maximum detected concentrations of essential nutrients found in surface water and sediment and the recommended daily allowances (RDAs) established by the National Research Council (NRC) (1989). Daily intake of nutrients from Soldier Creek was estimated by assuming that an individual ingests 0.5 L/day of surface water (an upper-bound water ingestion value assuming 10 hours swimming), or 100 mg/kg of sediments (the upper-bound daily soil ingestion rate for adults). Essential nutrients include calcium, chromium, copper, fluoride, iodine, iron, magnesium, manganese, molybdenum, phosphorus, selenium, and zinc.

In addition to chemicals excluded based on RDAs, sodium was also excluded based on comparison with normal dietary intake. While sodium is an essential nutrient, there is not an established RDA for this element. The normal dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson 1992), while dietary levels less than 1,000 mg/day are considered "sodium-restricted."

The following tables list chemicals that are essential nutrients and that were excluded from the COC lists because they are present at concentrations that are likely to be beneficial rather than detrimental:

- A total of 9 nutrients (**Table 2-13**) were excluded from the surface water COC list for the on-base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-14**) were excluded from the surface water COC list for the off-base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-15**) were excluded from the surface water COC list for the on-base portion of East Soldier Creek.

- A total of 10 nutrients (**Table 2-16**) were excluded from the surface water COC list for the off-base portion of East Soldier Creek.

- A total of 10 nutrients (**Table 2-17**) were excluded from the sediment COC list for the on-base portion of West Soldier Creek.

- A total of 11 nutrients (**Table 2-18**) were excluded from the sediment COC list for the off-base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-19**) were excluded from the sediment COC list for the on-base portion of East Soldier Creek.

- A total of 11 nutrients (**Table 2-20**) were excluded from the sediment COC list for the off-base portion of East Soldier Creek.

2.3.4 Chemicals Present at Background Concentration

As noted in the RAGS (USEPA 1989a), a comparison of sample concentrations to naturally occurring background concentrations can be used to identify nonsite-related chemicals. This approach was taken for evaluating inorganic chemicals only. The maximum concentrations for samples collected from an upstream and off-base portion of Crutcho Creek (PES 1996)

were considered as the background concentrations. Chemicals found to be present at concentrations within 2 times background concentrations were assumed to be present at background levels (as defined in USEPA Region IV, USEPA 1991d), and were subsequently not included on the list of potential chemicals of concern. Based on this analysis, the following chemicals were excluded as potential COCs:

- A total of 3 chemicals (**Table 2-21**) were excluded from the surface water COC list on-base portion of West Soldier Creek because they were detected at background levels.

- A total of 3 chemicals (**Table 2-22**) were excluded from the surface water COC list for the off-base portion of West Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-23**) were excluded from the surface water COC list the on-base portion of East Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-24**) were excluded from the surface water COC list for the off-base portion of East Soldier Creek because they were detected at background levels.

- A total of 2 chemicals (**Table 2-25**) were excluded from the sediment COC list for the on-base portion of West Soldier Creek because they were detected at background levels.

- A total of 5 chemicals (**Table 2-26**) were excluded from the sediment COC list for the off-base portion of West Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-27**) were excluded from the sediment COC list for the on-base portion of East Soldier Creek because they were detected at background levels.

- A total of 6 chemicals (**Table 2-28**) were excluded from the sediment COC list for the off-base portion of East Soldier Creek because they were detected at background levels.

2.3.5 Chemicals Considered as Laboratory Contaminants

Methylene chloride in all sediment and surface water samples was considered to be a laboratory contaminant by comparing the detected concentration with the laboratory method blanks. Therefore, it was excluded as a potential COC.

2.4 CHEMICALS OF CONCERN

A group of chemicals were identified as chemicals of concern based on the criteria described in the previous sections for each environmental medium (surface water and sediments) in each stream segment. It is important to note that many of the identified COCs are present at very low concentrations, well below health-based criteria such as maximum contaminant levels (MCLs). These chemicals have been retained for future evaluation as a conservative measure. The selected chemicals will be further evaluated in the process of a quantitative RA to determine whether these chemicals may contribute risks to the human receptors discussed in **Section 3.0**. The chemicals of concern, maximum and minimum detected concentrations, and frequency of detection are listed in the following tables:

- **Table 2-29** presents the COCs for surface water in the on-base portion of West Soldier Creek.

- **Table 2-30** presents the COCs for surface water in the off-base portion of West Soldier Creek.

- **Table 2-31** presents the COCs for surface water in the on-base portion of East Soldier Creek.

- **Table 2-32** presents the COCs for surface water in the off-base portion of East Soldier Creek.

- **Table 2-33** presents the COCs for sediments in the on-base portion of West Soldier Creek.

- **Table 2-34** presents the COCs for sediments in the off-base portion of West Soldier Creek.

- **Table 2-35** presents the COCs for sediments in the on-base portion of East Soldier Creek.

- **Table 2-36** presents the COCs for sediments in the off-base portion of East Soldier Creek

TABLES

TABLE 2-1

SAMPLING LOCATIONS IN EACH STREAM SEGMENT

AREA	SAMPLE LOCATION
On-Base West Soldier Creek (Area 1)	QW01 QW02 QW03 QW04 QW07
Off-Base West Soldier Creek (Area 2)	QW05 QW06
On-Base East Soldier Creek (Area 3)	QE01 QE02 QE03 QE04 QE05 QE06 QE07 QE08 QE09
Off-Base East Soldier Creek (Area 4)	QE10 QE11

TABLE 2-2
CHEMICALS NOT DETECTED IN ON-BASE
WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	9
	Lead	9
	Selenium	9
	Silver	9
	Thallium	9
PCBs/Pesticides	4,4'-DDD	9
	4,4'-DDE	9
	4,4'-DDT	9
	Aldrin	9
	Aroclor 1016	9
	Aroclor 1221	9
	Aroclor 1232	9
	Aroclor 1242	9
	Aroclor 1248	9
	Aroclor 1254	9
	Aroclor 1260	9
	Dieldrin	9
	Endosulfan I	9
	Endosulfan II	9
	Endosulfan sulfate	9
	Endrin	9
	Endrin aldehyde	9
	Heptachlor	9
	Heptachlor epoxide	9
	Methoxychlor	9
	Toxaphene	9
	alpha-BHC	9
	alpha-Chlordane	9
	beta-BHC	9
	delta-BHC	9
	gamma-BHC (Lindane)	9
	gamma-Chlordane	9
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	9
	1,2,4-Trichlorobenzene	9
	1,2-Dichlorobenzene	9
	1,3-Dichlorobenzene	9
	1,4-Dichlorobenzene	9
	1-Chloronaphthalene	9
	1-Naphthylamine	9
	2,3,4,6-Tetrachlorophenol	9
	2,4,5-Trichlorophenol	9
	2,4,6-Trichlorophenol	9
	2,4-Dichlorophenol	9
	2,4-Dimethylphenol	9
	2,4-Dinitrophenol	9
	2,4-Dinitrotoluene	9

TABLE 2-2
CHEMICALS NOT DETECTED IN ON-BASE
WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2,6-Dichlorophenol	9
(Continued)	2,6-Dinitrotoluene	9
	2-Chloronaphthalene	9
	2-Chlorophenol	9
	2-Methylnaphthalene	9
	2-Methylphenol	9
	2-Naphthylamine	9
	2-Nitrophenol	9
	2-Picoline	9
	3,3'-Dichlorobenzidine	9
	3,3'-Dimethylbenzidine	9
	3-Methylcholanthrene	9
	3-Nitroaniline	9
	3/4-Methylphenol	9
	4,6-Dinitro-2-methylphenol	9
	4-Aminobiphenyl	9
	4-Bromophenyl phenyl ether	9
	4-Chloro-3-methylphenol	9
	4-Chloroaniline	9
	4-Chlorophenyl phenyl ether	9
	4-Nitroaniline	9
	4-Nitrophenol	9
	7,12-Dimethylbenz(a)-anthracene	9
	Acenaphthene	9
	Acenaphthylene	9
	Acetophenone	9
	Aniline	9
	Anthracene	9
	Azobenzene	9
	Benzidine	9
	Benzo(a)anthracene	9
	Benzo(a)pyrene	9
	Benzo(b)fluoranthene	9
	Benzo(g,h,i)perylene	9
	Benzo(k)fluoranthene	9
	Benzyl alcohol	9
	Butyl benzyl phthalate	9
	Chrysene	9
	Di-n-butyl phthalate	9
	Di-n-octyl phthalate	9
	Dibenz(a,h)anthracene	9
	Dibenzofuran	9
	Diethyl phthalate	9
	Diphenylamine	9
	Ethyl methanesulfonate	9
	Fluoranthene	9

TABLE 2-2
CHEMICALS NOT DETECTED IN ON-BASE
WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Fluorene	9
(Continued)	Hexachlorobenzene	9
	Hexachlorobutadiene	9
	Hexachlorocyclopentadiene	9
	Hexachloroethane	9
	Indeno(1,2,3-cd)pyrene	9
	Isophorone	9
	Methyl methanesulfonate	9
	N-Nitroso-di-n-butylamine	9
	N-Nitroso-di-n-propylamine	9
	N-Nitrosodiphenylamine	9
	N-Nitrosopiperidine	9
	Naphthalene	9
	Nitrobenzene	9
	Pentachlorobenzene	9
	Pentachloronitrobenzene	9
	Pentachlorophenol	9
	Phenacetin	9
	Phenanthrene	9
	Phenol	9
	Pronamide	9
	Pyrene	9
	a,a-Dimethylphenethyl-amine	9
	bis(2-Chloroethoxy)methane	9
	bis(2-Chloroethyl) ether	9
	bis(2-Chloroisopropyl)ether	9
	bis(2-Ethylhexyl)phthalate	9
	p-Dimethylaminoazobenzene	9
Volatile Organics	1,1,1,2-Tetrachloroethane	9
	1,1,1-Trichloroethane	9
	1,1,2,2-Tetrachloroethane	9
	1,1,2-Trichloroethane	9
	1,1-Dichloroethane	9
	1,1-Dichloroethene	9
	1,2,3-Trichloropropane	9
	1,2-Dichloroethane	9
	1,2-Dichloropropane	9
	2-Butanone (MEK)	9
	2-Chloroethyl vinyl ether	9
	2-Hexanone	9
	4-Methyl-2-pentanone (MIBK)	9
	Acrolein	9
	Acrylonitrile	9
	Benzene	9
	Bromodichloromethane	9
	Bromoform	9

TABLE 2-2
CHEMICALS NOT DETECTED IN ON-BASE
WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Bromomethane	9
(Continued)	Carbon tetrachloride	9
	Chlorobenzene	9
	Chloroethane	9
	Chloroform	9
	Chloromethane	9
	Dibromochloromethane	9
	Dibromomethane	9
	Dichlorodifluoromethane	9
	Ethyl methacrylate	9
	Ethylbenzene	9
	Iodomethane	9
	Methylene chloride	9
	Styrene	9
	Trichlorofluoromethane	9
	Vinyl acetate	9
	Vinyl chloride	9
	Xylenes (total)	9
	cis-1,3-Dichloropropene	9
	trans-1,2-Dichloroethene	9
	trans-1,3-Dichloropropene	9
	trans-1,4-Dichloro-2-butene	9

TABLE 2-3
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	6
	Lead	6
	Silver	6
	Thallium	6
PCBs/Pesticides	4,4'-DDD	8
	4,4'-DDE	8
	4,4'-DDT	8
	Aldrin	8
	Aroclor 1016	8
	Aroclor 1221	8
	Aroclor 1232	8
	Aroclor 1242	8
	Aroclor 1248	8
	Aroclor 1254	8
	Aroclor 1260	8
	Dieldrin	8
	Endosulfan I	8
	Endosulfan II	8
	Endosulfan sulfate	8
	Endrin	8
	Endrin aldehyde	8
	Heptachlor	8
	Heptachlor epoxide	8
	Methoxychlor	8
	Toxaphene	8
	alpha-BHC	8
	alpha-Chlordane	8
	beta-BHC	8
	delta-BHC	8
	gamma-BHC (Lindane)	8
	gamma-Chlordane	8
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	8
	1,2,4-Trichlorobenzene	8
	1,2-Dichlorobenzene	8
	1,3-Dichlorobenzene	8
	1,4-Dichlorobenzene	8
	1-Chloronaphthalene	8
	1-Naphthylamine	8
	2,3,4,6-Tetrachlorophenol	8
	2,4,5-Trichlorophenol	8
	2,4,6-Trichlorophenol	8
	2,4-Dichlorophenol	8
	2,4-Dimethylphenol	8
	2,4-Dinitrophenol	8
	2,4-Dinitrotoluene	8
	2,6-Dichlorophenol	8
	2,6-Dinitrotoluene	8
	2-Chloronaphthalene	8

TABLE 2-3
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
	2-Chlorophenol	8
	2-Methylnaphthalene	8
	2-Methylphenol	8
	2-Naphthylamine	8
	2-Nitrophenol	8
	2-Picoline	8
	3,3'-Dichlorobenzidine	8
	3,3'-Dimethylbenzidine	8
	3-Methylcholanthrene	8
	3-Nitroaniline	8
	3/4-Methylphenol	8
	4,6-Dinitro-2-methylphenol	8
	4-Aminobiphenyl	8
	4-Bromophenyl phenyl ether	8
	4-Chloro-3-methylphenol	8
	4-Chloroaniline	8
	4-Chlorophenyl phenyl ether	8
	4-Nitroaniline	8
	4-Nitrophenol	8
	7,12-Dimethylbenz(a)-anthracene	8
	Acenaphthene	8
	Acenaphthylene	8
	Acetophenone	8
	Aniline	8
	Anthracene	8
	Azobenzene	8
	Benzidine	8
	Benzo(a)anthracene	8
	Benzo(a)pyrene	8
	Benzo(b)fluoranthene	8
	Benzo(g,h,i)perylene	8
	Benzo(k)fluoranthene	8
	Benzyl alcohol	8
	Butyl benzyl phthalate	8
	Chrysene	8
	Di-n-butyl phthalate	8
	Di-n-octyl phthalate	8
	Dibenz(a,h)anthracene	8
	Dibenzofuran	8
	Diethyl phthalate	8
	Dimethyl phthalate	8
	Diphenylamine	8
	Ethyl methanesulfonate	8
	Fluoranthene	8
	Fluorene	8
	Hexachlorobenzene	8
	Hexachlorobutadiene	8
	Hexachlorocyclopentadiene	8

TABLE 2-3
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
	Hexachloroethane	8
	Indeno(1,2,3-cd)pyrene	8
	Isophorone	8
	Methyl methanesulfonate	8
	N-Nitroso-di-n-butylamine	8
	N-Nitroso-di-n-propylamine	8
	N-Nitrosodiphenylamine	8
	N-Nitrosopiperidine	8
	Naphthalene	8
	Nitrobenzene	8
	Pentachlorobenzene	8
	Pentachloronitrobenzene	8
	Pentachlorophenol	8
	Phenacetin	8
	Phenanthrene	8
	Phenol	8
	Pronamide	8
	Pyrene	8
	a,a-Dimethylphenethyl-amine	8
	bis(2-Chloroethoxy)methane	8
	bis(2-Chloroethyl) ether	8
	bis(2-Chloroisopropyl)ether	8
	bis(2-Ethylhexyl)phthalate	8
	p-Dimethylaminoazobenzene	8
Volatile Organics	1,1,1,2-Tetrachloroethane	8
	1,1,1-Trichloroethane	8
	1,1,2,2-Tetrachloroethane	8
	1,1,2-Trichloroethane	8
	1,1-Dichloroethane	8
	1,1-Dichloroethene	8
	1,2,3-Trichloropropane	8
	1,2-Dichloroethane	8
	1,2-Dichloropropane	8
	2-Butanone (MEK)	8
	2-Chloroethyl vinyl ether	8
	2-Hexanone	8
	4-Methyl-2-pentanone (MIBK)	8
	Acrolein	8
	Acrylonitrile	8
	Benzene	8
	Bromodichloromethane	8
	Bromoform	8
	Bromomethane	8
	Carbon disulfide	8
	Carbon tetrachloride	8
	Chlorobenzene	8
	Chloroethane	8
	Chloroform	8

TABLE 2-3
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
	Chloromethane	8
	Dibromochloromethane	8
	Dibromomethane	8
	Dichlorodifluoromethane	8
	Ethyl methacrylate	8
	Ethylbenzene	8
	Iodomethane	8
	Styrene	8
	Tetrachloroethene	8
	Toluene	8
	Trichloroethene	8
	Trichlorofluoromethane	8
	Vinyl acetate	8
	Vinyl chloride	8
	Xylenes (total)	8
	cis-1,3-Dichloropropene	8
	trans-1,2-Dichloroethene	8
	trans-1,3-Dichloropropene	8
	trans-1,4-Dichloro-2-butene	8

TABLE 2-4
CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	27
	Silver	27
	Thallium	27
PCBs/Pesticides	4,4'-DDD	36
	4,4'-DDE	36
	4,4'-DDT	36
	Aldrin	36
	Aroclor 1016	36
	Aroclor 1221	36
	Aroclor 1232	36
	Aroclor 1242	36
	Aroclor 1248	36
	Aroclor 1254	36
	Aroclor 1260	36
	Dieldrin	36
	Endosulfan I	36
	Endosulfan II	36
	Endosulfan sulfate	36
	Endrin	36
	Endrin aldehyde	36
	Heptachlor	36
	Heptachlor epoxide	36
	Methoxychlor	36
	Toxaphene	36
	alpha-BHC	36
	alpha-Chlordane	36
	beta-BHC	36
	delta-BHC	36
	gamma-BHC (Lindane)	36
	gamma-Chlordane	36
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	36
	1,2,4-Trichlorobenzene	36
	1,3-Dichlorobenzene	36
	1,4-Dichlorobenzene	36
	1-Chloronaphthalene	36
	1-Naphthylamine	36
	2,3,4,6-Tetrachlorophenol	36
	2,4,5-Trichlorophenol	36
	2,4-Dichlorophenol	36
	2,4-Dimethylphenol	36
	2,4-Dinitrophenol	36
	2,4-Dinitrotoluene	36
	2,6-Dichlorophenol	36
	2,6-Dinitrotoluene	36
	2-Chloronaphthalene	36
	2-Methylnaphthalene	36
	2-Methylphenol	36
	2-Naphthylamine	36

TABLE 2-4
CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2-Nitrophenol	36
(Continued)	2-Picoline	36
	3,3'-Dichlorobenzidine	36
	3,3'-Dimethylbenzidine	36
	3-Methylcholanthrene	36
	3-Nitroaniline	36
	3/4-Methylphenol	36
	4,6-Dinitro-2-methylphenol	36
	4-Aminobiphenyl	36
	4-Bromophenyl phenyl ether	36
	4-Chloro-3-methylphenol	36
	4-Chloroaniline	36
	4-Chlorophenyl phenyl ether	36
	4-Nitroaniline	36
	7,12-Dimethylbenz(a)-anthracene	36
	Acenaphthene	36
	Acenaphthylene	36
	Acetophenone	36
	Anthracene	36
	Azobenzene	36
	Benzo(a)anthracene	36
	Benzo(a)pyrene	36
	Benzo(b)fluoranthene	36
	Benzo(g,h,i)perylene	36
	Benzo(k)fluoranthene	36
	Benzyl alcohol	36
	Chrysene	36
	Di-n-octyl phthalate	36
	Dibenz(a,h)anthracene	36
	Diphenylamine	36
	Ethyl methanesulfonate	36
	Fluorene	36
	Hexachlorobenzene	36
	Hexachlorobutadiene	36
	Hexachlorocyclopentadiene	36
	Hexachloroethane	36
	Indeno(1,2,3-cd)pyrene	36
	Isophorone	36
	Methyl methanesulfonate	36
	N-Nitroso-di-n-butylamine	36
	N-Nitroso-di-n-propylamine	36
	N-Nitrosodiphenylamine	36
	N-Nitrosopiperidine	36
	Nitrobenzene	36
	Pentachlorobenzene	36
	Pentachloronitrobenzene	36
	Pentachlorophenol	36
	Phenacetin	36

TABLE 2-4
CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Phenanthrene	36
'(Continued)	Pronamide	36
	Pyrene	36
	a,a-Dimethylphenethyl-amine	36
	bis(2-Chloroethoxy)methane	36
	bis(2-Chloroethyl) ether	36
	bis(2-Chloroisopropyl)ether	36
	p-Dimethylaminoazobenzene	36
Volatile Organics	1,1,1,2-Tetrachloroethane	36
	1,1,1-Trichloroethane	36
	1,1,2,2-Tetrachloroethane	36
	1,1,2-Trichloroethane	36
	1,1-Dichloroethane	36
	1,1-Dichloroethene	36
	1,2,3-Trichloropropane	36
	1,2-Dichloroethane	36
	1,2-Dichloropropane	36
	2-Chloroethyl vinyl ether	36
	4-Methyl-2-pentanone (MIBK)	36
	Acrolein	36
	Acrylonitrile	36
	Benzene	36
	Bromodichloromethane	36
	Bromomethane	36
	Carbon tetrachloride	36
	Chlorobenzene	36
	Chloroethane	36
	Chloromethane	36
	Dibromomethane	36
	Ethyl methacrylate	36
	Ethylbenzene	36
	Iodomethane	36
	Styrene	36
	Tetrachloroethene	36
	Toluene	36
	Trichloroethene	36
	Trichlorofluoromethane	36
	Vinyl acetate	36
	Vinyl chloride	36
	Xylenes (total)	36
	cis-1,3-Dichloropropene	36
	trans-1,2-Dichloroethene	36
	trans-1,3-Dichloropropene	36
	trans-1,4-Dichloro-2-butene	36

TABLE 2-5
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	6
	Thallium	6
PCBs/Pesticides	4,4'-DDD	8
	4,4'-DDE	8
	Aldrin	8
	Aroclor 1016	8
	Aroclor 1221	8
	Aroclor 1232	8
	Aroclor 1242	8
	Aroclor 1248	8
	Aroclor 1254	8
	Aroclor 1260	8
	Dieldrin	8
	Endosulfan I	8
	Endosulfan II	8
	Endosulfan sulfate	8
	Endrin	8
	Endrin aldehyde	8
	Heptachlor	8
	Heptachlor epoxide	8
	Methoxychlor	8
	Toxaphene	8
	alpha-BHC	8
	alpha-Chlordane	8
	beta-BHC	8
	delta-BHC	8
	gamma-BHC (Lindane)	8
	gamma-Chlordane	8
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	8
	1,2,4-Trichlorobenzene	8
	1,2-Dichlorobenzene	8
	1,3-Dichlorobenzene	8
	1,4-Dichlorobenzene	8
	1-Chloronaphthalene	8
	1-Naphthylamine	8
	2,3,4,6-Tetrachlorophenol	8
	2,4,5-Trichlorophenol	8
	2,4,6-Trichlorophenol	8
	2,4-Dichlorophenol	8
	2,4-Dimethylphenol	8
	2,4-Dinitrophenol	8
	2,4-Dinitrotoluene	8
	2,6-Dinitrotoluene	8
	2-Chloronaphthalene	8
	2-Chlorophenol	8
	2-Methylnaphthalene	8
	2-Methylphenol	8
	2-Naphthylamine	8
	2-Nitrophenol	8

TABLE 2-5
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2-Picoline	8
(Continued)	3,3'-Dichlorobenzidine	8
	3,3'-Dimethylbenzidine	8
	3-Methylcholanthrene	8
	3-Nitroaniline	8
	4,6-Dinitro-2-methylphenol	8
	4-Aminobiphenyl	8
	4-Bromophenyl phenyl ether	8
	4-Chloro-3-methylphenol	8
	4-Chloroaniline	8
	4-Chlorophenyl phenyl ether	8
	4-Nitroaniline	8
	4-Nitrophenol	8
	7,12-Dimethylbenz(a)-anthracene	8
	Acenaphthene	8
	Acenaphthylene	8
	Acetophenone	8
	Aniline	8
	Anthracene	8
	Azobenzene	8
	Benzidine	8
	Benzo(a)anthracene	8
	Benzo(a)pyrene	8
	Benzo(b)fluoranthene	8
	Benzo(g,h,i)perylene	8
	Benzo(k)fluoranthene	8
	Benzoic acid	8
	Benzyl alcohol	8
	Butyl benzyl phthalate	8
	Chrysene	8
	Di-n-butyl phthalate	8
	Di-n-octyl phthalate	8
	Dibenz(a,h)anthracene	8
	Dibenzofuran	8
	Diethyl phthalate	8
	Dimethyl phthalate	8
	Diphenylamine	8
	Ethyl methanesulfonate	8
	Fluoranthene	8
	Fluorene	8
	Hexachlorobenzene	8
	Hexachlorobutadiene	8
	Hexachlorocyclopentadiene	8
	Hexachloroethane	8
	Indeno(1,2,3-cd)pyrene	8
	Isophorone	8
	Methyl methanesulfonate	8
	N-Nitroso-di-n-butylamine	8
	N-Nitroso-di-n-propylamine	8

TABLE 2-5
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	N-Nitrosodiphenylamine	8
(Continued)	N-Nitrosopiperidine	8
	Naphthalene	8
	Nitrobenzene	8
	Pentachlorobenzene	8
	Pentachloronitrobenzene	8
	Pentachlorophenol	8
	Phenacetin	8
	Phenanthrene	8
	Pronamide	8
	Pyrene	8
	a,a-Dimethylphenethyl-amine	8
	bis(2-Chloroethoxy)methane	8
	bis(2-Chloroethyl) ether	8
	bis(2-Chloroisopropyl)ether	8
	bis(2-Ethylhexyl)phthalate	8
	p-Dimethylaminoazobenzene	8
Volatile Organics	1,1,1,2-Tetrachloroethane	8
	1,1,1-Trichloroethane	8
	1,1,2,2-Tetrachloroethane	8
	1,1,2-Trichloroethane	8
	1,1-Dichloroethane	8
	1,1-Dichloroethene	8
	1,2,3-Trichloropropane	8
	1,2-Dichloroethane	8
	1,2-Dichloropropane	8
	2-Butanone (MEK)	8
	2-Chloroethyl vinyl ether	8
	2-Hexanone	8
	4-Methyl-2-pentanone (MIBK)	8
	Acrolein	8
	Acrylonitrile	8
	Benzene	8
	Bromodichloromethane	8
	Bromoform	8
	Bromomethane	8
	Carbon disulfide	8
	Carbon tetrachloride	8
	Chlorobenzene	8
	Chloroethane	8
	Chloroform	8
	Chloromethane	8
	Dibromochloromethane	8
	Dibromomethane	8
	Dichlorodifluoromethane	8
	Ethyl methacrylate	8
	Ethylbenzene	8
	Iodomethane	8
	Styrene	8

TABLE 2-5
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Tetrachloroethene	8
(Continued)	Toluene	8
	Trichloroethene	8
	Trichlorofluoromethane	8
	Vinyl acetate	8
	Vinyl chloride	8
	Xylenes (total)	8
	cis-1,3-Dichloropropene	8
	trans-1,2-Dichloroethene	8
	trans-1,3-Dichloropropene	8
	trans-1,4-Dichloro-2-butene	8

TABLE 2-6
CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Pesticides/PCBs	4,4'-DDD	45
	4,4'-DDE	45
	4,4'-DDT	45
	Aroclor 1016	45
	Aroclor 1221	45
	Aroclor 1232	45
	Aroclor 1242	45
	Aroclor 1248	45
	Aroclor 1260	45
	Dieldrin	45
	Endosulfan I	45
	Endosulfan II	45
	Endosulfan sulfate	45
	Endrin	45
	Endrin aldehyde	45
	Heptachlor	45
	Heptachlor epoxide	45
	Methoxychlor	45
	Toxaphene	45
	alpha-BHC	45
	alpha-Chlordane	45
	beta-BHC	45
	delta-BHC	45
	gamma-BHC (Lindane)	45
	gamma-Chlordane	45
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	45
	1-Chloronaphthalene	45
	2,3,4,6-Tetrachlorophenol	45
	2,4,5-Trichlorophenol	45
	2,4,6-Trichlorophenol	45
	2,4-Dichlorophenol	45
	2,4-Dinitrophenol	45
	2,4-Dinitrotoluene	45
	2,6-Dichlorophenol	45
	2,6-Dinitrotoluene	45
	2-Chloronaphthalene	45
	2-Chlorophenol	45
	2-Methylphenol	45
	2-Naphthylamine	45
	2-Nitrophenol	45
	2-Picoline	45
	3,3'-Dichlorobenzidine	22
	3,3'-Dimethylbenzidine	45
	3-Methylcholanthrene	45
	3-Nitroaniline	45
	4-Aminobiphenyl	45
	4-Bromophenyl phenyl ether	45
	4-Chloro-3-methylphenol	45

TABLE 2-6
CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	4-Chloroaniline	45
(continued)	4-Chlorophenyl phenyl ether	45
	4-Nitroaniline	45
	7,12-Dimethylbenz(a)-anthracene	45
	Acetophenone	45
	Aniline	45
	Azobenzene	45
	Benzyl alcohol	45
	Diethyl phthalate	45
	Diphenylamine	45
	Ethyl methanesulfonate	45
	Hexachlorobenzene	45
	Hexachlorobutadiene	45
	Hexachlorocyclopentadiene	45
	Hexachloroethane	45
	Isophorone	45
	Methyl methanesulfonate	45
	N-Nitroso-di-n-butylamine	45
	N-Nitroso-di-n-propylamine	45
	N-Nitrosodiphenylamine	45
	N-Nitrosopiperidine	45
	Nitrobenzene	45
	Pentachlorobenzene	45
	Pentachloronitrobenzene	45
	Phenacetin	45
	Phenol	45
	Pronamide	45
	a,a-Dimethylphenethyl-amine	45
	bis(2-Chloroethoxy)methane	45
	bis(2-Chloroethyl) ether	45
	bis(2-Chloroisopropyl)ether	45
	p-Dimethylaminoazobenzene	45
Volatile Organics	1,1,1,2-Tetrachloroethane	45
	1,1,1-Trichloroethane	45
	1,1,2,2-Tetrachloroethane	45
	1,1,2-Trichloroethane	45
	1,1-Dichloroethane	45
	1,1-Dichloroethene	45
	1,2,3-Trichloropropane	45
	1,2-Dichloroethane	45
	1,2-Dichloropropane	45
	2-Chloroethyl vinyl ether	45
	2-Hexanone	45
	4-Methyl-2-pentanone (MIBK)	45
	Acrolein	45
	Benzene	45
	Bromodichloromethane	45
	Bromoform	45

TABLE 2-6
CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Volatile Organics	Bromomethane	45
(continued)	Carbon tetrachloride	45
	Chloroethane	45
	Chloroform	45
	Chloromethane	45
	Dibromochloromethane	45
	Dibromomethane	45
	Dichlorodifluoromethane	45
	Ethyl methacrylate	45
	Ethylbenzene	45
	Iodomethane	45
	Styrene	45
	Trichlorofluoromethane	45
	Vinyl acetate	45
	Vinyl chloride	45
	cis-1,3-Dichloropropene	45
	trans-1,2-Dichloroethene	45
	trans-1,3-Dichloropropene	45
	trans-1,4-Dichloro-2-butene	45

TABLE 2-7
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Metals	Mercury	8
	Thallium	6
Pesticides/PCBs	4,4'-DDD	8
	4,4'-DDE	8
	4,4'-DDT	8
	Aldrin	8
	Aroclor 1016	8
	Aroclor 1221	8
	Aroclor 1232	8
	Aroclor 1242	8
	Aroclor 1248	8
	Aroclor 1260	8
	Dieldrin	8
	Endosulfan I	8
	Endosulfan II	8
	Endosulfan sulfate	8
	Endrin	8
	Endrin aldehyde	8
	Heptachlor	8
	Heptachlor epoxide	8
	Methoxychlor	8
	Toxaphene	8
	alpha-BHC	8
	alpha-Chlordane	8
	beta-BHC	8
	delta-BHC	8
	gamma-BHC (Lindane)	8
	gamma-Chlordane	8
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	8
	1,2,4-Trichlorobenzene	8
	1,2-Dichlorobenzene	8
	1,3-Dichlorobenzene	8
	1,4-Dichlorobenzene	8
	1-Chloronaphthalene	8
	1-Naphthylamine	8
	2,3,4,6-Tetrachlorophenol	8
	2,4,5-Trichlorophenol	8
	2,4,6-Trichlorophenol	8
	2,4-Dichlorophenol	8
	2,4-Dimethylphenol	8
	2,4-Dinitrophenol	8
	2,4-Dinitrotoluene	8
	2,6-Dichlorophenol	8
	2,6-Dinitrotoluene	8
	2-Chloronaphthalene	8
	2-Chlorophenol	8
	2-Methylnaphthalene	8
	2-Methylphenol	8
	2-Naphthylamine	8

TABLE 2-7
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2-Nitrophenol	8
(continued)	2-Picoline	8
	3,3'-Dichlorobenzidine	8
	3,3'-Dimethylbenzidine	4
	3-Methylcholanthrene	8
	3-Nitroaniline	8
	3/4-Methylphenol	8
	4,6-Dinitro-2-methylphenol	8
	4-Aminobiphenyl	8
	4-Bromophenyl phenyl ether	8
	4-Chloro-3-methylphenol	8
	4-Chloroaniline	8
	4-Chlorophenyl phenyl ether	8
	4-Nitroaniline	8
	4-Nitrophenol	8
	7,12-Dimethylbenz(a)-anthracene	8
	Acenaphthene	8
	Acenaphthylene	8
	Acetophenone	8
	Aniline	8
	Anthracene	8
	Azobenzene	8
	Benzoic acid	8
	Di-n-butyl phthalate	8
	Di-n-octyl phthalate	8
	Dibenz(a,h)anthracene	8
	Dibenzofuran	8
	Diethyl phthalate	8
	Dimethyl phthalate	8
	Diphenylamine	8
	Ethyl methanesulfonate	8
	Fluorene	8
	Hexachlorobenzene	8
	Hexachlorobutadiene	8
	Hexachlorocyclopentadiene	8
	Hexachloroethane	8
	Isophorone	8
	Methyl methanesulfonate	8
	N-Nitroso-di-n-butylamine	8
	N-Nitroso-di-n-propylamine	8
	N-Nitrosodiphenylamine	8
	N-Nitrosopiperidine	8
	Naphthalene	8
	Nitrobenzene	8
	Pentachlorobenzene	8
	Pentachloronitrobenzene	8
	Pentachlorophenol	8
	Phenacetin	8
	Phenol	8

TABLE 2-7
CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Pronamide	8
(continued)	a,a-Dimethylphenethyl-amine	8
	bis(2-Chloroethoxy)methane	8
	bis(2-Chloroethyl) ether	8
	bis(2-Chloroisopropyl)ether	8
	p-Dimethylaminoazobenzene	8
Volatile Organics	1,1,1,2-Tetrachloroethane	8
	1,1,1-Trichloroethane	8
	1,1,2,2-Tetrachloroethane	8
	1,1,2-Trichloroethane	8
	1,1-Dichloroethane	8
	1,1-Dichloroethene	8
	1,2,3-Trichloropropane	8
	1,2-Dichloroethane	8
	1,2-Dichloropropane	8
	2-Butanone (MEK)	8
	2-Chloroethyl vinyl ether	2
	2-Hexanone	8
	4-Methyl-2-pentanone (MIBK)	8
	Acrolein	8
	Acrylonitrile	8
	Benzene	8
	Bromodichloromethane	8
	Bromoform	8
	Bromomethane	8
	Carbon disulfide	8
	Carbon tetrachloride	8
	Chlorobenzene	8
	Chloroethane	8
	Chloroform	8
	Chloromethane	8
	Dibromochloromethane	8
	Dibromomethane	8
	Dichlorodifluoromethane	8
	Ethyl methacrylate	8
	Ethylbenzene	8
	Iodomethane	8
	Styrene	8
	Tetrachloroethene	8
	Toluene	8
	Trichloroethene	4
	Trichlorofluoromethane	8
	Vinyl acetate	8
	Vinyl chloride	8
	Xylenes (total)	8
	cis-1,3-Dichloropropene	8
	trans-1,2-Dichloroethene	8
	trans-1,3-Dichloropropene	8
	trans-1,4-Dichloro-2-butene	8

TABLE 2-8

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Pesticides/PCBs	4,4'-DDT	64
	Aroclor 1016	64
	Aroclor 1221	64
	Aroclor 1232	64
	Aroclor 1242	64
	Aroclor 1248	64
	Endosulfan I	64
	Endosulfan II	64
	Endosulfan sulfate	64
	Endrin	64
	Endrin aldehyde	64
	Heptachlor epoxide	64
	Methoxychlor	64
	Toxaphene	64
	alpha-BHC	64
	beta-BHC	64
	gamma-BHC (Lindane)	64
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	64
	1,2,4-Trichlorobenzene	64
	1-Naphthylamine	64
	2,3,4,6-Tetrachlorophenol	64
	2,4,5-Trichlorophenol	64
	2,4,6-Trichlorophenol	64
	2,4-Dichlorophenol	64
	2,4-Dimethylphenol	64
	2,4-Dinitrophenol	64
	2,4-Dinitrotoluene	64
	2,6-Dichlorophenol	64
	2,6-Dinitrotoluene	64
	2-Chlorophenol	64
	2-Methylphenol	64
	2-Nitrophenol	64
	2-Picoline	64
	3,3'-Dichlorobenzidine	64
	3,3'-Dimethylbenzidine	64
	3-Nitroaniline	64
	4,6-Dinitro-2-methylphenol	64
	4-Aminobiphenyl	64
	4-Bromophenyl phenyl ether	64
	4-Chloro-3-methylphenol	64
	4-Chloroaniline	64
	4-Chlorophenyl phenyl ether	64
	4-Nitroaniline	64
	7,12-Dimethylbenz(a)-anthracene	64
	Acetophenone	64
	Aniline	64
	Azobenzene	64
	Benzyl alcohol	64
	Diphenylamine	64
	Ethyl methanesulfonate	64
	Hexachlorobenzene	64

TABLE 2-8
CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Hexachlorobutadiene	64
(Continued)	Hexachlorocyclopentadiene	64
	Hexachloroethane	64
	Isophorone	64
	Methyl methanesulfonate	64
	N-Nitroso-di-n-butylamine	64
	N-Nitroso-di-n-propylamine	64
	N-Nitrosopiperidine	64
	Nitrobenzene	64
	Pentachlorobenzene	64
	Pentachloronitrobenzene	64
	Phenacetin	64
	Pronamide	64
	a,a-Dimethylphenethyl-amine	64
	bis(2-Chloroethoxy)methane	64
	bis(2-Chloroethyl) ether	64
	bis(2-Chloroisopropyl)ether	64
	p-Dimethylaminoazobenzene	64
Volatile Organics	1,1,1,2-Tetrachloroethane	64
	1,1,2,2-Tetrachloroethane	64
	1,1,2-Trichloroethane	64
	1,1-Dichloroethene	64
	1,2,3-Trichloropropane	64
	1,2-Dichloroethane	64
	1,2-Dichloropropane	64
	2-Chloroethyl vinyl ether	15
	2-Hexanone	64
	4-Methyl-2-pentanone (MIBK)	64
	Acrolein	64
	Acrylonitrile	64
	Benzene	64
	Bromodichloromethane	64
	Bromoform	64
	Bromomethane	64
	Chloroethane	64
	Chloroform	64
	Dibromochloromethane	64
	Dibromomethane	64
	Dichlorodifluoromethane	64
	Ethyl methacrylate	64
	Iodomethane	64
	Styrene	64
	Trichloroethene	64
	Trichlorofluoromethane	64
	Vinyl acetate	64
	Vinyl chloride	64
	cis-1,3-Dichloropropene	64
	trans-1,2-Dichloroethene	64
	trans-1,3-Dichloropropene	64
	trans-1,4-Dichloro-2-butene	64

TABLE 2-9
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Metals	Thallium	16
Pesticides/PCBs	4,4'-DDD	18
	4,4'-DDE	18
	4,4'-DDT	18
	Aroclor 1016	18
	Aroclor 1221	18
	Aroclor 1232	18
	Aroclor 1242	18
	Aroclor 1248	18
	Aroclor 1260	18
	Endosulfan I	18
	Endosulfan II	18
	Endosulfan sulfate	18
	Endrin	18
	Endrin aldehyde	18
	Heptachlor epoxide	18
	Methoxychlor	18
	Toxaphene	18
	alpha-BHC	18
	beta-BHC	18
	delta-BHC	18
	gamma-BHC (Lindane)	18
	gamma-Chlordane	18
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	18
	1,2,4-Trichlorobenzene	18
	1,2-Dichlorobenzene	18
	1,3-Dichlorobenzene	18
	1,4-Dichlorobenzene	18
	1-Naphthylamine	18
	2,3,4,6-Tetrachlorophenol	18
	2,4,5-Trichlorophenol	18
	2,4,6-Trichlorophenol	18
	2,4-Dichlorophenol	18
	2,4-Dimethylphenol	18
	2,4-Dinitrophenol	18
	2,4-Dinitrotoluene	18
	2,6-Dichlorophenol	18
	2,6-Dinitrotoluene	18
	2-Chloronaphthalene	18
	2-Chlorophenol	18
	2-Methylnaphthalene	18
	2-Methylphenol	18
	2-Naphthylamine	18
	2-Nitrophenol	18
	2-Picoline	18
	3,3'-Dichlorobenzidine	18
	3,3'-Dimethylbenzidine	18
	3-Methylcholanthrene	18

TABLE 2-9
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	3-Nitroaniline	18
(continued)	4,6-Dinitro-2-methylphenol	18
	4-Aminobiphenyl	18
	4-Bromophenyl phenyl ether	18
	4-Chloro-3-methylphenol	18
	4-Chloroaniline	18
	4-Chlorophenyl phenyl ether	18
	4-Nitroaniline	18
	4-Nitrophenol	18
	7,12-Dimethylbenz(a)-anthracene	18
	Acenaphthene	18
	Acenaphthylene	18
	Acetophenone	18
	Aniline	18
	Anthracene	18
	Azobenzene	18
	Benzidine	18
	Benzo(k)fluoranthene	18
	Benzyl alcohol	18
	Butyl benzyl phthalate	18
	Di-n-butyl phthalate	18
	Dibenz(a,h)anthracene	18
	Dibenzofuran	18
	Diethyl phthalate	18
	Diphenylamine	18
	Ethyl methanesulfonate	18
	Fluorene	18
	Hexachlorobenzene	18
	Hexachlorobutadiene	18
	Hexachlorocyclopentadiene	18
	Hexachloroethane	18
	Isophorone	18
	Methyl methanesulfonate	18
	N-Nitroso-di-n-butylamine	18
	N-Nitroso-di-n-propylamine	18
	N-Nitrosodiphenylamine	18
	N-Nitrosopiperidine	18
	Naphthalene	18
	Nitrobenzene	18
	Pentachlorobenzene	18
	Pentachloronitrobenzene	18
	Pentachlorophenol	18
	Phenacetin	18
	Phenol	18
	Pronamide	18
	a,a-Dimethylphenethyl-amine	18
	bis(2-Chloroethoxy)methane	18
	bis(2-Chloroethyl) ether	18

TABLE 2-9
CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	bis(2-Chloroisopropyl)ether	18
(continued)	p-Dimethylaminoazobenzene	18
Volatile Organics	1,1,1,2-Tetrachloroethane	18
	1,1,1-Trichloroethane	18
	1,1,2,2-Tetrachloroethane	18
	1,1,2-Trichloroethane	18
	1,1-Dichloroethane	18
	1,1-Dichloroethene	18
	1,2,3-Trichloropropane	18
	1,2-Dichloroethane	18
	1,2-Dichloropropane	18
	2-Chloroethyl vinyl ether	5
	2-Hexanone	18
	4-Methyl-2-pentanone (MIBK)	18
	Acrolein	18
	Acrylonitrile	18
	Benzene	18
	Bromodichloromethane	18
	Bromoform	18
	Bromomethane	18
	Carbon tetrachloride	18
	Chloroethane	18
	Chloroform	18
	Chloromethane	18
	Dibromochloromethane	18
	Dibromomethane	18
	Dichlorodifluoromethane	18
	Ethyl methacrylate	18
	Ethylbenzene	18
	Iodomethane	18
	Styrene	18
	Tetrachloroethene	18
	Trichloroethene	18
	Trichlorofluoromethane	18
	Vinyl acetate	18
	Vinyl chloride	18
	Xylenes (total)	18
	cis-1,3-Dichloropropene	18
	trans-1,2-Dichloroethene	18
	trans-1,3-Dichloropropene	18
	trans-1,4-Dichloro-2-butene	18

TABLE 2-10
CHEMICALS DETECTED AT LOW FREQUENCY AND CONCENTRATION
ON-BASE EAST SOLDIER CREEK SURFACE WATER

Group	Chemical	Maximum Detected Concentration (mg/L)	Frequency
Semivolatile Organics	2,4,6-Trichlorophenol	0.001	1/36
	2-Chlorophenol	0.0014	1/36
	Dibenzofuran	0.0011	1/36
	Diethyl phthalate	0.0011	1/36
	Dimethyl phthalate	0.0013	1/36
	Naphthalene	0.0014	1/36
	bis(2-Ethylhexyl)phthalate	0.0013	1/36
Volatile Organics	2-Hexanone*	0.0054	1/36
	Carbon disulfide	0.0025	1/36
	Chloroform**	0.001	1/36
	Dibromochloromethane**	0.0011	1/36
	Dichlorodifluoromethane	0.0024	1/36

* No EPA Region III Tap Water RBC is available for comparison; therefore, the chemical is retained as a COC.

** Maximum detected concentrations exceeded the Region III Tap Water RBC concentration. Therefore, the chemical is retained as a COC.

TABLE 2-11
CHEMICALS DETECTED AT LOW FREQUENCY AND CONCENTRATION
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Group	Chemical	Max Concentration (mg/kg)	Frequency
Metals	Antimony	7.9	2/45
Pesticides	Aldrin	0.036	2/45
Semivolatile Organics	1-Naphthylamine*	0.56	1/45
	2,4-Dimethylphenol	0.18	1/45
	3/4-Methylphenol	0.06	1/45
	4,6-Dinitro-2-methylphenol*	17	1/45
	4-Nitrophenol	0.23	1/45
	Acenaphthylene	0.31	1/45
	Benzidine**	0.35	1/45
	Benzoic acid	0.069	1/45
	Butyl benzyl phthalate	0.071	2/45
	Di-n-octyl phthalate	0.12	2/45
	Dimethyl phthalate	0.3	1/45
	Pentachlorophenol	0.096	1/45
	Acrylonitrile	0.0012	1/45
	Xylenes (total)	0.0015	1/45

* No Region III Industrial Soil RBC is available for comparison; therefore, the chemical is retained as a COC.

** Maximum detected concentration exceeded the Region III RBC concentration for industrial soils. Therefore, the chemical is retained as a COC.

TABLE 2-12
CHEMICALS DETECTED AT LOW FREQUENCY AND CONCENTRATION
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Group	Chemical	Maximum Concentration (mg/kg)	Frequency
Metals	Antimony	15.8	3/64
Pesticides/PCBs	4,4'-DDD	0.26	1/64
	Aroclor 1260	0.48	1/64
	delta-BHC*	3.2	1/64
	gamma-Chlordane	0.038	2/64
Semivolatile Organics	1,2-Dichlorobenzene	3.6	2/64
	1,3-Dichlorobenzene	1.8	2/64
	2-Naphthylamine*	0.14	1/64
	3-Methylcholanthrene	1.3	2/64
	3/4-Methylphenol	0.11	1/64
	4-Nitrophenol	0.57	1/64
	Acenaphthylene	0.36	1/64
	Benzidine**	0.29	1/64
	Benzoic acid	0.05	1/64
	Butyl benzyl phthalate	0.23	2/64
	Di-n-butyl phthalate	0.51	3/64
	Diethyl phthalate	0.12	1/64
	Dimethyl phthalate	0.28	1/64
	N-Nitrosodiphenylamine	0.047	1/64
	Pentachlorophenol	0.49	1/64
	Phenol	0.044	1/64
Volatile Organics	1,1,1-Trichloroethane	0.029	3/64
	1,1-Dichloroethane	0.0025	2/64
	Carbon tetrachloride	0.0036	2/64
	Chloromethane	0.0034	1/64
	Ethylbenzene	0.42	3/64
	Tetrachloroethene	0.033	2/64

* No Region III Industrial Soil RBC is available for comparison; therefore, the chemical is retained as a COC.

** Maximum detected concentration exceeded the Region III RBC concentration for industrial soils. Therefore, the chemical is retained as a COC.

TABLE 2-13
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	59.4	29.7	1200
Chromium	0.014	0.007	0.2
Copper	0.017	0.0085	3
Magnesium	11	5.5	400
Manganese	0.23	0.115	5
Molybdenum	0.061	0.0305	0.25
Potassium	10	5	390-780[d]
Sodium	8.8	4.4	1000[e]
Zinc	0.019	0.0095	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-14
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	61.2	30.6	1200
Chromium	0.02	0.01	0.2
Copper	0.012	0.006	3
Magnesium	25.6	12.8	400
Manganese	0.0087	0.00435	5
Molybdenum	0.028	0.014	0.25
Potassium	5.9	2.95	390-780[d]
Selenium	0.0045	0.00225	0.075
Sodium	60.8	30.4	1000[e]
Zinc	0.079	0.0395	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-15
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/L)
Calcium	101	50.5	1,200
Chromium	0.042	0.021	0.2
Copper	0.27	0.135	3
Magnesium	48.8	24.4	400
Manganese	0.069	0.0345	5
Molybdenum	0.44	0.22	0.25
Potassium	5.3	2.65	390-780[d]
Selenium	0.024	0.012	0.075
Sodium	113	56.5	1,000[e]
Zinc	0.058	0.029	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-16
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	57.8	28.9	1,200
Chromium	0.018	0.009	0.2
Copper	0.028	0.014	3
Magnesium	26.5	13.25	400
Manganese	0.098	0.049	5
Molybdenum	0.13	0.065	0.25
Potassium	5.6	2.8	390-780[d]
Selenium	0.015	0.0075	0.075
Sodium	207	103.5	1,000[e]
Zinc	0.024	0.012	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-17
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	33,000	3.3	1,200
Copper	1,220	0.122	3
Iron	31,800	3.18	30
Magnesium	18,700	1.87	400
Manganese	4,140	0.414	5
Molybdenum	136	0.0136	0.25
Potassium	4,370	0.437	390-780[d]
Selenium	17.7	0.00177	0.075
Sodium	937	0.0937	1,000[e]
Zinc	2,570	0.257	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg/day of sediment / day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-18
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	117000	11.7	1200
Chromium	139	0.0139	0.2
Copper	17000	1.7	3
Iron	13800	1.38	30
Magnesium	9220	0.922	400
Manganese	1840	0.184	5
Molybdenum	11.2	0.00112	0.25
Potassium	552	0.0552	390-780[d]
Selenium	0.48	0.000048	0.075
Sodium	400	0.04	1000[e]
Zinc	1670	0.167	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg/day of sediment / day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10 kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-19
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	231,000	23.1	1,200
Copper	1,050	0.105	3
Iron	20,200	2.02	30
Magnesium	17,300	1.73	400
Manganese	728	0.0728	5
Molybdenum	135	0.0135	0.25
Potassium	2,530	0.253	390-780[d]
Selenium	7.2	0.00072	0.075
Sodium	296	0.0296	1,000[e]
Zinc	545	0.0545	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg/day of sediment/day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10 kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-20
ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	91,600	9.16	1,200
Chromium	318	0.0318	0.2
Copper	100	0.01	3
Iron	27,900	2.79	30
Magnesium	24,100	2.41	400
Manganese	1,730	0.173	5
Molybdenum	5.9	0.00059	0.25
Potassium	1,260	0.126	390-780[d]
Selenium	0.26	0.000026	0.075
Sodium	225	0.0225	1000[e]
Zinc	113	0.0113	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg/day of sediment / day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended Potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992)

TABLE 2-21
CHEMICALS DETECTED AT BACKGROUND LEVELS
ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2 x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.4	8.7	0.025
Barium	0.74	1.5	0.27
Iron	3.0	5.9	0.27

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

ND = No Data

NA = Not Applicable

TABLE 2-22
CHEMICALS DETECTED AT BACKGROUND LEVELS
OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2 x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.4	8.7	0.025
Barium	0.74	1.5	0.31
Iron	3.0	5.9	0.069

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

ND = No Data

NA = Not Applicable

TABLE 2-23

CHEMICALS DETECTED AT BACKGROUND LEVELS ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2 x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.4	8.7	0.035
Barium	0.74	1.5	0.64
Iron	3.0	5.9	0.086
Lead	0.012	0.024	0.011

Note: a. Samples from of-base Crutcho Creek were used to identify background concentrations.
ND = No Data
NA = Not Applicable

TABLE 2-24
CHEMICALS DETECTED AT BACKGROUND LEVELS
OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2 x Background Concentration (mg/L)	Maximum Detected Surface Water Concentration (mg/L)
Aluminum	4.4	8.7	0.033
Barium	0.74	1.5	0.46
Iron	3.0	5.9	0.091
Lead	0.012	0.024	0.0008

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

ND = No Data

NA = Not Applicable

TABLE 2-25
CHEMICALS DETECTED AT BACKGROUND LEVELS
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2 x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17,100	34,200	23,400
Arsenic	14	28	9.6

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

ND= Not Detected

NA = Not Applicable

TABLE 2-26
CHEMICALS DETECTED AT BACKGROUND LEVELS
OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2 x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17100	34200	5580
Arsenic	14	28	4.4
Barium	2620	5240	3350
Nickel	110	220	95.4
Selenium	1	2	0.48

Note: a. Samples from off-base Crutcho Creek were used to identify background concentrations.
ND = Not Detected
NA = Not Applicable

TABLE 2-27
CHEMICALS DETECTED AT BACKGROUND LEVELS
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2 x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17,100	34,200	16,700
Arsenic	14	28	13.2
Barium	2,620	5,240	2,440

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

ND = Not Detected

NA = Not Applicable

TABLE 2-28
CHEMICALS DETECTED AT BACKGROUND LEVELS
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2 x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17,100	34,200	10,600
Arsenic	14	28	5.1
Barium	2,620	5,240	1,490
Lead	44	88	82.3
Nickel	110	220	124
Silver	7	14	5.9

Note: a. Samples from off-base Crutcho Creek were used to identify background concentrations
ND = Not Detected
NA = Note Applicable

exceeded background levels.

TABLE 2-29
CHEMICALS OF CONCERN
ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.0006	0.0002	5/9
Cadmium	0.001	0.0001	3/9
Cobalt	0.0012	0.0003	8/9
Nickel	0.04	0.0027	9/9
Vanadium	0.0046	0.0006	9/9
Semivolatile Organics			
Benzoic acid	0.0012	0.001	3/9
Dimethyl phthalate	0.001	0.001	1/9
Volatile Organics			
Acetone	0.0084	0.0038	6/9
Carbon disulfide	0.004	0.0026	2/9
Tetrachloroethene	0.0015	0.0015	1/9
Toluene	0.0036	0.0036	1/9
Trichloroethene	0.013	0.0094	2/9

TABLE 2-30
CHEMICALS OF CONCERN
OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg.L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.0005	0.0003	4/6
Cadmium	0.0007	0.0003	6/6
Cobalt	0.0003	0.0002	4/6
Nickel	0.01	0.0044	6/6
Vanadium	0.013	0.0062	6/6
Semivolatile Organics			
Benzoic acid	0.0012	0.0012	1/8
Volatile Organics			
Acetone	0.0047	0.0027	2/8

TABLE 2-31
CHEMICALS OF CONCERN
ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.0006	0.0001	20/27
Cadmium	0.0037	0.0001	20/27
Cobalt	0.0016	0.0001	17/27
Nickel	0.0098	0.0016	27/27
Vanadium	0.027	0.0038	27/27
Semivolatile Organics			
1,2-Dichlorobenzene	0.0017	0.001	2/36
4-Nitrophenol	0.0013	0.001	2/36
Aniline	0.004	0.0018	2/36
Benzidine	0.0012	0.0011	2/36
Benzoic acid	0.0016	0.0012	4/36
Butyl benzyl phthalate	0.0032	0.0014	4/36
Di-n-butyl phthalate	0.0014	0.0011	2/36
Fluoranthene	0.0016	0.0011	3/36
Phenol	0.002	0.0014	3/36
Volatile Organics			
2-Butanone (MEK)	0.0054	0.0014	9/36
2-Hexanone	0.0054	0.0054	1/36
Acetone	0.026	0.003	21/36
Bromoform	0.004	0.001	7/36
Chloroform	0.001	0.001	1/36
Dibromochloromethane	0.0011	0.0011	1/36

TABLE 2-32
CHEMICALS OF CONCERN
OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.0006	0.0003	6/6
Cadmium	0.0008	0.0003	6/6
Cobalt	0.0007	0.0002	6/6
Nickel	0.0087	0.0038	6/6
Silver	0.0002	0.0002	1/6
Vanadium	0.017	0.0055	6/6
Pesticides			
4,4'-DDT	0.000075	0.000075	1/8
Semivolatile Organics			
2,6-Dichlorophenol	0.0028	0.002	2/8
3/4-Methylphenol	0.0012	0.0012	1/8
Phenol	0.002	0.002	1/8
Volatile Organics			
Acetone	0.0097	0.0029	4/8

TABLE 2-33
CHEMICALS OF CONCERN
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Barium*	5,560	77	45/45
Beryllium	1.6	0.26	42/45
Cadmium	306	0.56	31/45
Chromium	5,140	11	45/45
Cobalt	109	3	45/45
Lead	616	5.7	45/45
Mercury	1.5	0.026	16/45
Nickel	8,790	6	45/45
Silver	245	0.42	25/45
Thallium	61.6	0.13	12/33
Vanadium	121	9.8	45/45
PCBs			
Aroclor 1254	86	0.072	23/45
Semivolatile Organics			
1,2,4-Trichlorobenzene	0.14	0.051	3/45
1,2-Dichlorobenzene	1.7	0.044	4/45
1,3-Dichlorobenzene	0.15	0.071	3/45
1,4-Dichlorobenzene	0.3	0.13	3/45
1-Naphthylamine[(a)]	0.56	0.56	1/45
2-Methylnaphthalene	0.6	0.042	3/45
4,6-Dinitro-2-methylphenol	17	17	1/45
Acenaphthene	0.37	0.081	7/45
Anthracene	0.58	0.058	13/45
Benzidine	0.35	0.35	1/45
Benzo(a)anthracene	3.4	0.054	27/45
Benzo(a)pyrene	3.6	0.046	28/45
Benzo(b)fluoranthene	7	0.041	30/45
Benzo(g,h,i)perylene	2.8	0.041	26/45
Benzo(k)fluoranthene	2.1	0.053	8/45
Chrysene	4.1	0.076	29/45
Di-n-butyl phthalate	0.51	0.037	5/45
Dibenz(a,h)anthracene	0.77	0.059	14/45
Dibenzofuran	0.31	0.072	7/45
Fluoranthene	7.6	0.05	35/45
Fluorene	0.32	0.075	7/45
Indeno(1,2,3-cd)pyrene	2.4	0.063	25/45
Naphthalene	0.51	0.074	7/45
Phenanthrene	5.7	0.046	28/45
Pyrene	8.4	0.048	33/45
bis(2-Ethylhexyl)phthalate	22	0.051	30/45
Volatile Organics			
2-Butanone (MEK)	0.062	0.0099	3/45
Acetone	0.12	0.0013	32/45
Carbon disulfide	0.0094	0.0025	3/45
Chlorobenzene[(a)]	0.0043	0.0023	3/45
Tetrachloroethene	0.089	0.0021	7/45
Toluene	0.015	0.0014	11/45
Trichloroethene	0.016	0.0075	4/22

* Barium was not considered a COC for the current exposure scenario, because all detected concentrations at the 0- to 6-inch depth were below background levels.

(a) These chemicals were only detected below the 0.5-foot level. Therefore, they are only evaluated in the future exposure scenario.

TABLE 2-34
CHEMICALS OF CONCERN
OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	17.3	5.8	2/8
Beryllium	0.33	0.29	2/8
Cadmium	23.4	2.5	7/8
Cobalt	40.8	3.2	8/8
Lead	640	9.3	7/8
Silver	15.5	1.5	6/8
Vanadium	23.3	5.5	8/8
PCBs			
Aroclor 1254	6	0.38	8/8
Semivolatile Organics			
Benzidine	0.046	0.046	1/8
Benzo(a)anthracene	0.3	0.086	2/8
Benzo(a)pyrene	0.21	0.075	2/8
Benzo(b)fluoranthene	0.4	0.04	5/8
Benzo(g,h,i)perylene	0.11	0.059	2/8
Benzo(k)fluoranthene	0.21	0.21	1/8
Benzyl alcohol	0.079	0.079	1/8
Butyl benzyl phthalate	0.11	0.11	1/8
Chrysene	0.4	0.098	2/8
Fluoranthene	0.7	0.047	6/8
Indeno(1,2,3-cd)pyrene	0.12	0.047	2/8
Phenanthrene	0.078	0.056	2/8
Pyrene	0.59	0.069	4/8
bis(2-Ethylhexyl) phthalate	0.51	0.087	8/8
Volatile Organics			
Acetone	0.013	0.0025	4/8

TABLE 2-35
CHEMICALS OF CONCERN
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Beryllium	1	0.13	45/64
Cadmium	390	1.4	60/64
Chromium	2920	9.1	64/64
Cobalt	90.1	1.4	64/64
Lead	1210	6.6	63/64
Mercury	4.7	0.022	52/64
Nickel	1420	6.9	64/64
Silver	38.4	0.47	44/64
Thallium	62.6	0.12	7/49
Vanadium	105	3.8	64/64
Pesticides/PCBs			
4,4'-DDE	0.072	0.013	4/64
Aldrin	3.7	0.0017	13/64
Aroclor 1254	39	0.028	40/64
Dieldrin	25	0.0062	11/64
Heptachlor	7	0.0028	30/64
alpha-Chlordane	16	0.0016	12/64
delta-BHC	3.2	3.2	1/64
Semivolatile Organics			
1,4-Dichlorobenzene	4.1	0.14	6/64
1-Chloronaphthalene	2.6	0.26	9/64
2-Chloronaphthalene	2.1	0.071	9/64
2-Methylnaphthalene	10	0.047	12/64
2-Naphthylamine[(a)]	0.14	0.14	1/64
Acenaphthene	17	0.071	33/64
Anthracene	36	0.052	41/64
Benzidine	0.29	0.29	1/64
Benzo(a)anthracene	59	0.063	56/64
Benzo(a)pyrene	45	0.066	56/64
Benzo(b)fluoranthene	83	0.055	57/64
Benzo(g,h,i)perylene	20	0.042	50/64
Benzo(k)fluoranthene	23	0.079	9/64
Chrysene	57	0.059	58/64
Di-n-octyl phthalate	8.9	0.056	13/64
Dibenz(a,h)anthracene	6	0.073	26/64
Dibenzofuran	11	0.048	22/64
Fluoranthene	120	0.04	62/64
Fluorene	23	0.057	36/64
Indeno(1,2,3-cd)pyrene	20	0.042	49/64
Naphthalene	15	0.06	23/64
Phenanthrene	110	0.06	56/64
Pyrene	110	0.052	60/64
bis(2-Ethylhexyl)phthalate	24	0.053	62/64
Volatile Organics			
2-Butanone (MEK)	0.25	0.0064	22/64
Acetone	0.74	0.0044	56/64
Carbon disulfide	0.027	0.0014	19/64
Chlorobenzene	25	0.0014	23/64
Toluene	0.76	0.0019	14/64
Xylenes (total)	0.77	0.0017	6/64

(a) 2-Naphthylamine was only detected below the 0.5-foot depth; therefore, it was evaluated only in the future exposure scenario.

TABLE 2-36
CHEMICALS OF CONCERN
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	5.6	5.6	1/18
Beryllium	0.65	0.15	18/18
Cadmium	34.9	0.66	11/18
Cobalt	11.2	2.3	18/18
Mercury	0.2	0.013	7/18
Vanadium	28.6	7.7	18/18
Pesticides/PCBs			
Aldrin	0.039	0.0012	4/18
Aroclor 1254	0.69	0.061	5/18
Dieldrin	0.34	0.2	2/18
Heptachlor	0.25	0.012	5/18
alpha-Chlordane	0.12	0.029	3/18
Semivolatile Organics			
1-Chloronaphthalene	0.27	0.27	1/18
3/4-Methylphenol	0.44	0.44	1/18
Benzo(a)anthracene	0.53	0.045	2/18
Benzo(a)pyrene	0.44	0.045	3/18
Benzo(b)fluoranthene	0.79	0.085	4/18
Benzo(g,h,i)perylene	0.2	0.2	1/18
Benzoic acid	0.056	0.056	1/18
Chrysene	0.6	0.058	4/18
Di-n-octyl phthalate	0.1	0.1	1/18
Dimethyl phthalate	0.16	0.086	2/18
Fluoranthene	1.4	0.043	8/18
Indeno(1,2,3-cd)pyrene	0.18	0.18	1/18
Phenanthrene	0.85	0.067	2/18
Pyrene	1.2	0.1	4/18
bis(2-Ethylhexyl) phthalate	2.5	0.054	13/18
Volatile Organics			
2-Butanone (MEK)	0.0022	0.0022	1/18
Acetone	0.029	0.0088	17/18
Carbon disulfide	0.0076	0.0015	4/18
Chlorobenzene	0.0017	0.0014	3/18
Toluene	0.013	0.0013	3/18

3.0
EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to estimate the magnitude of potential chemical exposure among various receptor populations. The steps required to perform an exposure assessment include the following:

- Identification of potential receptor populations
- Evaluation of potential exposure pathways for completeness
- Evaluation of potential exposure parameters
- Estimation of exposure point concentrations
- Estimation of daily intake factors

The approach of this RA was to incorporate conservative exposure assumptions when estimating the magnitude of potential exposure, so that potential risks posed by the site are not underestimated. At the same time, exposure scenarios which are considered unlikely were excluded, since they do not reflect realistic exposure conditions. It is important to note that for purposes of an RA, exposure can be defined for both reasonable maximum exposure (RME) and average exposure. The RME represents the most exposed individual in a population, while the average exposure represents the most likely exposure for the potentially exposed population. Both RME and average exposure scenarios are evaluated in this RA.

3.1 IDENTIFICATION OF POTENTIAL RECEPTOR POPULATIONS

Potential receptors include human, plant, and animal populations, as well as, environmental receptors (e.g., streams, ponds, and lakes) that may be exposed to site-related chemicals. An assessment of potentially exposed plant and animal populations are addressed under a separate evaluation (WCFS 1997). Only potential human receptor populations are addressed in this RA. Populations to be evaluated include those individuals most likely to come into contact with contaminated surface water and sediments in the four stream segments currently being assessed.

Local off-base populations cannot readily come into contact with the on-base portions of East or West Soldier Creek because Tinker AFB is an active military facility with restricted access. For most site workers or visitors, exposure to the on-base portions of the creek is likely to be minimal, if at all. For the purposes of an RA, it was assumed that the population with the greatest potential for contact with surface water or sediment from the creek would be a construction worker involved in repair or installation of underground pipelines around or under the creek. Because land use at Tinker AFB is unlikely to change in the foreseeable future, this scenario is considered a maximum exposure scenario for both current and future use conditions (evaluation of the maximum exposed population provides a conservative estimation of risks for all potentially exposed populations).

Off-base portions of East and West Soldier Creeks flow through several residential and nonresidential areas. Access to the creek in these areas is essentially unrestricted, therefore, a number of different receptors could potentially contact stream sediments and surface water. The receptor with the potential for maximum exposure is likely to be a local resident who swims or wades in the creek. This is particularly true for children, for whom the stream would act as an "attractive nuisance." Since a residential exposure scenario is highly conservative, evaluation of this scenario in the RA should be protective of local populations under both current and future use conditions.

Based on the discussion presented above, the populations to be evaluated quantitatively in the RA consist of the following:

- On-base construction worker
- Off-base child resident
- Off-base adult resident

3.2 EVALUATION OF POTENTIAL EXPOSURE PATHWAYS

An exposure pathway is the mechanism by which a receptor may come into contact with a chemical. As defined by the RAGS, there are four major elements that characterize a complete exposure pathway (EPA 1989a). These elements are:

- A source and mechanism of chemical release
- A transport medium for the chemical
- A point of potential receptor contact with the medium (i.e., an exposure point)
- A route of exposure (e.g., ingestion) for the receptor to come into contact with the chemical

For an exposure pathway to be complete, all four elements must be present. The absence of any one of these elements results in an incomplete exposure pathway for which site-related health risks do not exist. Thus, the evaluation of potential exposure pathways is necessary to focus on only those pathways that are complete and could potentially impact human health.

To develop a conceptual understanding of the sites and their potential to impact human health and environment, a site conceptual exposure model (SCEM) is developed. This model represents a theoretical exposure analysis and is used to identify complete exposure pathways. **Figure 3-1** depicts the site conceptual exposure model for the four stream segments of concern in Soldier Creek. This model specifically identifies chemical sources, release mechanisms, transport media, exposure routes, and receptor populations. Potential on-base sources of chemical release were identified previously in **Section 1.1** (Site Description) and **2.0** (Chemicals of Concern). The mechanism of release refers to the physicochemical properties of the chemicals that influence their mobility and potential contact with a receptor. The presence and identification of receptors was discussed in **Section 3.1** (Identification of Potential Receptor Populations). An evaluation of potential exposure pathways identified in the SCEM is presented in the following sections.

3.2.1 Identification of Potential Sources of Chemical Release

Numerous on-base and off-base sources of chemical release have been identified in previous investigations (see B&V 1993, and NUS 1989 for detailed reviews). On-base sources of contamination include:

- Outfalls from Building 3001
- Building 3001
- Southwest tank area
- North tank area
- IWTP (Inactivated April 1996)

Besides the on-base sources of release, several potential off-base sources have also been identified (B&V 1993):

- A paint shop
- The site of a former trailer park
- An auto repair shop
- A service station
- A salvage yard

Because the on-base sources differ in nature from the off-base sources, it is likely that the on-base receptors will be exposed to different chemical constituents and/or concentrations than off-base receptors.

3.2.2 Identification of Potential Exposure Points and Exposure Routes

Exposure points are the locations where potentially exposed populations may contact contaminated media. In the present RA, surface water and sediments in Soldier Creek are the exposure points of concern. Groundwater exposure is being evaluated and is not included in the current scope of this investigation.

Exposure routes are the mode of contact (inhalation, ingestion, or dermal contact) with the contaminated media. On-base construction workers could be exposed to contaminants in on-base portions of East and West Soldier Creek via incidental ingestion and dermal contact

with surface water and sediments while performing excavation activities or wading in the creek where the construction activities are occurring.

The water level in the off-base portion of West Soldier Creek generally is very shallow and swimming is not possible. However, off-base residents may be exposed to surface water and sediments while wading. Ingestion and dermal contact with contaminated surface water and sediments while wading is assumed to represent complete exposure pathways for both child and adult resident receptors.

Although Soldier Creek does not include any swimming areas per se, several off-base portions of East Soldier creek are deep enough to swim in, and potentially could be used by children for swimming. Consequently, a child resident swimming scenario will be evaluated quantitatively in this RA. A wading scenario for adults is assumed. Exposure is assumed via ingestion and direct dermal contact with surface water and sediment for both children and adults.

Inhalation exposure is assumed to be minor or incomplete for all scenarios and will not be evaluated in this RA because both East and West Soldier Creeks are located in open, unconfined areas where atmospheric dilution would quickly attenuate the concentrations of volatilized compounds released from the creek.

Potential exposure to contaminants in the surface water and sediments via ingestion of fish or game animals is not likely to be a significant pathway. Neither East or West Soldier Creeks contain a viable game and fish population, and the location of Tinker AFB within the metropolitan area of Oklahoma City precludes any hunting activities. For these reasons, exposure to contaminants via the food chain is considered an incomplete (or minor) exposure pathway and is not evaluated in this RA.

3.3 RECEPTOR POPULATIONS NOT INCLUDED IN THE RISK ASSESSMENT

Certain potential receptor populations can be excluded from consideration in the RA if they do not represent realistic exposure scenarios. Although sensitive populations (e.g., pregnant

women, the elderly or infirm in hospitals or elderly care facilities, etc.) are likely to be located within the greater metropolitan area of Oklahoma City, they were excluded from the quantitative evaluation because these populations are not likely to be exposed to the media of concern (surface water and sediment).

3.4 EVALUATION OF POTENTIAL EXPOSURE PARAMETERS

To calculate the chronic daily intake (CDI) of COCs and to estimate the associated potential health risks, a number of exposure parameters must first be quantified. Parameters which are typically quantified include the following:

- Life span (days)
- Exposure duration (years)
- Exposure frequency (days/year)
- Exposure time (hours/day)
- Soil/sediment ingestion rate (mg/day)
- Body weight (kg)
- Exposed skin surface area (cm^2)
- Dermal soil adherence (mg/cm^2)
- Dermal soil absorption factor (unitless)
- Water ingestion rate (L/hour)
- Permeability constant (cm/hour)

The exposure parameter assumptions used in this RA were the same as those used in the previous RA performed by WCFS (1996). Consequently, direct comparison of potential risks between the two RAs was possible.

The numerical values for these parameters (**Tables 3-1, 3-2, 3-3** and **3-4)** are used to estimate the extent of chemical exposure. The numerical values were developed using site-specific information supplemented by a number of USEPA reference sources. USEPA guidance used

when developing exposure assumptions include the Exposure Factors Handbook (USEPA 1989b), Standard Default Exposure Factors; USEPA 1991a, OSWER Directive 9285.6-03; Dermal Exposure Assessment: Principles and Applications (USEPA 1992a), USEPA Region IV Guidance (1992b) and RAGS (USEPA 1989a). These exposure assumptions are conservative. As a result, potential exposures and potential health risks are not likely to be underestimated.

The basis for the selection of the number values for the exposure parameters are discussed in the following sections.

3.4.1.1 Life Span

As recommended in the RAGS, life span is assumed to be the same for all receptor populations, and is given as 70 years (1989a).

3.4.1.2 Exposure Duration

Exposure duration refers to the number of years in which exposure occurs. On-base construction workers are assumed to be full-time employees of Tinker AFB and are assumed to have a RME duration of 25 years, as given by the USEPA (1991a). The average exposure duration of 5 years for an on-base construction worker is based on the average time an individual spends at one job. This information is supplied by the Bureau of Labor Statistics (U.S. Department of Labor 1987). Residents are assumed to have a reasonable maximum exposure duration of 30 years (5 years between ages 1-6, and 25 years afterward), based on the upper 90th percentile value for time spent in a single residence. The exposure duration for average exposure for an adult resident is assumed to be 9 years based on the mean time spent at a single residence (Exposure Factors Handbook, EPA 1989b). For child residents, the entire 5 year age span (ages 1-6) is conservatively assumed for average exposure.

3.4.1.3 Exposure Frequency

Exposure frequency refers to the number of days per year spent in direct contact with the creek. For RME and average exposure, on-base construction workers are assumed to spend

5 days and 1 day per year, respectively, working in the vicinity of the creeks. For adult residents, 1 day per month during the summer months (4 days/year) is assumed for RME. One half of the RME exposure frequency (2 days/year) is assumed for average exposure. For children (ages 1-6) , 2 days per week during the 17 summer weeks (34 days/year) is assumed for the RME exposure frequency. One half of the RME exposure frequency (17 days/year) is assumed for average exposure.

3.4.1.4 Exposure Time

Exposure time refers to the number of hours per day that a receptor is in contact with a potentially contaminated medium. For on-base construction workers, this is assumed to be 8 hours per day, reflecting a normal working day. For average exposure, one half of the time is assumed (4 hours/day) as the fraction of the working day the worker would be in direct contact with surface water or sediment. For adult residents, 2 and 1 hours per day exposure time were assumed for RME and average exposure, respectively. For children, exposure times of 6 and 3 hours per day were assumed for RME and average exposure, respectively.

3.4.1.5 Sediment Ingestion Rate

The sediment ingestion rate refers to the amount of sediment that is ingested daily. Upper-bound ingestion rates provided by USEPA (1991a) were used to evaluate RME exposure. The RME ingestion rates used in this RA were 50 mg/day for workers, 100 mg/day for adult residents, and 200 mg/day for children. For average exposure, ingestion rates of 10 mg/day were assumed for both workers and adult residents, based on information presented in the Exposure Factors Handbook (USEPA 1989b). An average ingestion rate of 100 mg/day was assumed for children, based on one-half the RME value.

3.4.1.6 Body Weight

Body weights were obtained from the Exposure Factors Handbook (USEPA 1989b). An adult body weight of 70 kg was used to evaluate construction workers. Age-weighted average body weights were calculated at 57.1 kg and 15.1 kg, respectively, for adult and child residents.

3.4.1.7 Skin Surface Area

Exposed skin surface area is important when evaluating uptake of chemicals that are absorbed dermally. For dermal exposure to surface water and sediment in West and East Soldier Creeks, an RME surface area of 9,800 cm^2 was estimated for an on-base construction worker, based on the adult surface areas of the head, hands, arms and lower legs (Exposure Factors Handbook; USEPA 1989b). For average exposure, an exposed area of 2,000 cm^2 was assumed for the construction worker based on the surface area of hands and forearms. Whole body immersion (6,500 cm^2) was assumed for children swimming in the creek, both for RME and average exposure scenarios, as well as for the RME child wading scenario. The average exposed surface area for a wading child was assumed to 1,800 cm^2 based on the surface area for hands, forearms and feet. For adult residents, an RME surface area of 8,620 cm^2 was assumed, based on exposure of the head, hands, forearms, and lower legs. For average exposure, an exposed surface area of 2,800 cm^2 was assumed based on exposure of the hands, forearms and feet.

3.4.1.8 Dermal Sediment Adherence

Dermal sediment adherence is used, in conjunction with exposed skin surface area, to define the total amount of sediment adhering to exposed skin surfaces. The USEPA recommends 1.0 mg/cm^2 and 0.2 mg/cm^2 for upperbound (RME) exposure and average exposure, respectively (Dermal Exposure Assessment: Principles and Applications; USEPA 1992a).

3.4.1.9 Dermal Absorption Factor

The dermal sediment absorption factor provides an estimate of potential chemical absorption through the skin. As presented in USEPA Region IV guidance (1991c), dermal absorption is assumed to be 1.0 percent for organic chemicals and 0.1 percent for inorganic chemicals.

3.4.1.10 Surface Water Ingestion Rate

An RME surface water ingestion rate of 0.05 L/hour was assumed for children swimming in East Soldier Creek, based on data presented in the RAGS (USEPA 1989a). For average

exposure while swimming, an ingestion rate of 0.025 L/hour was assumed, based on one-half the RME value.

Surface water ingestion while wading is assumed to be significantly less than while swimming. For all wading scenarios, the RME surface water ingestion rate was assumed to be 0.005 L/hour and the average surface water ingestion rate was assumed to 0.0025 L/hour, based on the assumption that ingestion during wading is 10 percent of the ingestion rate during swimming.

3.4.1.11 Permeability Constant

Permeability constants are chemical-specific values used to define the dermal uptake of chemicals from aqueous media, and are presented in units of cm/hour. Permeability constants used in this RA are derived from Dermal Exposure Assessment: Principles and Applications (USEPA 1992a).

3.5 ESTIMATION OF EXPOSURE POINT CONCENTRATION

Exposure point concentrations are chemical concentrations to which a receptor is exposed when contact is made with a specific environmental medium. The RME and average exposure point concentrations for the COCs are presented in **Tables 3-5 to 3-14**.

When calculating exposure point concentrations for the COCs, chemicals were assumed to be present at one-half the detection limit for any samples in which they were reported as undetected, in accordance with the RAGS (1989a). Using the approach recommended by USEPA (OSWER 9285.7-080; USEPA 1992c), exposure point concentrations for both surface water and sediments were calculated as the upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

$$UCL = e^{(m + 0.5S2 + SH/\sqrt{n-1})}$$

Where:

UCL = Upper 95 percent confidence level

e = Constant (Base of natural log, equal to 2.718)

m = mean of transformed data

S = Standard Deviation of the transformed data

n = number of samples

H = H-statistics (from table published in Gilbert 1987)

The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was adopted as the RME exposure point concentration. Use of the maximum concentration, if less than the 95 percent UCL, is recommended by RAGS (USEPA 1989a). This approach is supported by the observation that the 95 percent UCL concentration may exceed the maximum detected concentration in instances where the variation of the data is large or when high detection limits strongly influence calculation of 95 percent UCL values. The concentration associated with the RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

Exposure point concentrations calculated for surface water (presented in **Tables 3-5, 3-6, 3-7**, and **3-8**) are used to calculate risks associated with both current and future use scenarios. Sediment samples collected from 0 to 0.5 feet are considered to be associated with current use scenarios. Sediment samples collected from 0 to 5.0 feet are considered to be associated with future use scenarios.

- **Table 3-9** presents the current on-base West Soldier Creek sediment exposure point concentrations.

- **Table 3-10** presents the future on-base West Soldier Creek sediment exposure point concentrations.

- **Table 3-11** presents both the current and future off-base West Soldier Creek sediment exposure point concentrations.

- **Table 3-12** presents the on-base current sediment exposure point concentrations.

- **Table 3-13** presents the on-base East Soldier Creek future sediment exposure point concentrations.

- **Table 3-14** presents the off-base East Soldier Creek current and future sediment exposure point concentrations.

3.6 CALCULATION OF DAILY CHEMICAL INTAKES

Chronic daily intakes (CDIs) represent the daily amount of chemical taken in by a receptor per kilogram body weight, and are used with the Critical Toxicity Values (CTVs) to estimate hazard quotients and potential cancer risks for each chemical (see detailed discussion in **Section 4.0**). The CDIs are calculated for individual chemicals and receptors, based on the potential exposure parameters discussed in **Section 3.4**, using the following equations:

Surface water ingestion for on-base worker scenario:

$$CDI = (CW \times IR \times ET \times EF \times ED)/(BW \times AT1 \times AT2)$$

Surface water dermal exposure for on-base worker scenario:

$$CDI = (CW \times SA \times PC \times ET \times EF \times ED \times CF)/(BW \times AT1 \times AT2)$$

Sediment ingestion for on-base worker scenario:

$$CDI = (CS \times CF \times IR \times EF \times ED)/(BW \times AT1 \times AT2)$$

Sediment dermal exposure for on-base worker scenario:

$$CDI = (CS \times CF \times SA \times AF \times ABS \times EF \times ED)/(BW \times AT1 \times AT2)$$

Surface water ingestion for off-base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = [(IRc \times ETc \times EFc \times EDc) / BWc + (IRa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)$$

Surface water dermal exposure for off-base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = \{[(SAc \times PC \times ETc \times EFc \times EDc) / BWc + (SAa \times PC \times ETa \times EFa \times EDa)/BWa]/(AT1 \times AT2)\} \times CF$$

Sediment ingestion for off-base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = \{[(IRc \times EFc \times EDc) / BWc + (IRa \times EFa \times EDa) / BWa] \times CF\}/ (AT1 \times AT2)$$

Sediment dermal exposure for off-base residential scenario:

$$CDI = CS \times AF \times HIF \quad and$$

$$HIF = \{[(SAc \times EFc \times EDc \times ABS) / BWc + (SAa \times EFa \times EDa \times ABS) / BWa] \times CF\} / (AT1 \times AT2)$$

Where:

- *CDI* = Chronic Daily Intake
- *HIF* = Human Intake Factor
- *CW* = Concentration in Surface Water
- *CS* = Concentration in Sediments
- *IR* = Ingestion Rate (L/hour for surface water, mg/day for sediments)
- *IRc* = Child Resident Ingestion Rate (L/hour for surface water, mg/day for sediments)
- *IRa* = Adult Resident Ingestion Rate (L/hour for surface water, mg/day for sediments)
- *ET* = Worker Exposure Time (hours)
- *ETc* = Child Resident Exposure Time (hours)
- *ETa* = Adult Resident Exposure Time (hours)
- *SA* = Worker Skin Surface Area available for contact (cm^2)
- *SAc* = Child Resident Skin Surface Area available for contact (cm^2)
- *SAa* = Adult Resident Skin Surface Area available for contact (cm^2)
- *EF* = Worker Exposure Frequency (days/year)
- *EFc* = Child Resident Exposure Frequency (days/year)

EFa = Adult Resident Exposure Frequency (days/year)

ED = Worker Exposure Duration (years)

EDc = Child Resident Exposure Duration (years)

EDa = Adult Resident Exposure Duration (years)

BW = Worker Body Weight (kg)

BWc = Child Body Weight (kg)

BWa = Adult Body Weight (kg)

AF = Adherence Factor (unitless)

ABS = Absorption Factor (unitless)

AT1 = Days Per Year = 365 days/year

AT2 = Averaging Time (70 years for carcinogenic effects, duration exposure for noncarcinogenic effects)

CF = Conversion Factor

Attachment A presents the CDI calculations associated with each medium, route of exposure, and receptor.

TABLES

TABLE 3-1

EXPOSURE PARAMETERS
DERMAL CONTACT WITH SEDIMENTS

Exposure Parameter	ADULT RESIDENT		CHILD		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(SA) Exposed Surface Area - wading (cm^2)	8,620 [b,n]	2,800 [b,n]	6,500 [c,n]	1,800 [c,n]	9,800 [b]	2,000 [e]
(SA) Exposed Surface Area - swimming (cm^2)	na	na	6,500 [d,n]	6,500 [d,n]	na	na
(AF) Dermal Sediment Adherence (mg/cm^2)	1.00 [f]	0.20 [f]	1.00 [f]	0.20 [f]	1.00 [f]	0.20 [f]
(ABS) Absorption Factor (unitless)	Chemical Specific [g]					
(ED) Exposure Duration (years)	25 [h]	9 [i]	5 [h]	5 [r]	25 [j]	5 [j]
(EF) Exposure Frequency (days/year)	4 [k]	2 [o]	34 [l]	17 [o]	5 [m]	1 [m]
(BW) Body Weight (kg)	57.1 [n]	57.1 [n]	15.1 [n]	15.1 [n]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[p]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[q]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. The surface area of head, hands, arms, and lower legs is assumed for RME. The surface area of hands, forearms and feet is assumed for average exposure.

c. Exposed surface area is based on whole body for RME. For average exposure, surface area of hands, forearms, and feet are used.

d. Exposed surface area is based on whole body for both RME and average exposure.

e. Average exposed surface for construction worker based on hands and forearms.

f. Dermal adherence based on Dermal Exposure Assessment: Principles and Applications (USEPA, 1992).

g. Based on the EPA Region IV Guidance (Feb. 11, 1992), 1.0% dermal absorption is assumed for organics and 0.1% for inorganics.

h. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989).

i. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989).

j. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (EPA, 1991). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

k. Assumes 1 day/month exposure during the 4 months of summer.

l. Assumes 2 day/week exposure for the 17 weeks of summer.

m. Exposure frequency for construction workers assumes minor construction activities in the creek.

n. Age-weighted average.

o. Assumed value based on one-half the RME value.

p. Averaging time for noncarcinogenic effects is based on the exposure duration.

q. Averaging time for carcinogenic effects is based on assumed lifetime of 70 years.

r. Average exposure duration for a child assumes entire 5 year age span (age 1-6).

na. Not applicable.

TABLE 3-2

EXPOSURE PARAMETERS
INGESTION OF SEDIMENTS

Exposure Parameter	ADULT RESIDENT		CHILD		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(IR) Ingestion Rate (mg/day)	100 [b]	10 [c]	200 [b]	100 [k]	50 [b]	10 [c]
(ED) Exposure Duration (years)	25 [d]	9 [e]	5 [d]	5 [n]	25 [f]	5 [f]
(EF) Exposure Frequency (days/year)	4 [g]	2 [k]	34 [h]	17 [k]	5 [i]	1 [i]
(BW) Body Weight (kg)	57.1 [j]	57.1 [j]	15.1 [j]	15.1 [j]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[l]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[m]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. For RME, standard default sediment ingestion rates of 100 mg/day for adult resident, 200mg/day for children and 50 mg/day for workers were assumed (USEPA, 1991b).

c. Average ingestion rate as identified in Exposure Factors Handbook (USEPA, 1989).

d. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989).

e. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989).

f. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (EPA, 1991). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

g. Assumes 1 day/month exposure during the 4 months of summer.

h. Assumes 2 day/week for the 17 weeks of summer.

i. Exposure frequency for construction workers assumes minor construction activities in the creek.

j. Age-weighted average.

k. Assumed value based on one-half the RME value.

l. Averaging time for noncarcinogenic effects is based on the exposure duration.

m. Averaging time for carcinogenic effects is based on assumed lifetime of 70 years.

n. Average exposure duration for a child assumes entire 5-year age span (age 1-6).

TABLE 3-3

EXPOSURE PARAMETERS
DERMAL CONTACT WITH SURFACE WATER

Exposure Parameter	ADULT RESIDENT		CHILD		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(SA) Exposed Surface Area - wading (cm^2)	8,620 [c,m]	2,800 [e,m]	6,500 [d,m]	1,800 [e,m]	9,800 [c]	2,000 [f]
(SA) Exposed Surface Area - swimming (cm^2)[b]	na	na	6,500 [d,m]	6,500 [d,m]	na	na
(PC) Dermal Permeability Constant (cm/hour)	Chemical-Specific					
(ET) Exposure Time (hours/day)	2	1 [o]	6	3 [o]	8	4 [o]
(ED) Exposure Duration (years)	25 [g]	9 [h]	5 [g]	5 [r]	25 [i]	5 [i]
(EF) Exposure Frequency (days/year)	4 [j]	2 [o]	34 [k]	17 [o]	5 [l]	1 [l]
(BW) Body Weight (kg)	57.1 [m]	57.1 [m]	15.1 [m]	15.1 [m]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[p]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[q]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. Swimming is only evaluated for the child scenario in off-base portions of East Soldier Creek.

c. The surface area of head, hands, arms, and lower legs is assumed for RME.

d. Exposed surface area is based on whole body exposure.

e. Average exposure assumes surface area of hands, forearms, and feet.

f. Average exposed surface area for construction workers based on hands and forearms.

g. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989).

h. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989).

i. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (EPA, 1991). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

j. Assumes 1 day/month exposure during the 4 months of summer.

k. Assumes 2 day/week exposure for the 17 weeks of summer.

l. Exposure frequency for construction workers assumes minor construction activities in the creek.

m. Age-weighted average.

o. Assumed value based on one-half the RME value.

p. Averaging time for noncarcinogenic effects is based on the exposure duration.

q. Averaging time for carcinogenic effects is based on lifetime of 70 years.

r. Average exposure duration for a child assumes entire 5-year age span (age 1-6).

na. Not applicable.

TABLE 3-4

EXPOSURE PARAMETERS
INGESTION OF SURFACE WATER

Parameter	ADULT RESIDENT		CHILD		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(IR) Ingestion Rate - wading (L/hour)	0.005 [c]	0.0025 [l]	0.005 [c]	0.0025 [l]	0.005 [c]	0.0025 [l]
(IR) Ingestion Rate - Swimming (L/hour)[b]	na	na	0.050 [d]	0.025 [l]	na	na
(ET) Exposure Time (hours/day)	2	1 [l]	6	3 [l]	8	4 [l]
(ED) Exposure Duration (years)	25 [e]	9 [f]	5 [e]	5 [o]	25 [g]	5 [g]
(EF) Exposure Frequency (days/year)	4 [h]	2 [l]	34 [i]	17 [l]	5 [j]	1 [j]
(BW) Body Weight (kg)	57.1 [k]	57.1 [k]	15.1 [k]	15.1 [k]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[m]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[n]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. Swimming is only evaluated for the child scenario in off-base portions of East Soldier Creek.

c. Assumed to be one-tenth of the surface water ingestion rate while swimming.

d. Surface water ingestion rate while swimming as identified in RAGS (USEPA, 1989).

e. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989).

f. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989).

g. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (EPA, 1991). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

h. Assumes 1 day/month exposure during the 4 months of summer.

i. Assumes 2 day/week exposure for the 17 weeks of summer.

j. Exposure frequency for construction workers assumes minor construction activities in the creek.

k. Age-weighted average.

l. Assumed value based on one-half the RME value.

m. Averaging time for noncarcinogenic effects is based on the exposure duration.

n. Averaging time for carcinogenic effects is based on lifetime of 70 years.

o. Average exposure duration for a child assumes entire 5-year age span (age 1-6).

na. Not applicable.

TABLE 3-5
EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	6.00E-04	8.56E-04	2.43E-03	6.00E-04	6.00E-04
Cadmium	1.00E-03	3.00E-04	6.41E-04	6.41E-04	3.00E-04
Cobalt	1.20E-03	5.94E-04	9.17E-04	9.17E-04	5.94E-04
Nickel	4.00E-02	1.90E-02	8.15E-02	4.00E-02	1.90E-02
Vanadium	4.60E-03	2.61E-03	5.17E-03	4.60E-03	2.61E-03
Semivolatile Organics					
Benzoic acid	1.20E-03	1.69E-02	4.09E-01	1.20E-03	1.20E-03
Dimethyl phthalate	1.00E-03	4.51E-03	7.45E-03	1.00E-03	1.00E-03
Volatile Organics					
Acetone	8.40E-03	5.10E-03	5.96E-03	5.96E-03	5.10E-03
Carbon disulfide	4.00E-03	1.90E-03	2.47E-03	2.47E-03	1.90E-03
Tetrachloroethene	1.50E-03	1.50E-03	1.50E-03	1.50E-03	1.50E-03
Toluene	3.60E-03	2.62E-03	2.85E-03	2.85E-03	2.62E-03
Trichloroethene	1.30E-02	4.43E-03	7.98E-03	7.98E-03	4.43E-03

Note:

a. One half of the detection limit is used for all nondetects when calculating values.
b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.
c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.
d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-6
EXPOSURE POINT CONCENTRATIONS
OFF-BASE WEST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	5.00E-04	7.67E-04	2.11E-03	5.00E-04	5.00E-04
Cadmium	7.00E-04	4.17E-04	5.95E-04	5.95E-04	4.17E-04
Cobalt	3.00E-04	2.67E-04	3.10E-04	3.00E-04	2.67E-04
Nickel	1.00E-02	7.85E-03	1.12E-02	1.00E-02	7.85E-03
Vanadium	1.30E-02	1.03E-02	1.41E-02	1.30E-02	1.03E-02
Semivolatile Organics					
Benzoic acid	1.20E-03	2.20E-02	1.38E-01	1.20E-03	1.20E-03
Volatile Organics					
Acetone	4.70E-03	4.68E-03	5.54E-03	4.70E-03	4.68E-03

Note:

a. One half of the detection limit is used for all nondetects when calculating values.
b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.
c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.
d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-7
EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	6.00E-04	6.00E-04	1.01E-03	6.00E-04	6.00E-04
Cadmium	3.70E-03	5.76E-04	8.54E-04	8.54E-04	5.76E-04
Cobalt	1.60E-03	3.11E-04	3.53E-04	3.53E-04	3.11E-04
Nickel	9.80E-03	4.77E-03	5.76E-03	5.76E-03	4.77E-03
Vanadium	2.70E-02	1.63E-02	2.02E-02	2.02E-02	1.63E-02
Semivolatile Organics					
1,2-Dichlorobenzene	1.70E-03	4.79E-03	5.38E-03	1.70E-03	1.70E-03
4-Nitrophenol	1.30E-03	2.36E-02	3.52E-02	1.30E-03	1.30E-03
Aniline	4.00E-03	4.87E-03	5.15E-03	4.00E-03	4.00E-03
Benzidine	1.20E-03	6.49E-02	1.36E-01	1.20E-03	1.20E-03
Benzoic acid	1.60E-03	2.24E-02	4.01E-02	1.60E-03	1.60E-03
Butyl benzyl phthalate	3.20E-03	4.69E-03	5.19E-03	3.20E-03	3.20E-03
Di-n-butyl phthalate	1.40E-03	4.77E-03	5.36E-03	1.40E-03	1.40E-03
Fluoranthene	1.60E-03	4.70E-03	5.37E-03	1.60E-03	1.60E-03
Phenol	2.00E-03	4.71E-03	5.27E-03	2.00E-03	2.00E-03
Volatile Organics					
2-Butanone (MEK)	5.40E-03	4.57E-03	5.03E-03	5.03E-03	4.57E-03
2-Hexanone	5.40E-03	5.01E-03	5.03E-03	5.03E-03	5.01E-03
Acetone	2.60E-02	7.96E-03	9.24E-03	9.24E-03	7.96E-03
Bromoform	4.00E-03	2.40E-03	2.59E-03	2.59E-03	2.40E-03
Chloroform	2.50E-03	2.46E-03	2.58E-03	2.50E-03	2.46E-03
Dibromochloromethane	2.50E-03	2.46E-03	2.57E-03	2.50E-03	2.46E-03

Note:

a. One half of the detection limit is used for all nondetects when calculating values.

b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-8
EXPOSURE POINT CONCENTRTIONS
OFF-BASE EAST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	6.00E-04	4.17E-04	5.90E-04	5.90E-04	4.17E-04
Cadmium	8.00E-04	4.33E-04	7.03E-04	7.03E-04	4.33E-04
Cobalt	7.00E-04	3.50E-04	6.69E-04	6.69E-04	3.50E-04
Nickel	8.70E-03	6.35E-03	9.32E-03	8.70E-03	6.35E-03
Silver	2.00E-04	2.42E-04	2.62E-04	2.00E-04	2.00E-04
Vanadium	1.70E-02	1.24E-02	1.98E-02	1.70E-02	1.24E-02
Pesticides					
4,4'-DDT	7.50E-05	5.26E-05	5.87E-05	5.87E-05	5.26E-05
Semivolatile Organics					
2,6-Dichlorophenol	2.80E-03	4.33E-03	5.92E-03	2.80E-03	2.80E-03
3/4-Methylphenol	1.20E-03	4.48E-03	7.46E-03	1.20E-03	1.20E-03
Phenol	2.00E-03	4.58E-03	6.01E-03	2.00E-03	2.00E-03
Volatile Organics					
Acetone	9.70E-03	5.59E-03	7.36E-03	7.36E-03	5.59E-03

Note:

a. One half of the detection limit is used for all nondetects when calculating values.
b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.
c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.
d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-9
EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration.[d] (mg/kg)	Average Exposure Point Conc.[e] (mg/kg)
Metals					
Beryllium	1.50E+00	8.17E-01	1.14E+00	1.14E+00	8.17E-01
Cadmium	1.90E+02	2.80E+01	5.71E+02	1.90E+02	2.80E+01
Chromium	2.23E+03	4.44E+02	2.77E+03	2.23E+03	4.44E+02
Cobalt	1.09E+02	2.72E+01	5.17E+01	5.17E+01	2.72E+01
Lead	4.34E+02	1.09E+02	2.66E+02	2.66E+02	1.09E+02
Mercury	1.50E+00	2.02E-01	3.21E-01	3.21E-01	2.02E-01
Nickel	3.69E+03	5.80E+02	5.63E+03	3.69E+03	5.80E+02
Silver	1.31E+02	2.55E+01	3.58E+02	1.31E+02	2.55E+01
Thallium	6.16E+01	8.87E+01	4.23E+05	6.16E+01	6.16E+01
Vanadium	1.21E+02	3.75E+01	4.95E+01	4.95E+01	3.75E+01
Pesticides/PCBs					
Aroclor 1254	6.10E+01	4.81E+00	3.15E+02	6.10E+01	4.81E+00
Semivolatile organics					
1,2,4-Trichlorobenzene	1.40E-01	4.14E-01	5.72E-01	1.40E-01	1.40E-01
1,2-Dichlorobenzene	1.60E+00	4.83E-01	8.21E-01	8.21E-01	4.83E-01
1,3-Dichlorobenzene	1.50E-01	4.15E-01	5.71E-01	1.50E-01	1.50E-01
1,4-Dichlorobenzene	2.50E-01	4.20E-01	5.72E-01	2.50E-01	2.50E-01
2-Methylnaphthalene	4.20E-02	4.25E-01	6.85E-01	4.20E-02	4.20E-02
4,6-Dinitro-2-methylphenol	1.70E+01	2.91E+00	4.42E+00	1.70E+01	2.91E+00
Acenaphthene	3.70E-01	3.93E-01	6.10E-01	3.70E-01	3.70E-01
Anthracene	5.80E-01	3.14E-01	4.22E-01	4.22E-01	3.14E-01
Benzidine	3.50E-01	5.86E+00	1.08E+01	3.50E-01	3.50E-01
Benzo(a)anthracene	3.40E+00	8.02E-01	1.98E+00	1.98E+00	8.02E-01
Benzo(a)pyrene	3.60E+00	8.89E-01	2.03E+00	2.03E+00	8.89E-01
Benzo(b)fluoranthene	7.00E+00	1.29E+00	5.33E+00	5.33E+00	1.29E+00
Benzo(g,h,i)perylene	2.80E+00	7.09E-01	1.34E+00	1.34E+00	7.09E-01
Benzo(k)fluoranthene	2.10E+00	4.90E-01	7.01E-01	7.01E-01	4.90E-01
Chrysene	4.10E+00	1.03E+00	3.02E+00	3.02E+00	1.03E+00

TABLE 3-9
EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration.[d] (mg/kg)	Average Exposure Point Conc.[e] (mg/kg)
Semivolatile organics (continued)					
Di-n-butyl phthalate	5.10E-01	4.02E-01	8.50E-01	5.10E-01	4.02E-01
Dibenz(a,h)anthracene	7.70E-01	2.89E-01	3.98E-01	3.98E-01	2.89E-01
Dibenzofuran	2.50E-01	3.85E-01	6.59E-01	2.50E-01	2.50E-01
Fluoranthene	7.60E+00	1.78E+00	1.16E+01	7.60E+00	1.78E+00
Fluorene	3.20E-01	3.86E-01	6.03E-01	3.20E-01	3.20E-01
Indeno(1,2,3-cd)pyrene	2.40E+00	6.27E-01	1.14E+00	1.14E+00	6.27E-01
Naphthalene	3.20E-01	3.94E-01	6.20E-01	3.20E-01	3.20E-01
Phenanthrene	5.70E+00	1.17E+00	3.48E+00	3.48E+00	1.17E+00
Pyrene	8.40E+00	1.62E+00	8.36E+00	8.36E+00	1.62E+00
bis(2-Ethylhexyl)phthalate	3.70E+00	7.09E-01	1.85E+00	1.85E+00	7.09E-01
Volatile organics					
2-Butanone (MEK)	6.20E-02	1.03E-02	1.20E-02	1.20E-02	1.03E-02
Acetone	1.20E-01	1.70E-02	2.66E-02	2.66E-02	1.70E-02
Carbon disulfide	5.60E-03	3.67E-03	4.03E-03	4.03E-03	3.67E-03
Tetrachloroethene	8.90E-02	8.39E-03	9.43E-03	9.43E-03	8.39E-03
Toluene	1.50E-02	4.35E-03	5.40E-03	5.40E-03	4.35E-03
Trichloroethene	1.30E-02	4.83E-03	6.89E-03	6.89E-03	4.83E-03

Note:

a. Surface (0-0.5 feet) sediment data are used in the calculations

b. One half of the detection limit is used for all nondetects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d. The concentrations associated with the 95 percent UCL or the maximum concentration detected, whichever was lower was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average expsoure point concentration.

TABLE 3-10
EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration.[d] (mg/kg)	Average Exposure Point Concentration.[e] (mg/kg)
Metals					
Barium	5.56E+03	5.20E+02	6.18E+02	6.18E+02	5.20E+02
Beryllium	1.60E+00	7.18E-01	8.97E-01	8.97E-01	7.18E-01
Cadmium	3.06E+02	2.30E+01	1.01E+02	1.01E+02	2.30E+01
Chromium	5.14E+03	3.72E+02	6.11E+02	6.11E+02	3.72E+02
Cobalt	1.09E+02	1.95E+01	2.41E+01	2.41E+01	1.95E+01
Lead	6.16E+02	7.80E+01	1.11E+02	1.11E+02	7.80E+01
Mercury	1.50E+00	1.50E-01	1.78E-01	1.78E-01	1.50E-01
Nickel	8.79E+03	5.13E+02	9.41E+02	9.41E+02	5.13E+02
Silver	2.45E+02	2.00E+01	4.94E+01	4.94E+01	2.00E+01
Thallium	6.16E+01	8.08E+01	2.90E+04	6.16E+01	6.16E+01
Vanadium	1.21E+02	3.25E+01	3.74E+01	3.74E+01	3.25E+01
Pesticides/PCBs					
Aroclor 1254	8.60E+01	5.77E+00	4.19E+01	4.19E+01	5.77E+00
Semivolatile Organics					
1,2,4-Trichlorobenzene	1.40E-01	7.02E-01	5.86E-01	1.40E-01	1.40E-01
1,2-Dichlorobenzene	1.70E+00	7.81E-01	7.33E-01	7.33E-01	7.33E-01
1,3-Dichlorobenzene	1.50E-01	7.04E-01	5.78E-01	1.50E-01	1.50E-01
1,4-Dichlorobenzene	3.00E-01	7.11E-01	5.76E-01	3.00E-01	3.00E-01
1-Naphthylamine	5.60E-01	7.00E-01	5.60E-01	5.60E-01	5.60E-01
2-Methylnaphthalene	6.00E-01	6.97E-01	5.96E-01	5.96E-01	5.96E-01
4,6-Dinitromethylphenol	1.70E+01	2.91E+00	4.42E+00	4.42E+00	2.91E+00
Acenaphthene	3.70E-01	6.98E-01	5.73E-01	3.70E-01	3.70E-01
Anthracene	5.80E-01	6.45E-01	4.89E-01	4.89E-01	4.89E-01
Benzidine	3.50E-01	5.86E+00	1.08E+01	3.50E-01	3.50E-01
Benzo(a)anthracene	3.40E+00	8.80E-01	1.01E+00	1.01E+00	8.80E-01
Benzo(a)pyrene	3.60E+00	9.32E-01	1.14E+00	1.14E+00	9.32E-01
Benzo(b)fluoranthene	7.00E+00	8.20E-01	1.35E+00	1.35E+00	8.20E-01
Benzo(g,h,i)perylene	2.80E+00	8.30E-01	8.84E-01	8.84E-01	8.30E-01

TABLE 3-10
EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration.[d] (mg/kg)	Average Exposure Point Concentration.[e] (mg/kg)
Semivolatile Organic					
(continued)					
Benzo(k)fluoranthene	2.10E+00	7.47E-01	6.65E-01	6.65E-01	6.65E-01
Chrysene	4.10E+00	6.59E-01	9.08E-01	9.08E-01	6.59E-01
Di-n-butyl phthalate	5.10E-01	7.03E-01	6.32E-01	5.10E-01	5.10E-01
Dibenz(a,h)anthracene	7.70E-01	6.38E-01	4.93E-01	4.93E-01	4.93E-01
Dibenzofuran	3.10E-01	6.75E-01	5.50E-01	3.10E-01	3.10E-01
Fluoranthene	7.60E+00	1.02E+00	1.80E+00	1.80E+00	1.02E+00
Fluorene	3.20E-01	6.95E-01	5.73E-01	3.20E-01	3.20E-01
Indeno(1,2,3-cd)pyrene	2.40E+00	7.88E-01	7.93E-01	7.93E-01	7.88E-01
Naphthalene	5.10E-01	6.84E-01	5.52E-01	5.10E-01	5.10E-01
Phenanthrene	5.70E+00	1.08E+00	1.45E+00	1.45E+00	1.08E+00
Pyrene	8.40E+00	9.89E-01	1.66E+00	1.66E+00	9.89E-01
bis(2-Ethylhexyl)phthalate	2.20E+01	1.04E+00	1.26E+00	1.26E+00	1.04E+00
Volatile Organics					
2-Butanone (MEK)	6.20E-02	8.38E-03	8.78E-03	8.78E-03	8.38E-03
Acetone	1.20E-01	1.32E-02	1.66E-02	1.66E-02	1.32E-02
Carbon disulfide	9.40E-03	3.64E-03	3.85E-03	3.85E-03	3.64E-03
Chlorobenzene	4.30E-03	3.52E-03	3.71E-03	3.71E-03	3.52E-03
Tetrachloroethene	8.90E-02	7.59E-03	6.87E-03	6.87E-03	6.87E-03
Toluene	1.50E-02	3.86E-03	4.30E-03	4.30E-03	3.86E-03
Trichloroethene	1.60E-02	4.95E-03	6.06E-03	6.06E-03	4.95E-03

Note:

a. Sediment data collected from 0-5 foot depth are used in the calculations.

b. One half of the detection limit is used for all nondetects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-11
EXPOSURE POINT CONCENTRATIONS
OFF-BASE WEST SOLDIER CREEK SEDIMENTS
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	1.73E+01	5.61E+00	9.32E+00	9.32E+00	5.61E+00
Beryllium	3.30E-01	1.82E-01	2.78E-01	2.78E-01	1.82E-01
Cadmium	2.34E+01	8.92E+00	1.31E+02	2.34E+01	8.92E+00
Cobalt	4.08E+01	9.18E+00	2.43E+01	2.43E+01	9.18E+00
Lead	6.40E+02	1.11E+02	3.53E+03	6.40E+02	1.11E+02
Silver	1.55E+01	4.08E+00	2.53E+01	1.55E+01	4.08E+00
Vanadium	2.33E+01	1.35E+01	2.16E+01	2.16E+01	1.35E+01
Pesticides/PCBs					
Aroclor 1254	6.00E+00	2.28E+00	1.07E+01	6.00E+00	2.28E+00
Semivolatile Organics					
Benzidine	4.60E-02	2.73E+00	1.01E+02	4.60E-02	4.60E-02
Benzo(a)anthracene	3.00E-01	1.95E-01	2.62E-01	2.62E-01	1.95E-01
Benzo(a)pyrene	2.10E-01	1.83E-01	2.46E-01	2.10E-01	1.83E-01
Benzo(b)fluoranthene	4.00E-01	1.57E-01	4.04E-01	4.00E-01	1.57E-01
Benzo(g,h,i)perylene	1.10E-01	1.68E-01	2.54E-01	1.10E-01	1.10E-01
Benzo(k)fluoranthene	2.10E-01	1.99E-01	2.05E-01	2.05E-01	1.99E-01
Benzyl alcohol	7.90E-02	1.84E-01	2.45E-01	7.90E-02	7.90E-02
Butyl benzyl phthalate	1.10E-01	1.86E-01	2.19E-01	1.10E-01	1.10E-01
Chrysene	4.00E-01	2.09E-01	2.89E-01	2.89E-01	2.09E-01
Fluoranthene	7.00E-01	1.91E-01	6.24E-01	6.24E-01	1.91E-01
Indeno(1,2,3-cd)pyrene	1.20E-01	1.68E-01	2.82E-01	1.20E-01	1.20E-01
Phenanthrene	7.80E-02	1.64E-01	2.73E-01	7.80E-02	7.80E-02
Pyrene	5.90E-01	2.11E-01	4.01E-01	4.01E-01	2.11E-01
bis(2-Ethylhexyl)phthalate	5.10E-01	2.25E-01	3.74E-01	3.74E-01	2.25E-01
Volatile Organics					
Acetone	1.30E-02	6.40E-03	9.74E-03	9.74E-03	6.40E-03

Note:

a. Sediment data collected from 0-5 feet depth are used int he calculations.

b. One half of the detection limit is used for all non-detects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean cancentration assuming lognormal distribution.

d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-12
EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Metals					
Beryllium	1.00E+00	3.45E-01	4.27E-01	4.27E-01	3.45E-01
Cadmium	3.90E+02	2.93E+01	7.40E+01	7.40E+01	2.93E+01
Chromium	2.92E+03	3.44E+02	7.36E+02	7.36E+02	3.44E+02
Cobalt	9.01E+01	1.03E+01	1.34E+01	1.34E+01	1.03E+01
Lead	1.21E+03	1.59E+02	3.15E+02	3.15E+02	1.59E+02
Mercury	4.70E+00	5.66E-01	8.80E-01	8.80E-01	5.66E-01
Nickel	1.42E+03	1.59E+02	3.57E+02	3.57E+02	1.59E+02
Silver	3.84E+01	4.23E+00	6.40E+00	6.40E+00	4.23E+00
Thallium	6.26E+01	9.02E+01	2.30E+04	6.26E+01	6.26E+01
Vanadium	1.05E+02	2.33E+01	2.99E+01	2.99E+01	2.33E+01
Pesticides/PCBs					
4,4'-DDE	7.20E-02	1.23E-01	3.27E-01	7.20E-02	7.20E-02
Aldrin	3.70E+00	1.66E-01	3.88E-01	3.88E-01	1.66E-01
Aroclor 1254	3.90E+01	4.21E+00	2.07E+01	2.07E+01	4.21E+00
Dieldrin	2.50E+01	7.77E-01	1.02E+00	1.02E+00	7.77E-01
Heptachlor	7.00E+00	2.60E-01	6.79E-01	6.79E-01	2.60E-01
alpha-Chlordane	1.60E+01	4.93E-01	5.96E-01	5.96E-01	4.93E-01
delta-BHC	3.20E+00	1.21E-01	1.96E-01	1.96E-01	1.21E-01
Semivolatile Organics					
1,4-Dichlorobenzene	2.40E+00	1.09E+00	1.68E+00	1.68E+00	1.09E+00
1-Chloronaphthalene	1.50E+00	4.77E+00	9.38E+00	1.50E+00	1.50E+00
2-Chloronaphthalene	3.10E-01	1.13E+00	1.74E+00	3.10E-01	3.10E-01
2-Methylnaphthalene	4.00E+00	1.03E+00	1.75E+00	1.75E+00	1.03E+00
Acenaphthene	1.70E+01	1.27E+00	1.79E+00	1.70E+01	1.27E+00
Anthracene	3.60E+01	2.41E+00	3.45E+00	3.45E+00	2.41E+00
Benzidine	2.90E-01	1.40E+01	3.06E+01	2.90E-01	2.90E-01
Benzo(a)anthracene	5.90E+01	5.15E+00	1.42E+01	1.42E+01	5.15E+00
Benzo(a)pyrene	4.50E+01	4.46E+00	1.16E+01	1.16E+01	4.46E+00
Benzo(b)fluoranthene	8.30E+01	8.21E+00	2.53E+01	2.53E+01	8.21E+00
Benzo(g,h,i)perylene	2.00E+01	2.55E+00	6.36E+00	6.36E+00	2.55E+00

TABLE 3-12
EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Semivolatile Organics (continued)					
Benzo(k)fluoranthene	7.40E+00	1.30E+00	2.19E+00	2.19E+00	1.30E+00
Chrysene	5.70E+01	5.65E+00	1.46E+01	1.46E+01	5.65E+00
Di-n-octyl phthalate	1.40E+00	1.12E+00	1.76E+00	1.40E+00	1.12E+00
Dibenz(a,h)anthracene	6.00E+00	9.65E-01	1.55E+00	1.55E+00	9.65E-01
Dibenzofuran	1.10E+01	1.12E+00	1.92E+00	1.92E+00	1.12E+00
Fluoranthene	1.20E+02	1.38E+01	6.81E+01	6.81E+01	1.38E+01
Fluorene	2.30E+01	1.43E+00	1.96E+00	1.96E+00	1.43E+00
Indeno(1,2,3-cd)pyrene	2.00E+01	2.29E+00	5.87E+00	5.87E+00	2.29E+00
Naphthalene	1.50E+01	1.54E+00	2.65E+00	2.65E+00	1.54E+00
Phenanthrene	1.10E+02	1.03E+01	3.66E+01	3.66E+01	1.03E+01
Pyrene	1.10E+02	1.14E+01	4.65E+01	4.65E+01	1.14E+01
bis(2-Ethylhexyl)phthalate	1.10E+01	2.48E+00	5.98E+00	5.98E+00	2.48E+00
Volatile Organics					
2-Butanone (MEK)	2.50E-01	2.13E-02	2.44E-02	2.44E-02	2.13E-02
Acetone	7.40E-01	5.65E-02	8.16E-02	8.16E-02	5.65E-02
Carbon disulfide	4.40E-03	5.95E-03	6.65E-03	4.40E-03	4.40E-03
Chlorobenzene	2.40E-01	2.09E-02	2.26E-02	2.26E-02	2.09E-02
Toluene	7.60E-01	2.70E-02	1.45E-02	1.45E-02	1.45E-02
Xylenes (total)	2.60E-03	6.05E-03	6.67E-03	2.60E-03	2.60E-03

Note:

a. Surface (0-0.5 feet) sediment data are used in the calculations

b. One half of the detection limit is used for all nondetects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d. The concentrations associated with the 95 percent UCL or the maximum concentration detected, whichever was lower was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average expsoure point concentration.

TABLE 3-13
EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Metals					
Beryllium	1.00E+00	3.58E-01	4.10E-01	4.10E-01	3.58E-01
Cadmium	3.90E+02	3.24E+01	5.72E+01	5.72E+01	3.24E+01
Chromium	2.92E+03	3.60E+02	5.38E+02	5.38E+02	3.60E+02
Cobalt	9.01E+01	1.01E+01	1.10E+01	1.10E+01	1.01E+01
Lead	1.21E+03	1.30E+02	1.82E+02	1.82E+02	1.30E+02
Mercury	4.70E+00	4.42E-01	5.27E-01	5.27E-01	4.42E-01
Nickel	1.42E+03	1.46E+02	2.04E+02	2.04E+02	1.46E+02
Silver	3.84E+01	4.28E+00	5.38E+00	5.38E+00	4.28E+00
Thallium	6.26E+01	8.97E+01	5.04E+03	6.26E+01	6.26E+01
Vanadium	1.05E+02	2.24E+01	2.53E+01	2.53E+01	2.24E+01
Pesticides/PCBs					
4,4'-DDE	7.20E-02	1.24E-01	1.74E-01	7.20E-02	7.20E-02
Aldrin	3.70E+00	1.46E-01	1.61E-01	1.61E-01	1.46E-01
Aroclor 1254	3.90E+01	3.41E+00	7.38E+00	7.38E+00	3.41E+00
Dieldrin	2.50E+01	8.38E-01	6.31E-01	6.31E-01	6.31E-01
Heptachlor	7.00E+00	2.74E-01	4.14E-01	4.14E-01	2.74E-01
alpha-Chlordane	1.60E+01	6.03E-01	3.92E-01	3.92E-01	3.92E-01
delta-BHC	3.20E+00	9.60E-02	9.80E-02	9.80E-02	9.60E-02
Semivolatile Organics					
1,4-Dichlorobenzene	4.10E+00	1.08E+00	1.37E+00	1.37E+00	1.08E+00
1-Chloronaphthalene	2.60E+00	5.12E+00	7.78E+00	2.60E+00	2.60E+00
2-Chloronaphthalene	2.10E+00	1.06E+00	1.36E+00	1.36E+00	1.06E+00
2-Methylnaphthalene	1.00E+01	1.11E+00	1.43E+00	1.43E+00	1.11E+00
2-Naphthylamine	1.40E-01	1.16E+00	1.50E+00	1.40E-01	1.40E-01
Acenaphthene	1.70E+01	1.28E+00	1.39E+00	1.39E+00	1.28E+00
Anthracene	3.60E+01	2.35E+00	2.56E+00	2.56E+00	2.35E+00
Benzidine	2.90E-01	1.54E+01	2.54E+01	2.90E-01	2.90E-01
Benzo(a)anthracene	5.90E+01	4.68E+00	7.93E+00	7.93E+00	4.68E+00
Benzo(a)pyrene	4.50E+01	4.00E+00	6.62E+00	6.62E+00	4.00E+00
Benzo(b)fluoranthene	8.30E+01	6.91E+00	1.41E+01	1.41E+01	6.91E+00

TABLE 3-13
EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Semivolatile Organics (continued)					
Benzo(g,h,i)perylene	2.00E+01	2.31E+00	3.72E+00	3.72E+00	2.31E+00
Benzo(k)fluoranthene	2.30E+01	1.55E+00	1.88E+00	1.88E+00	1.55E+00
Chrysene	5.70E+01	4.99E+00	9.10E+00	9.10E+00	4.99E+00
Di-n-octyl phthalate	8.90E+00	1.26E+00	1.69E+00	1.69E+00	1.26E+00
Dibenz(a,h)anthracene	6.00E+00	9.82E-01	1.25E+00	1.25E+00	9.82E-01
Dibenzofuran	1.10E+01	1.13E+00	1.47E+00	1.47E+00	1.13E+00
Fluoranthene	1.20E+02	1.30E+01	3.17E+01	3.17E+01	1.30E+01
Fluorene	2.30E+01	1.42E+00	1.48E+00	1.48E+00	1.42E+00
Indeno(1,2,3-cd)pyrene	2.00E+01	2.08E+00	3.27E+00	3.27E+00	2.08E+00
Naphthalene	1.50E+01	1.36E+00	1.77E+00	1.77E+00	1.36E+00
Phenanthrene	1.10E+02	9.49E+00	1.84E+01	1.84E+01	9.49E+00
Pyrene	1.10E+02	1.02E+01	2.26E+01	2.26E+01	1.02E+01
bis(2-Ethylhexyl)phthalate	2.40E+01	3.46E+00	6.24E+00	6.24E+00	3.46E+00
Volatile Organics					
2-Butanone (MEK)	2.50E-01	4.64E-02	3.68E-02	3.68E-02	3.68E-02
Acetone	7.40E-01	7.50E-02	8.79E-02	8.79E-02	7.50E-02
Carbon disulfide	2.70E-02	1.81E-02	1.02E-02	1.02E-02	1.02E-02
Chlorobenzene	2.50E+01	4.65E-01	1.12E-01	1.12E-01	1.12E-01
Toluene	7.60E-01	4.31E-02	2.23E-02	2.23E-02	2.23E-02
Xylenes (total)	7.70E-01	2.35E-02	1.02E-02	1.02E-02	1.02E-02

Note:

a. Sediment data collected from 0-5 feet depth are used in the calculations.
b. One half of the detection limit is used for all nondetects when calculating values.
c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.
d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.
e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-14
EXPOSURE POINT CONCENTRATIONS
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	5.60E+00	3.93E+00	4.10E+00	4.10E+00	3.93E+00
Beryllium	6.50E-01	4.49E-01	5.44E-01	5.44E-01	4.49E-01
Cadmium	3.49E+01	5.52E+00	3.08E+01	3.08E+01	5.52E+00
Cobalt	1.12E+01	5.41E+00	6.61E+00	6.61E+00	5.41E+00
Mercury	2.00E-01	6.93E-02	1.13E-01	1.13E-01	6.93E-02
Vanadium	2.86E+01	1.86E+01	2.14E+01	2.14E+01	1.86E+01
Pesticides/PCBs					
Aldrin	3.90E-02	4.92E-03	8.93E-03	8.93E-03	4.92E-03
Aroclor 1254	6.90E-01	1.01E-01	2.16E-01	2.16E-01	1.01E-01
Dieldrin	3.40E-01	3.26E-02	5.77E-02	5.77E-02	3.26E-02
Heptachlor	2.50E-01	2.29E-02	9.93E-02	9.93E-02	2.29E-02
alpha-Chlordane	1.20E-01	1.29E-02	3.00E-02	3.00E-02	1.29E-02
Semivolatile Organics					
1-Chloronaphthalene	2.70E-01	1.43E+00	1.92E+00	2.70E-01	2.70E-01
3/4-Methylphenol	4.40E-01	3.19E-01	4.00E-01	4.00E-01	3.19E-01
Benzo(a)anthracene	5.30E-01	2.79E-01	3.84E-01	3.84E-01	2.79E-01
Benzo(a)pyrene	4.40E-01	2.65E-01	3.98E-01	3.98E-01	2.65E-01
Benzo(b)fluoranthene	7.90E-01	2.72E-01	3.64E-01	3.64E-01	2.72E-01
Benzo(g,h,i)perylene	2.00E-01	2.70E-01	3.17E-01	2.00E-01	2.00E-01
Benzoic acid	5.60E-02	1.72E+00	3.59E+00	5.60E-02	5.60E-02
Chrysene	6.00E-01	2.59E-01	3.56E-01	3.56E-01	2.59E-01
Di-n-octyl phthalate	1.00E-01	3.00E-01	3.85E-01	1.00E-01	1.00E-01
Dimethyl phthalate	1.60E-01	2.97E-01	3.86E-01	1.60E-01	1.60E-01

TABLE 3-14
EXPOSURE POINT CONCENTRATIONS
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Ave. Exposure Point Concentration[e] (mg/kg)
Semivolatile Organics					
(continued)					
Fluoranthene	1.40E+00	2.95E-01	4.96E-01	4.96E-01	2.95E-01
Indeno(1,2,3-cd)pyrene	1.80E-01	2.69E-01	3.16E-01	1.80E-01	1.80E-01
Phenanthrene	8.50E-01	2.98E-01	3.96E-01	3.96E-01	2.98E-01
Pyrene	1.20E+00	3.05E-01	3.90E-01	3.90E-01	3.05E-01
bis(2-Ethylhexyl)phthalate	2.50E+00	4.74E-01	1.06E+00	1.06E+00	4.74E-01
Volatile Organics					
2-Butanone (MEK)	2.20E-03	6.09E-03	6.90E-03	2.20E-03	2.20E-03
Acetone	2.90E-02	1.67E-02	2.03E-02	2.03E-02	1.67E-02
Carbon disulfide	7.60E-03	3.19E-03	3.71E-03	3.71E-03	3.19E-03
Chlorobenzene	1.70E-03	2.93E-03	3.34E-03	1.70E-03	1.70E-03
Toluene	1.30E-02	3.55E-03	4.25E-03	4.25E-03	3.55E-03

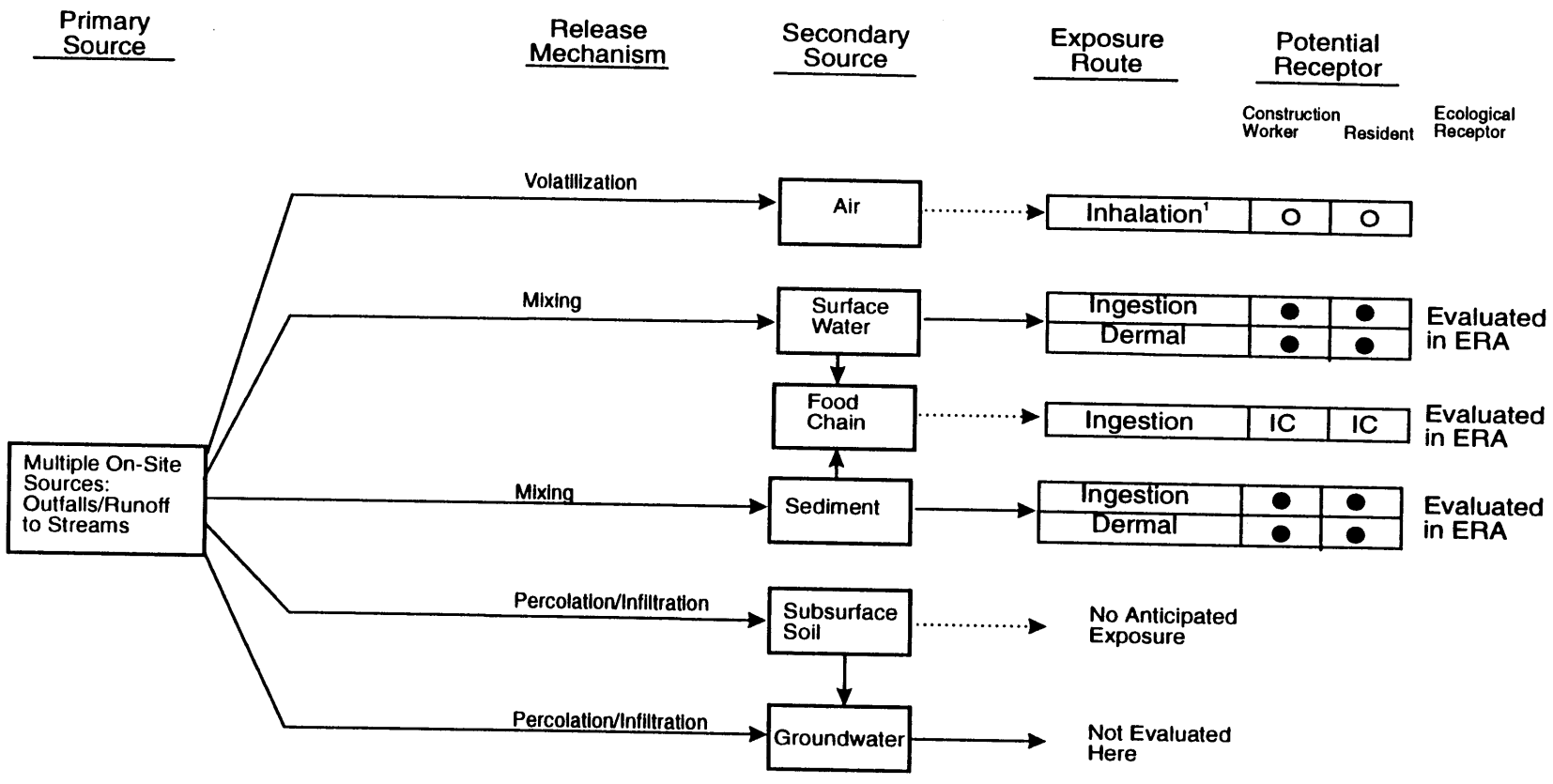
Note:

a. Sediment data collected from 0-5-foot depth are used in the calculations.
b. One half of the detection limit is used for all non-detects when calculating values.
c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.
d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.
e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

FIGURES

FIGURE 3-1

Site Conceptual Exposure Model - East and West Soldier Creek
Tinker Air Force Base, Oklahoma City, Oklahoma



1 Inhalation exposure to volatilized compounds is anticipated to be minor due to atsmospheric dilution.

- - - Incomplete Pathway or Minor Pathway

—— Complete Pathway

O Minor Exposure Route

● Complete Exposure Route

IC Incomplete Exposure Route

Graphics\F93506/FIGA.CDR 1/10/97

Woodward-Clyde Consultants

4.0
TOXICITY ASSESSMENT

In general, the chemicals of concern identified in West and East Soldier Creeks consist of volatile and semivolatile organic compounds, PCBs, pesticides, and metals. The toxicity assessment provides the critical toxicity values (CTVs) for the COCs. The CTVs are values developed by the USEPA that are used to evaluate potential cancer risks and noncarcinogenic health hazards associated with chemical exposure.

4.1 TOXICITY ASSESSMENT OF NONCARCINOGENIC EFFECTS

The noncarcinogenic CTV is known as the reference dose (RfD). Reference doses are based on the premise that noncarcinogenic (i.e., toxic) effects exhibit a threshold. As long as the chronic daily intake (CDI) of a compound is less than the reference dose, no noncarcinogenic health effect is believed to be posed by the exposure. RfDs doses are developed using human and animal studies, and incorporate safety factors to ensure health protection in the most sensitive population.

Substances that produce noncarcinogenic effects are generally thought to have a threshold below which there are no observable adverse health effects. This threshold dose, also known as no-observed-adverse-effect level (NOAEL), is the highest level (determined in epidemiologic studies or animal studies) at which there is no statistically or biologically significant effects of concern, often called the "critical toxic effect." For certain substances, only a LOAEL, or "lowest-observed-adverse-effect level," has been determined. This is the lowest dose of a substance that produces either a statistically or biologically significant indication of the critical toxic effect. The NOAEL or the LOAEL may be used to calculate the RfD of a particular chemical.

RfDs are calculated by dividing the NOAEL (or LOAEL) by uncertainty factors, which generally range from 10 to 1,000. For example, uncertainties include variations in the sensitivity of individuals within a population and the extrapolation of data from experimental animals to humans. The RfD is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day) for oral exposure.

Dermal RfDs can be derived from oral RfDs by adjusting the oral value to account for the percent of gastrointestinal absorption associated with the study used to derive the RfD (i.e., converting the oral RfD from an "administered" to an "absorbed" dose). However, this approach is not currently recommended by USEPA's Dermal Exposure Assessment: Principles and Applications because of metabolic differences between exposure rates (i.e., oral vs. dermal exposures) (USEPA 1992a). USEPA currently recommends use of oral RfDs to evaluate dermal exposure, although it should be noted that this approach may lead to an underestimation of dermal risk for some compounds (USEPA 1992a). The methodology for deriving RfDs is more fully described in the RAGS (USEPA 1989a).

The USEPA defines a chronic RfD as an estimate of a daily exposure level for the human population that is unlikely to result in deleterious effects during a lifetime (i.e., 70 years according to USEPA guidance). A chronic RfD is used to evaluate the potential noncarcinogenic hazards associated with long-term chemical exposures (7 years to a lifetime). Chronic RfDs for the COCs are shown in **Table 4-1**. For the ingestion route, the RfD is for the administered dose (assuming 100 percent absorption by the gastrointestinal tract) unless otherwise noted. This assumption enhances the conservatism of the RA since many chemicals in the environment are not readily absorbed by the gastrointestinal tract. RfDs have also been developed from many of the carcinogens to account for their noncarcinogenic effects.

The potential for noncarcinogenic effects to occur as a result of exposure is evaluated by comparing the exposure level, or daily chemical intake, over a specified time period (e.g., subchronic or chronic) with a RfD derived for a similar exposure period. A Hazard Quotient (HQ) is derived for each chemical as follows:

$$HQ = [Average\ Daily\ Intake] / [RfD]$$

If exposure is equivalent to or less than the RfD, the HQ will be 1.0 or less, which represents an intake level unlikely to be associated with potential adverse effect due to the chemical. If exposure exceeds the RfD, the resulting HQ will exceed 1.0, and it will be concluded that a hazard may exist. For each noncarcinogenic chemical of potential concern specific to each

exposure pathway, an HQ will be derived. HQs for each chemical are then summed for each exposure pathway to derive a value referred to as a Hazard Index (HI):

$$HI = HQ1 + HQ2 + HQ3 \ldots\ldots\ldots\ldots + HQn$$

HIs greater than 1.0 are generally viewed as indicating that exposure to a particular medium identified in the exposure scenario represents a potential human health hazard. Exposure pathway HIs are summed across pathways whenever appropriate, since individuals may be simultaneously exposed to chemicals via more than one pathway (e.g., to both soil and surface water).

4.2 TOXICITY ASSESSMENT OF CARCINOGENIC EFFECTS

The carcinogenic CTV is termed the slope factor (SF). Slope factors are developed based on a dose-response curve for carcinogenicity of the specific chemicals. As with RfD values, slope factors are developed from human and animal studies and are designed to be health protective (i.e., to overestimate the actual risks). The SF is used to estimate an upperbound probability of an individual developing cancer as a result of exposure to a potential carcinogen. Carcinogens with USEPA-derived SFs are also given an USEPA weight-of-evidence classification whereby potential carcinogens are grouped according to the likelihood that the chemical is a human carcinogen, depending on the quality and quantity of carcinogenic potency data for a given chemical. **Table 4-2** presents the USEPA weight-of-evidence classification system.

In estimating the risk posed by potential carcinogens, it is the common practice of the USEPA and other regulatory agencies to assume that any exposure level is associated with a finite probability, however minute, of producing a carcinogenic response. The USEPA assumes that a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation. This mechanism for carcinogenicity is referred to as "non-threshold" since there is theoretically no level of exposure for such a substance that does not pose a small, though finite, probability of producing a carcinogenic response.

SFs are based primarily on the results of animal studies. There is uncertainty whether all animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a certain number of chemical substances are known to be human carcinogens. The EPA assumes that humans are as sensitive to all animal carcinogens as the most sensitive animal species. This policy decision is designed to prevent underestimating risk and introduces the potential to overestimate carcinogenic risk.

It is generally assumed by the USEPA in developing SFs that the risk of cancer is linearly related to the dose. A linearized multistage model is commonly used by the USEPA for low-dose extrapolation of experimentally derived data to the low dose range. This conservative mathematical model is based on the multistage theory of carcinogenesis wherein the response is assumed to be linear at low doses. From the slope of the extrapolation curve estimated by the model, the USEPA calculates the upper 95th percent confidence limit of the slope. This value, the SF, expressed in units of $(mg/kg\text{-}day)^{-1}$, is used to convert the average daily intake of chemical, normalized over a lifetime, directly to a cancer risk. This represents an estimation of an upperbound incremental lifetime probability that an individual will develop cancer as a result of exposure to a potential carcinogen. This model provides a conservative estimate of cancer risk at low doses, and is likely to overestimate the actual cancer risk. The USEPA acknowledges that actual SFs are likely to be between zero and the estimate provided by the linearized multistage model (USEPA 1989a). The SFs and weight-of-evidence classifications for the COCs are included in **Table 4-1**.

Risks associated with individual COCs can be derived by multiplying the SF and the estimated CDI (i.e., average daily intake for entire lifetime) for each exposure pathway as follows:

$$\textit{Risk Estimate} = CDI \times SF$$

An overall risk estimate for each exposure scenario can be calculated by combining the risk estimates for individual chemicals and exposure routes. Risk estimates are then compared with the USEPA's acceptable risk range of 1×10^{-4} (1 in 10,000) to 1×10^{-6} (1 in 1,000,000) incremental excess lifetime cancer risk (NCP 1990).

4.3 SOURCES OF CRITICAL TOXICITY VALUES

The RfD and SF values listed in the present RA were obtained from the following sources:

- USEPA's Integrated Risk Information System on-line database system (USEPA 1996b)
- USEPA's Health Effects Assessment Summary Tables (USEPA 1992d and 1994)
- USEPA Region III Risk-based Concentration Table (USEPA Region III 1996c)
- Drinking Water Regulation and Health Advisories (USEPA 1996a)

Available RfDs and SFs for each COC are presented in **Table 4-1**.

TABLES

TABLE 4-1

CRITICAL TOXICITY VALUES

Chemical Name	Cancer Class	Oral RfD mg/kg-day	Oral SF $(mg/kg\text{-}day)^{-1}$
1,2,4-Trichlorobenzene	D	1.00E-02 [a]	
1,2-Dichlorobenzene	D	9.00E-02 [a]	
1,3-Dichlorobenzene	D	8.90E-02 [g]	
1,4-Dichlorobenzene	B2		2.40E-02 [b]
2,6-Dichlorophenol		3.00E-03 [a,l]	
1-Chloronaphthalene		3.00E-02 [i]	
2,4-Dimethylphenol		2.00E-02 [a]	
4,6-Dinitro-2-Methylphenol			
2-Butanone (MEK)	D	6.00E-01 [a]	
2-Chloronaphthalene		8.00E-02 [a]	
2-Methylnaphthalene	D	3.00E-02 [i]	
3/4 Methylphenol	C	5.00E-02 [a,c]	
1-Naphthylamine			1.30E+02 [k]
2-Naphthylamine			1.30E+02 [g]
4-Nitrophenol	D	8.00E-03 [j]	
Acenaphthene		6.00E-02 [a]	
Acenaphthylene		3.00E-02 [a,i]	
Acetone	D	1.00E-01 [a]	
Acrylonitrile	B1	1.00E-03 [b]	5.40E-01 [a]
Aldrin	B2	3.00E-05 [a]	1.70E+01 [a]
alpha-BHC	B2		6.30E+00 [a]
alpha-Chlordane	B2	6.00E-05 [a]	1.30E+00 [a]
Aniline	B2		5.70E-03 [a]
Anthracene	D	3.00E-01 [a]	
Antimony	D	4.00E-04 [a]	
Aroclor 1254	B2	2.00E-05 [a]	
Arsenic	A	3.00E-04 [a]	1.50E+00 [a]
Barium		7.00E-02 [a]	
Benzene	A		2.90E-02 [a]
Benzidine	A	3.00E-03 [a]	2.30E+02 [a]
Benzo(a)anthracene	B2		7.30E-01 [h]
Benzo(a)pyrene	B2		7.30E+00 [a]
Benzo(b)fluoranthene	B2		7.30E-01 [h]
Benzo(g,h,i)perylene		3.00E-02 [i]	
Benzo(k)fluoranthene	B2		7.30E-02 [h]
Benzoic acid	D	4.00E+00 [a]	
Benzyl alcohol		3.00E-01 [b]	
Beryllium	B2	5.00E-03 [a]	4.30E+00 [a]
Bis(2-ethylhexyl) phthalate	B2	2.00E-02 [a]	1.40E-02 [a]
Bromoform	B2	2.00E-02 [a]	7.90E-03 [a]
Butyl benzyl phthalate	C	2.00E-01 [a]	
Cadmium (Food)	B1	1.00E-03 [a]	
Cadmium (water)	B1	5.00E-04 [a]	
Carbon disulfide		1.00E-01 [a]	
Chlorobenzene		2.00E-02 [a]	
Chloroform	B2	1.00E-02 [a]	6.10E-03 [a]
Chloromethane	B2		1.30E-02 [b]
Chromium (III)	D	1.00E+00 [a]	
Chromium (IV)	A	5.00E-03 [a]	

TABLE 4-1

CRITICAL TOXICITY VALUES

Chemical Name	Cancer Class	Oral RfD mg/kg-day	Oral SF $(mg/kg\text{-}day)^{-1}$
Chrysene	B2		7.30E-03 [h]
Cobalt		6.00E-02 [g]	
delta-BHC	D		
DDE	B2		3.41E-01 [a]
DDT	B2	5.00E-04 [a]	3.41E-01 [a]
Di-n-butyl phthalate	D	1.00E-01 [a]	
Di-n-octyl phthalate		2.00E-02 [g]	
Dibenz(a,h)anthracene	B2		7.30E+00 [h]
Dibenzofuran	D	4.00E-03 [g]	
Dibromochloromethane	C	2.00E-02	8.40E-02
Dieldrin	B2	5.00E-05 [a]	1.60E+01 [a]
Dimethyl phthalate	D	1.00E+01 [b]	
Ethylbenzene	D	1.00E-01 [a]	
Fluoranthene		4.00E-02 [a]	
Fluorene		4.00E-02 [a]	
Heptachlor	B2	5.00E-04 [a]	4.50E+00 [a]
Indeno(1,2,3-cd)pyrene	B2		7.30E-01 [h]
Lead	B2		
Mercury	D	3.00E-04 [g]	
Molybdenum	D	5.00E-03 [b]	
N-Nitroso-di-n-propylamine	B2		7.00E+00 [a]
Naphthalene	D	3.00E-02 [d,i]	
Nickel	A	2.00E-02 [a,e]	
Phenanthrene	D	3.00E-02 [i]	
Phenol	D	6.00E-01 [a]	
Pyrene	D	3.00E-02 [a]	
Silver	D	5.00E-03 [a]	
Tetrachloroethene		1.00E-02 [a]	
Thallium	D	8.00E-05 [a,f]	
Toluene	D	2.00E-01 [a]	
trans-1,2-Dichloroethene	D	2.00E-02 [a]	
Trichloroethene	B2	6.00E-03 [g]	1.10E-02 [g]
Vanadium	D	7.00E-03 [b]	
Vinyl chloride	A		1.90E+00 [b]
Xylenes (total)	D	2.00E+00 [a]	

Note:

a). EPA's Integrated Risk Information System (USEPA, December 1995) on-line database system.

b). EPA's Health Effects Assessment Summary Tables (USEPA, 1994)

c). EPA's Health Effects Assessment Summary Tables (USEPA, 1992b)

d). Data Inadequate For Quantitative Risk Assessment

e). Subchronic value is used.

f). RfD value for Thallium (I) chloride is used.

g). EPA, Region III (1994).

h). Based on the slope factor of Benzo(a)pyyrene x Carcinogenic Equivalency Factor (EPA,1993).

i). The RfD value for pyrene is assumed as the surrogate RfD value for noncarcinogenic PAHs.

j). Drinking Water Regulation and Health Advisories (EPA, May 1995).

k). The slope factor for 2-Naphthylamine is assumed as the surrogate value for 1-Naphthylamine.

l). The RfD for 2,4-dichlorophenol is assumed as the surrogate value for 2,6-dichlorophenol.

TABLE 4-2
USEPA WEIGHT-OF-EVIDENCE CARCINOGENIC CLASSIFICATION OF CHEMICALS

Group	Description	Description of Evidence
A	Human carcinogen	Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.
B1 or B2	Probable human carcinogen	B1 indicates that limited human data are available from epidemiologic studies. B2 indicates sufficient evidence in animals and inadequate or no evidence in humans of carcinogenicity.
C	Possible human carcinogen	Limited evidence of carcinogenicity in animals.
D	Not classifiable as to human carcinogenicity	Inadequate evidence of carcinogenicity in animals.
E	No evidence of carcinogenicity in humans	No evidence of carcinogenicity in at least two adequate animal tests or in both epidemiologic and animal studies.

Note: Substances in Groups B and C are considered potential carcinogens.

5.0
CHARACTERIZATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS

5.1 PROCEDURE FOR CALCULATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS

The purpose of the risk characterization is to estimate the potential health risks associated with site chemicals. The potential health risks for each compound and exposure pathway are estimated in this Section of the RA. These risk estimates are calculated using the intake parameters developed in the exposure assessment (**Tables 3-1**, **3-2**, **3-3**, and **3-4**), the estimated exposure point concentrations (**Tables 3-5** to **3-14**), and the CTVs reported in the toxicity assessment (**Table 4-1**). The CDI calculations are discussed in **Section 3.6** and are presented in **Attachment A**. It should be noted that the CDIs used for calculating HQs are different from those used to estimate cancer risks (CRs). The CDIs used to calculate HQs are developed using the exposure period as an averaging period, while the CDIs used to calculate potential CRs assume lifetime as the averaging period. The approach for carcinogens is based on the assumption that a high dose received over a short period of time is equivalent to a low dose spread over a life-time, while the approach used for noncarcinogens assumes that chemical effects are only relevant during the period of exposure. The CDIs and their corresponding risks and hazards were calculated for each chemical using the arithmetic mean concentration to evaluate average exposure and the RME concentration to evaluate upperbound exposure.

As discussed in **Section 4.0**, the potential noncarcinogenic health hazard is calculated for each compound as the ratio of CDI and respective RfD. The ratio is termed the Hazard Quotient (HQ). The concept of HQ is based on the assumption that most toxicological effects of chemicals occur only after a threshold dose is achieved. The RfD for a compound is an estimate of the threshold concentration for the most sensitive human population associated with the lowest observed adverse effect for that compound. An HQ in excess of 1.0 indicates that the threshold has been exceeded and a potential health hazard may exist, while a value of less than 1.0 indicates the absence of a health hazard.

The summation of HQs for all compounds is termed the Hazard Index (HI). The assumption of additivity of sub-threshold HQ values in calculating an HI is only valid when the following conditions are met:

- All compounds affect the same target organ
- There are no antagonistic or synergistic effects between compounds (little is known about these interactions for most chemicals)

The first condition is not true for many chemicals, while the second assumption represents a major source of uncertainty. Assuming that no synergistic effects occur, the assumption of additivity does not appear to be valid for all compounds. The use of an HI in this RA should be considered highly conservative and will likely overestimate the potential for a health hazard.

Potential cancer risks are calculated for each compound as the arithmetic product of the CDI and the respective slope factor (SF). The estimated cancer risk for each compound may be summed to yield an overall cancer risk for each scenario. The basis for this approach is the regulatory assumption that cancer risks are additive (RAGS; USEPA 1989a). The approach is very conservative and likely to overestimate the true cancer risks associated with exposure to the chemicals of concern.

5.2 SUMMARY OF POTENTIAL NONCARCINOGENIC HEALTH HAZARD AND CANCER RISKS

The calculation of individual HQs and cancer risks for each receptor, exposure route and compound are presented in Attachment A and are summarized in **Tables 5-1** and **5-2**.

Both average exposure and RME hazard indices are less than the threshold value of 1.0 for all exposure scenarios and stream segments studied in this RA. This indicates that surface water and sediments in both West and East Soldier Creeks should not pose a noncarcinogenic health hazard to any on-base or off-base populations under current or future stream use conditions.

As shown on **Tables 5-1** and **5-2**, potential cancer risks associated with all scenarios are less than the Baseline risk level of 10^{-4} established by USEPA for identifying sites that require remedial action (USEPA 1991c). These results indicate that exposure to surface water and sediments in West and East Soldier Creeks are not likely to result in an unacceptable cancer risk for any on-base or off-base populations under current or future stream use conditions.

TABLES

TABLE 5-1

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (CURRENT SCENARIO)

	ON-BASE WORKER				OFF-BASE RESIDENT [a]			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	1.72E-06	1.36E-12	5.51E-05	2.45E-10	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	1.08E-06	0.00E+00	8.37E-05	0.00E+00	NA	NA	NA	NA
SEDIMENT INGESTION[b]	4.23E-04	2.65E-09	4.14E-02	3.82E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	5.08E-05	1.02E-09	6.08E-02	7.19E-07	NA	NA	NA	NA
TOTAL	4.77E-04	3.67E-09	1.02E-01	1.10E-06	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	1.09E-05	0.00E+00	1.57E-04	0.00E+00
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	2.42E-05	0.00E+00	2.06E-04	0.00E+00
SEDIMENT INGESTION[b]	NA	NA	NA	NA	1.55E-02	2.89E-07	7.83E-02	1.32E-06
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	5.02E-04	1.07E-08	2.46E-02	4.43E-07
TOTAL	NA	NA	NA	NA	1.60E-02	3.00E-07	1.03E-01	1.76E-06
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	2.53E-06	7.72E-09	5.98E-05	7.72E-07	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	7.50E-06	8.03E-09	3.85E-04	1.97E-06	NA	NA	NA	NA
SEDIMENT INGESTION[b]	4.18E-04	3.50E-09	1.93E-02	7.35E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	5.09E-05	1.39E-09	2.25E-02	1.43E-06	NA	NA	NA	NA
TOTAL	4.79E-04	2.06E-08	4.22E-02	4.91E-06	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	4.28E-04	2.96E-10	2.15E-03	2.65E-09
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	2.29E-03	3.33E-08	4.83E-03	1.58E-07
SEDIMENT INGESTION[b]	NA	NA	NA	NA	2.73E-03	1.14E-07	1.28E-02	7.13E-07
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	1.18E-04	9.96E-09	1.41E-03	1.86E-07
TOTAL	NA	NA	NA	NA	5.57E-03	1.58E-07	2.12E-02	1.06E-06

Note:

a. The hazard indices or cancer risk associated with both adult and child resident

b. Surface (0-0.5 feet) sediments data are used in the calculations.

TABLE 5-2

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (FUTURE SCENARIO)

	ON-BASE WORKER				OFF-BASE RESIDENT [a]			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	1.72E-06	1.36E-12	5.51E-05	2.45E-10	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	1.08E-06	0.00E+00	8.37E-05	0.00E+00	NA	NA	NA	NA
SEDIMENT INGESTION[b]	4.40E-04	4.72E-09	2.97E-02	5.99E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	5.83E-05	1.86E-09	4.20E-02	1.15E-06	NA	NA	NA	NA
TOTAL	5.01E-04	6.58E-09	7.18E-02	1.75E-06	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	1.09E-05	0.00E+00	1.57E-04	0.00E+00
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	2.42E-05	0.00E+00	2.06E-04	0.00E+00
SEDIMENT INGESTION[b]	NA	NA	NA	NA	1.55E-02	2.89E-07	7.83E-02	1.32E-06
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	5.02E-04	1.07E-08	2.46E-02	4.43E-07
TOTAL	NA	NA	NA	NA	1.60E-02	3.00E-07	1.03E-01	1.76E-06
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	2.53E-06	7.72E-09	5.98E-05	7.72E-07	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	7.50E-06	8.03E-09	3.85E-04	1.97E-06	NA	NA	NA	NA
SEDIMENT INGESTION[b]	4.01E-04	3.87E-09	1.23E-02	5.91E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	4.38E-05	1.53E-09	9.27E-03	1.15E-06	NA	NA	NA	NA
TOTAL	4.55E-04	2.12E-08	2.20E-02	4.48E-06	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	4.28E-04	2.96E-10	2.15E-03	2.65E-09
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	2.29E-03	3.33E-08	4.83E-03	1.58E-07
SEDIMENT INGESTION[b]	NA	NA	NA	NA	2.73E-03	1.14E-07	1.28E-02	7.13E-07
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	1.18E-04	9.96E-09	1.41E-03	1.86E-07
TOTAL	NA	NA	NA	NA	5.57E-03	1.58E-07	2.12E-02	1.06E-06

Note:

a. The hazard indices or cancer risk associated with both adult and child resident

b. Sediment data collected from 0 - 5.0-foot depth are used in the calculations.

6.0
REMEDIAL ACTION OBJECTIVES

The establishment of health-based Remedial Action Objectives (RAOs) (i.e., "cleanup goals") serves as an important means of guiding remedial activities. In general, development of health-based RAOs is warranted whenever a site is found to pose an unacceptable risk to either human health or the environment, and "cleanup" standards promulgated by state or federal agencies are not available. The approach used to develop health-based cleanup goals is derived from the RA process, which is a process whereby the magnitude of potential cancer risks and other health effects associated with site contaminants can be evaluated quantitatively. A human health-based cleanup goal is established by "back-calculating" a health protective contaminant concentration, given a target risk which is deemed acceptable, and using realistic intake factors to represent potentially exposed populations.

The approach used in this document to develop cleanup goals incorporates RME assumptions and reasonable site use scenarios so that residual risks posed by the site after corrective action are within a health-protective range. It is important to note that, since the RME is meant to represent the most exposed individual in a population, the estimates provided herein are conservative. That is, because cleanup goals developed using RME assumptions are health-protective of the most exposed individual in a population, they will be health-protective for all potentially exposed individuals within that population.

The approach used to calculate RAOs in this document is the same as that used in the previous RA performed by WCFS (1996). Risk-based RAOs were calculated for each chemical using the most conservative exposure scenario, that is, the scenario associated with the largest risk or hazard. For COCs found off-base, the largest risks and hazards were associated with residential exposure scenarios. For COCs found only in the on-base portions of the creek, the construction worker scenario is the only applicable scenario, and thus was used to calculate RAOs.

Human health RAOs are calculated based on both the carcinogenic and noncarcinogenic properties of the COCs. Four sets of human health RAOs are developed in this RA. For carcinogens, RAOs were calculated based on target risk levels of 10^{-6} (one in a million), 10^{-5}

(one in one hundred thousand), and 10^{-4} (one in ten thousand). These three values encompass the acceptable risk range of 10^{-6} to 10^{-4} identified by USEPA. For noncarcinogens, RAOs were calculated based on a target Hazard Index of 1.0. The equations used to calculate RAOs are presented below. These equations were used by WCFS (1996) and were used here to preserve continuity between the first RA prepared by WCFS (1996) and this current RA.

For carcinogens

RAO = (Risk Assessment Concentration/Calculated Risk) (Target Risk)

For noncarcinogens

RAO = (Risk Assessment Concentration/Calculated Hazard) (Target Hazard)

where

Risk Assessment Concentration = The maximum chemical exposure point concentration used in the RA

Calculated Risk = The highest calculated risk associated with the exposure point concentration

Target Risk = 10^{-6}, 10^{-5}, and 10^{-4}

Calculated Hazard = The highest calculated hazard associated with the exposure point concentration

Target Hazard = 1.0

The RAOs for chemicals in sediment are summarized in **Table 6-1**. For chemicals with both carcinogenic and noncarcinogenic RAOs, the lower level of these values is the health-protective value. Because surface water in the creek is a dynamic medium that is constantly changing, it is inappropriate to develop RAOs for chemicals in surface water. However, by using the same approach in calculating the RAOs, health-based indicators of water quality were developed for chemicals in surface water and are summarized in **Table 6-2**.

TABLES

TABLE 6-1
RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SEDIMENTS

Chemical	RME[a] (mg/kg)	Total HQ[b]	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcnogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
1,2,4-Trichlorobenzene	1.40E-01	4.05E-07		3.46E+05			
1,2-Dichlorobenzene	8.21E-01	9.48E-08		8.66E+06 [e]			
1,3-Dichlorobenzene	1.50E-01	1.75E-08		8.56E+06 [e]			
1,4-Dichlorobenzene	3.00E-01		7.45E-11		4.03E+03	4.03E+04	4.03E+05
1-Chloronaphthalene	2.70E-01	2.72E-06		9.94E+04			
1-Naphthylamine	5.60E-01		7.53E-07		7.44E-01	7.44E+00	7.44E+01
2-Butanone (MEK)	2.20E-03	1.11E-09		1.98E+06 [e]			
2-Chloronaphthalene	3.10E-01	1.12E-07		2.76E+06 [e]			
2-Methylnaphthalene	5.96E-01	5.76E-07		1.03E+06 [e]			
3/4-Methylphenol	4.00E-01	2.42E-06		1.66E+05			
4,4'-DDE	7.20E-02		1.02E-10		7.04E+02	7.04E+03	7.04E+04
4,6-Dinitro-2-methylphenol	4.42E+00						
Acenaphthene	1.79E+00	8.64E-07		2.07E+06 [e]			
Acetone	9.74E-03	2.95E-08		3.31E+05			
Aldrin	8.93E-03	8.99E-05	1.96E-08	9.93E+01	4.55E-01	4.55E+00	4.55E+01
alpha-Chlordane	3.00E-02	1.51E-04	5.05E-09	1.98E+02	5.94E+00	5.94E+01	5.94E+02
Anthracene	4.89E-01	4.72E-08		1.04E+07 [e]			
Antimony	4.10E+00	2.35E-03		1.74E+03			
Aroclor 1254	2.16E-01	3.26E-03		6.62E+01			
Barium	6.18E+02	1.03E-04		5.98E+06 [e]			
Benzidine	4.60E-02	4.64E-06	1.37E-06	9.91E+03	3.37E-02	3.37E-01	3.37E+00
Benzo(a)anthracene	2.62E-01		2.48E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(a)pyrene	2.10E-01		1.99E-07		1.06E+00	1.06E+01	1.06E+02
Benzo(b)fluoranthene	3.64E-01		3.45E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(g,h,i)perylene	1.10E-01	1.11E-06		9.92E+04			
Benzo(k)fluoranthene	2.05E-01		1.94E-09		1.06E+02	1.06E+03	1.06E+04
Benzoic acid	5.60E-02	4.23E-09		1.32E+07 [e]			
Benzyl alcohol	7.90E-02	7.96E-08		9.92E+05			
Beryllium	2.78E-01	1.27E-05	1.18E-07	2.18E+04	2.36E+00	2.36E+01	2.36E+02
bis(2-Ethylhexyl)phthalate	3.74E-01	5.66E-06	6.79E-10	6.61E+04	5.51E+02	5.51E+03	5.51E+04
Butyl benzyl phthalate	1.10E-01	1.66E-07		6.61E+05			
Cadmium	2.34E+01	5.38E-03		4.35E+03			
Carbon disulfide	3.71E-03	1.12E-08		3.31E+05			
Chlorobenzene	1.70E-03	2.57E-08		6.63E+04			
Chromium	7.36E+02	8.61E-06		8.55E+07 [e]			

TABLE 6-1
RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SEDIMENTS

Chemical	RME[a] (mg/kg)	Total HQ[b]	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcnogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
Chrysene	2.89E-01		2.73E-10		1.06E+03	1.06E+04	1.06E+05
Cobalt	6.61E+00	2.53E-05		2.61E+05			
delta-BHC	1.96E-01						
Di-n-butyl phthalate	5.10E-01	1.48E-07		3.45E+06 [e]			
Di-n-octyl phthalate	1.00E-01	1.51E-06		6.61E+04			
Dibenz(a,h)anthracene	4.93E-01		3.73E-08		1.32E+01	1.32E+02	1.32E+03
Dibenzofuran	3.10E-01	2.25E-06		1.38E+05			
Dieldrin	5.77E-02	3.49E-04	1.20E-07	1.65E+02	4.83E-01	4.83E+00	4.83E+01
Dimethyl phthalate	1.60E-01	4.84E-09		3.31E+07 [e]			
Fluoranthene	4.96E-01	3.75E-06		1.32E+05			
Fluorene	3.20E-01	2.31E-07		1.38E+06 [e]			
Heptachlor	9.93E-02	6.00E-05	5.78E-08	1.65E+03	1.72E+00	1.72E+01	1.72E+02
Indeno(1,2,3-cd)pyrene	1.20E-01		1.14E-08		1.06E+01	1.06E+02	1.06E+03
Lead	2.66E+02						
Mercury	1.13E-01	8.66E-05		1.31E+03			
Naphthalene	5.10E-01	4.92E-07		1.04E+06 [e]			
Nickel	3.57E+02	2.09E-04		1.71E+06 [e]			
Phenanthrene	7.80E-02	7.86E-07		9.92E+04			
Pyrene	3.90E-01	3.93E-06		9.92E+04			
Silver	6.40E+00	1.50E-05		4.28E+05			
Tetrachloroethene	9.43E-03	2.73E-08		3.45E+05			
Thallium	6.26E+01	9.16E-03		6.83E+03			
Toluene	4.25E-03	6.42E-09		6.63E+05			
Trichloroethene	6.06E-03	3.32E-08	7.84E-13	1.83E+05	7.73E+03	7.73E+04	7.73E+05
Vanadium	2.14E+01	7.03E-04		3.05E+04			
Xylenes (total)	2.60E-03	3.76E-11		6.91E+07 [e]			

Note: a). RME = Reasonable Maximum Exposure Concentration.

b). HQ = Hazard Quotient

c). Cleanup level = (Risk Assessment Conc/HQ) x HI where HI = 1.0

d). Cleanup level = (Risk Assessment Conc/Cancer risk) x Target cancer Risk

e). Calculated cleanup level is greater than 100% concentration and 100% concentration is assigned as the cleanup level.

TABLE 6-2
RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SEDIMENTS

Chemical	RME (mg/L)	Total HQ	Total Cancer Risk	Noncarcinogenic [a] Clean-up Level (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-6}) (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-5}) (mg/L)	Carcinogenic [b] Clean-up Level (Risk = 1 x 10^{-4}) (mg/L)
1,2-Dichlorobenzene	1.70E-03	1.78E-05		9.52E+01			
2,6-Dichlorophenol	2.80E-03	2.69E-03		1.04E+00			
2-Butanone (MEK)	5.03E-03	6.56E-08		7.66E+04			
3/4-Methylphenol	1.20E-03	2.28E-05		5.25E+01			
4,4'-DDT	5.87E-05	2.20E-03	1.61E-07	2.67E-02	3.66E-04	3.66E-03	3.66E-02
4-Nitrophenol	1.30E-03	1.65E-05		7.89E+01			
Acetone	7.36E-03	2.28E-05		3.23E+02			
Aniline	4.00E-03		3.39E-10		1.18E+01	1.18E+02	1.18E+03
Antimony	5.90E-04	5.20E-04		1.13E+00			
Benzidine	1.20E-03	1.11E-05	2.74E-06	1.08E+02	4.38E-04	4.38E-03	4.38E-02
Benzoic acid	1.20E-03	1.04E-07		1.16E+04			
Bromoform	2.59E-03	1.01E-06	5.72E-11	2.56E+03	4.53E+01	4.53E+02	4.53E+03
Butyl benzyl phthalate	3.20E-03	1.80E-05		1.78E+02			
Cadmium	7.03E-04	4.96E-04		1.42E+00			
Carbon disulfide	2.47E-03	1.94E-07		1.28E+04			
Cobalt	6.69E-04	3.94E-06		1.70E+02			
Di-n-butyl phthalate	1.40E-03	7.20E-06		1.94E+02			
Dimethyl phthalate	1.00E-03	3.23E-09		3.09E+05			
Fluoranthene	1.60E-03	2.21E-04		7.23E+00			
Nickel	8.70E-03	1.54E-04		5.66E+01			
Phenol	2.00E-03	1.82E-06		1.10E+03			
Silver	2.00E-04	1.41E-05		1.42E+01			
Tetrachloroethene	1.50E-03	1.17E-06		1.28E+03			
Toluene	2.85E-03	1.11E-07		2.56E+04			
Trichloroethene	7.98E-03	1.04E-05	2.45E-10	7.67E+02	3.26E+01	3.26E+02	3.26E+03
Vanadium	1.70E-02	8.57E-04		1.98E+01			

Note: a). Cleanup level = (Risk Assessment Conc/HQ) x HI where HI = 1.0
b). Cleanup level = (Risk Assessment Conc/Cancer risk) x Target Cancer Risk

7.0
UNCERTAINTY ANALYSIS

The USEPA guidance for RA provides a systematic means for organizing, analyzing, and presenting information on the nature and magnitude of potential risks to public health posed by chemical exposures. Despite the advanced state of the current methodology, uncertainties and limitations are inherent in the RA process. The uncertainty can lead to an over- or underestimation of the risk. **Table 7-1** presents a qualitative assessment of factors which may contribute to uncertainty in the estimation of potential risks. Available data quality, incomplete information about existing conditions and future circumstances, as well as other factors discussed below contribute to these uncertainties and limitations.

This section discusses the following sources of uncertainties associated with the Soldier Creek RA:

- Data collection and evaluation
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Remedial Action Objectives

7.1 DATA COLLECTION AND EVALUATION

7.1.1 Data Collection

Data used in this RA were collected from Soldier Creek during four quarterly sampling events as part of the long-term monitoring of Soldier Creek. These data are subject to uncertainty associated with sampling and analysis.

7.1.1.1 Sampling

It was assumed in the RA that samples collected were representative of areas where various populations may be exposed. However, collected samples may not be completely representative due to biases in sampling, random variability, or sources of non-random variation, such as the annual precipitation cycle or periodic releases from on-base or off-base outfalls. These sources of bias or variability may result in either an over- or underestimation of actual chemical concentrations and, subsequently, site risks.

7.1.1.2 Analysis

Samples were analyzed and subjected to data quality review procedures to assure that the data were suitable for use in decision-making. However, it should be understood that sample analysis is subject to uncertainties associated with precision and accuracy and evaluated through laboratory quality assurance (QA) programs. Uncertainties associated with precision and accuracy of analysis are generally random. While these errors are typically of low magnitude compared to other sources of uncertainty in the RA, they may lead to a possible over- or underestimation of risk.

7.1.2 Data Evaluation

In accordance with EPA guidance, several inorganic chemicals present at background concentrations were removed from consideration as potential COCs because they are not site-related contaminants. This exclusion process was not extended to organic chemicals, because it is difficult to establish true background levels for most organics. Nonetheless, it is likely that several of the organic chemicals identified as COCs are present at background levels, and are not site-related contaminants. Inclusion of these chemicals in the risk calculations will result in an overestimation of site-related risks.

7.2 EXPOSURE ASSESSMENT

The exposure assessment is based on a series of assumptions concerning concentrations of chemicals to which humans are exposed (exposure point concentrations) and patterns of behavior leading to exposure or intake of chemicals (exposure scenarios).

7.2.1 Exposure Point Concentrations

In compiling data for use in the RA, arithmetic mean concentrations and 95th percentile UCL on the mean concentrations were compiled for chemicals detected in each medium. For RME exposure scenarios, the 95th percentile UCL concentrations were used to estimate risk. Because UCL concentrations are high end values, typically closer to maximum concentrations than to the arithmetic mean concentrations, use of UCL concentrations in the RA will likely result in an overestimation of potential risk.

For the most part, the arithmetic mean and 95th percentile UCL chemical concentrations found in the four areas of Soldier Creek evaluated in this RA were used as exposure point concentrations. It was conservatively assumed that chemical concentrations observed at the creek will remain unchanged with time. The potential reduction in chemical concentrations by remedial action, migration, degradation, or attenuation were not considered in the current RA. The use of existing chemical concentrations projected into the future may result in an overestimation of potential health risks.

When calculating exposure point concentrations it was assumed that a chemical not detected in a given sample was actually present at one-half of its detection limit, if that chemical was present in any sample from that medium and stream segment. This approach, as described in the RAGS (USEPA 1989a), is a conservative approach that is likely to lead to an overestimation of risk, particularly when the quantification limits are high (due to interferences or sample dilution during analysis) or the only measured concentrations are "**J**" coded values less than the detection limits.

The use of statistical methods to calculate exposure point concentrations can result in calculated concentrations that exceed the maximum measured concentrations, particularly

when the sample size is small and the standard deviation of the results is large. Use of a statistical approach to calculate exposure point concentrations when the sample size is small or standard deviation is large is likely to result in an overestimation of risk.

7.2.2 Exposure Scenarios

The exposure assessment relied on a number of assumptions for potential human exposure. Assumptions used were based on:

- Site-specific information (including information provided in the Baseline Risk Assessments [B&V 1993 and WCFS 1996])
- RAGS (USEPA 1989a), the Exposure Factors Handbook (USEPA 1989b), and Dermal Exposure Assessment: Principles and Applications (USEPA 1992a)
- Professional judgment

The average case scenarios represent assumptions which are considered central values, or realistically conservative estimates for the exposed population. However, even the average case exposure scenario is conservative because it assumes individuals are exposed on a regular basis over a long period of time and, therefore, likely to overestimate risk. RME scenarios are developed to provide an upper bound risk estimate. The RME scenarios are based upon a combination of conservative assumptions for all variables related to exposure and, therefore, are highly likely to overestimate potential risks.

In some cases (e.g., the dermal permeability constants), published information for one chemical has been assumed to be representative of other related chemicals. These assumptions may lead to over- or underestimation of risk. The general approach used in this assessment was to use conservative assumptions for intake variables in the absence of strong scientific data, thus minimizing the likelihood that risks are underestimated.

7.3 TOXICITY ASSESSMENT

7.3.1 Uncertainties Associated with Critical Toxicity Values

In general, the available scientific information is insufficient to provide a thorough understanding of all the potential toxic properties of chemicals to which humans are potentially exposed. Consequently, varying degrees of uncertainty surround the assessment of adverse health effects among exposed populations. Sources of uncertainty related directly to toxicity data include:

- Use of dose-response data from experiments on homogenous, sensitive animal populations to predict effects in heterogeneous human populations with a wide range of sensitivities

- Extrapolation of data from: 1) high dose animal studies to low dose human exposures; 2) acute or subchronic exposure; and 3) one exposure route to another (e.g., from ingestion to inhalation or dermal absorption)

- Use of single-chemical test data that does not account for multiple exposures or synergistic and antagonistic responses

- Critical toxicity values (RfDs or SFs) are predicted values for the most sensitive subpopulations

A high degree of overall uncertainty may be associated with the Critical Toxicity Values used in the RA because there are numerous potential sources of uncertainty associated with the basic toxicology data. In an attempt to minimize the consequences of uncertainty, USEPA guidance typically relies on a conservative approach, applying numerous safety factors to the toxicity data to insure the Critical Toxicity Values used in the RA are protective of all sensitive human populations. Use of these critical toxicity values is highly likely to overestimate potential risk.

7.3.1.1 Uncertainties Associated with the Use of Surrogates

Some of the detected COCs don't have EPA-established critical toxicity values. Without a CTV, a chemical cannot be evaluated in the quantitative risk assessment. Consequently, surrogate compounds in this RA were identified for chemicals without CTVs of their own. The CTV of the surrogate compound was used to represent potential toxicity of the other chemical. There is uncertainty associated with this approach because there is insufficient data to show whether or not the two chemicals have similar toxicities. As a result, this approach may under- or overestimate risks.

7.4 RISK CHARACTERIZATION

Because there are uncertainties in each step of the risk assessment process, uncertainties are often magnified in the final risk characterization. The final quantitative estimates of risk may be one or several orders of magnitude different from the potential risk associated with the given exposure. Because of the conservative approaches used in each step, the overall results of the RA are more likely to overestimate than underestimate the potential risk associated with contaminants in Soldier Creek.

7.5 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are developed for the COCs using exposure assumptions developed in the exposure assessment and critical toxicity values identified in the toxicity assessment. All of the uncertainties associated with selection of COCs, development of exposure assumptions, and use of USEPA-derived toxicity values also apply to the calculation of remedial action objectives. Because of the inherent conservatism within the risk assessment process, the resulting remedial action objectives are likely to be overly conservative.

TABLES

TABLE 7-1

SUMMARY OF UNCERTAINTIES ASSOCIATED WITH RISK ASSESSMENT FOR SOLDIER CREEK

Assumptions	Estimated Magnitude of Effect on Risk	Direction of Effect on Risk Estimate
Data Collection and Evaluation		
Samples collected were representative of conditions to which various populations may be exposed.	Low - Moderate	May over- or underestimate risk.
Errors in chemical analysis	Low	May over- or underestimate risk.
High detection limit	Low-Moderate	May over- or underestimate risk.
For RME exposure scenarios, the 95th percentile UCL concentrations were used to estimate risk.	Low - Moderate	Likely result in an overestimate of risk.
Inclusion of background level organic compounds in the risk calculation.	Low - Moderate	May overestimate site-related risks.
Exposure Assessment		
Use of existing chemical concentrations projected into the future	Low - Moderate	May overestimate site-related risks.
Chemical concentrations reported as "below method detection limit" are used at one-half detection limit when calculating mean chemical concentration	Low - Moderate	May over- or underestimate risk, but usually overestimate risk.
Use combination of conservative assumptions to estimate RME associated risks.	Moderate	May over- or underestimate risk.
Toxicity Assessment		
The use of conservative USEPA models for developing Slope Factors (SF)	Moderate - High	May overestimate risk.
The Reference doses (RfD) for a compound is an estimate of the threshold concentration for the most sensitive human population associated with the lowest observed adverse effect for that compound	Moderate - High	May overestimate risk.
For some chemicals without a critical toxicity value of their own, a surrogate compound was identified and its critical toxicity value was used to evaluate the chemical in the quantitative risk assessment.	Moderate	May over- or underestimate risk.
Critical toxicity values weren't available for some identified COCs. Appropriate surrogates could not be identified for some chemicals without critical toxicity values. Therefore, these chemicals couldn't be evaluated in the quantitative risk assessment.	Low - Moderate	May underestimate risk.
Hazard indices (HIs) were developed assuming all toxic effects were additive	Low - Moderate	May overestimate risk.
Risk Characterization		
Conservative approaches used in each step	Moderate - High	May overestimate risk.
Remedial Action Objectives		
All the uncertainties associated with COC selection, exposure assumption development, and EPA-derived toxicity values are used.	Moderate - High	Likely to be overly conservative.

8.0
TRENDS

An RA of Soldier Creek was previously completed by WCFS in 1996 (WCFS 1996). The results of the 1st year risk assessment indicated that there were no unacceptable human health risks associated with the contaminant concentrations detected in sediments and surface water along Soldier Creek.

Contaminants and their concentrations are continuously changing along the length of Soldier Creek. Because of the dynamics of the Soldier Creek system, the results of the 1st year RA were compared to the results of this current risk assessment to evaluate any trends which may be occurring.

Tables 8-1 and **8-2** show the comparison of first year and second year noncarcinogenic health hazards and carcinogenic risks from surface water and sediments for on-base workers under the current and future use scenarios, respectively.

Table 8-3 shows the comparison of first year and second year off-base resident noncarcinogenic health hazards and carcinogenic risks from exposure to surface water and sediments under current and future use scenarios.

Individual COC contributions to the HIs and cancer risks of the second year RA are presented in Attachment A.

8.1 AREA 1: ON-BASE WEST SOLDIER CREEK

In general, there are no significant changes in the potential hazard index and cancer risks (i.e., both reports show HIs below 1.0 and cancer risks below 1×10^{-4}). The second year HIs are slightly higher than the first year, while the estimated cancer risks were slightly lower in the second year than in the first year. These changes are likely due to the differences in the COCs and their concentrations between the two years.

Sediments

More pesticides and phthalates were detected in the 1st year monitoring than in the second year. Data from the 2nd year showed more chlorinated benzenes detected than in the first year. For COCs detected in both years, concentrations did not vary significantly (i.e., concentrations were well within one order of magnitude between the two years). The metals detected from one year to the next were similar; however, the concentrations for some of these metals were higher (by a factor of 2 or more) in the second year.

For the current Base worker exposure scenario, the HI for noncarcinogenic health effects appears to be slightly higher in the second year RA compared to the first year RA. Second-year cancer risks appear to be slightly lower than those estimated in the first year RA. The cancer risks and noncarcinogenic health effects for both the first year and second year RAs were primarily driven by dermal exposures (see Table 8-1). Benzidine was the largest contributor to the cancer risk both years. Aroclor 1254 was the largest contributor to the HIs both years.

For the future Base worker exposure scenario, both the second year HIs and cancer risks appear to be slightly higher than were previously estimated in the first year RA. These small variations in estimated risks between the two RAs are likely due to the changes in the detected COCs and their concentrations. The cancer risks and noncarcinogenic health effects for both RAs were primarily driven by dermal exposures (see Table 8-2). Benzidine was the major contributor to the cancer risks both years. Aroclor 1254 was the major contributor to the HIs both years.

Surface Water

As with sediments, the COCs varied between the two RAs. The chemical groups which varied the most were metals and semivolatiles. More metals were detected above background in the second year RA than in the first year RA. The semivolatiles detected for the second year RA were different from those in the first year RA.

In general, both current and future estimated HI and cancer risks from surface water along the on-base portion of Soldier Creek are lower for the second year RA than those estimated in the first year report. Dermal contact with surface water was the primary exposure pathway for both RAs. Metals were the major contributors to the HI. No carcinogenic chemicals were detected in surface water along this creek segment during the second year of monitoring.

8.2 AREA 2: OFF-BASE WEST SOLDIER CREEK

The off-base residential HIs for this segment of Soldier Creek were approximately one order of magnitude higher in the second year RA than in the first year RA (Table 8-3). Potential estimated off-base residential cancer risks were not significantly different from the first year to the second year (Table 8-3). Again, the dynamics of the creek system resulted in different COC lists and concentrations between the two years.

Sediments

Overall, fewer chemicals were considered as COCs in the second year. More pesticides were detected in the first year than in the second year, and polycyclic aromatic hydrocarbons (PAH) concentrations were markedly lower in the second year than in the first year. The current and future off-base residential exposure scenarios for the second year RA indicated slightly higher estimated HIs and slightly lower cancer risks than were estimated in the first year RA.

The cancer risks and noncarcinogenic health effects for both RAs were primarily driven by ingestion of sediments. Aroclor 1254 and metals were the major contributors to the HIs for both RAs. Benzidine was the major carcinogenic contributor for the second year RA. PAHs were the major contributor to cancer risks in the first year RA.

Surface Water

More metals were considered as COCs in the second year RA than in the first year RA. Also, fewer volatiles were considered as COCs in the second year RA than in the first year RA.

The COC lists were significantly different; therefore, no real comparison of detected concentrations could be made for surface water along this segment of the creek.

A comparison of potential risks for Area 2 surface water indicated that both the HIs and cancer risks were lower in the second year RA than were estimated in the first year RA. Therefore, although the COCs varied, the COCs detected in the second year do not appear to have resulted in higher risks more toxic than those compounds considered COCs in the first year RA.

Dermal contact was the primary pathway of concern for surface water exposures. Metals were the major contributors to the HIs for both RAs. Arsenic was the major contributor to cancer risks in the first RA. No carcinogenic compounds were detected; therefore, there were no cancer risks from surface water for the second year RA along this creek segment.

8.3 AREA 3: ON-BASE EAST SOLDIER CREEK

In general, there are no significant changes in the potential HIs and cancer risks between the two RAs. The second year HIs are slightly higher than the first year, while the estimated cancer risks were slightly lower the second year than in the first year. These changes are likely due to the differences in the COCs and their concentrations between the two years.

Sediments

Fewer chemicals were considered COCs in the second year than in the first year RA, although more pesticides and metals were detected in the 2nd year. Several SVOCs and aldrin were detected at significantly higher concentrations in the second year than in the first year.

For the current Base worker exposure scenarios, estimated HIs were slightly higher in the second year than in the first year. Cancer risks were slightly lower in the second year RA than in the first year RA. The cancer risks and noncarcinogenic health effects for the second year RA were primarily driven by dermal exposure (see Table 8-1). The first year RA noncarcinogenic health effects and cancer risks were driven by ingestion of sediments.

Aroclor 1254 was the major contributor to the HI for both RAs. Benzidine and PAHs were the major contributors to the cancer risks for both RAs.

For the future Base worker exposure scenarios, second year estimated HIs and cancer risks were mostly lower than indicated in the first year RA (see Table 8-2). The noncarcinogenic health effects for the second year RA were primarily driven by ingestion of thallium and Aroclor 1254 in sediments. The cancer risks were primarily driven by dermal contact with thallium and Aroclor 1254.

The cancer risks and noncarcinogenic health effects for the first year RA were primarily driven by dermal contact. Aroclor 1254, and benzidine and PAHs were the major contributors to the HI and cancer risks, respectively.

Surface Water

More metals and SVOCs were considered COCs in the second year than in the first year. No pesticides were considered COCs in the 2nd year RA; however, pesticides were included in the first year RA. Several different volatiles were considered COCs in the second year RA than in the first year RA, and concentrations of recurring volatile COCs were approximately two (2) times higher in the second year than those detected for the first year RA.

For the current Base worker exposure scenario, estimated potential cancer risks were slightly higher in the second year RA than those for the first year RA, and HIs were slightly lower in the second year RA. For future Base worker exposure scenarios, cancer risks were slightly higher in the second year and HIs slightly lower than in the first year RA.

The cancer risks and noncarcinogenic health effects were primarily driven by dermal contact in both RAs. Metals were the major contributors to the HIs for both RAs. Benzidine was the major carcinogenic contributor in the second year RA. Aldrin was the major contributor to the cancer risks in the first year RA.

8.4 AREA 4: OFF-BASE EAST SOLDIER CREEK

Overall, the off-base residential HIs and cancer risks for this segment of Soldier Creek were lower in the second year RA than in the first year RA (see Table 8-3). Creek dynamics, again, influenced the HIs and cancer risks by changing the COCs and detected concentrations.

Sediments

Fewer metals and SVOCs were considered COCs in the second year RA than in the first year RA, especially fewer PAHs (both carcinogenic and noncarcinogenic). Additionally, the detected concentrations of PAHs in the second year were significantly lower than in the first year RA.

For current and future off-base residential exposure scenarios, the estimated HIs and cancer risks were lower in the second year than those estimated in the first year RA (see Table 8-3).

Cancer risks and noncarcinogenic health effects were primarily driven by ingestion of sediments. Aroclor 1254 and cadmium were the major contributors to the HI for both RAs. Beryllium and benzo(a)pyrene were the major carcinogenic contributors for the second year RA. Pesticides were a major contributor to cancer risks in the first year RA.

Surface Water

The detected pesticides and semivolatile organics considered to be COCs in the second year RA were significantly different than those identified as COCs in the first year RA. Additionally, the concentrations of COCs in the second year RA were lower than in the first year RA.

Estimated HIs and cancer risks were higher for dermal exposures to surface water than those indicated in the first year RA. Ingestion HIs and cancer risks were lower in the second year RA.

The cancer risks and noncarcinogenic health effects were primarily driven by dermal contact in the second year RA. 4,4-DDT and 2,6-dichlorophenol were the major contributors to the second year HIs. 4,4-DDT was also the major carcinogenic contributor in the second year RA.

Ingestion of surface water was the primary driver for cancer risks and noncarcinogenic health effects in the first year RA. Metals were the major contributors to the HI and arsenic was the major carcinogenic risk contributor.

TABLES

TABLE 8-1
COMPARISON OF FIRST YEAR AND SECOND YEAR NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (CURRENT BASE WORKER SCENARIO)

	ON-BASE WORKER (2nd Year)				ON-BASE WORKER (1st Year)			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	1.72E-06	1.36E-12	5.51E-05	2.45E-10	5.60E-06	5.14E-10	2.47E-04	5.56E-08
SURFACE WATER DERMAL EXPOSURE	1.08E-06	0.00E+00	8.37E-05	0.00E+00	4.27E-06	1.44E-09	4.50E-04	3.60E-07
SEDIMENT INGESTION	4.23E-04	2.65E-09	4.14E-02	3.82E-07	6.31E-05	2.96E-08	1.34E-02	4.62E-06
SEDIMENTS DERMAL EXPOSURE	5.08E-05	1.02E-09	6.08E-02	7.19E-07	1.68E-05	1.18E-08	2.34E-02	9.03E-06
TOTAL	4.77E-04	3.67E-09	1.02E-01	1.10E-06	8.98E-05	4.34E-08	3.75E-02	1.41E-05
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	2.53E-06	7.72E-09	5.98E-05	7.72E-07	1.51E-05	1.21E-10	5.39E-04	1.54E-08
SURFACE WATER DERMAL EXPOSURE	7.50E-06	8.03E-09	3.85E-04	1.97E-06	1.91E-05	1.53E-10	1.94E-03	1.88E-07
SEDIMENT INGESTION	4.18E-04	3.50E-09	1.93E-02	7.35E-07	1.52E-04	1.02E-07	1.78E-02	1.58E-05
SEDIMENTS DERMAL EXPOSURE	5.09E-05	1.39E-09	2.25E-02	1.43E-06	5.29E-05	4.09E-08	6.48E-03	2.50E-05
TOTAL	4.79E-04	2.06E-08	4.22E-02	4.91E-06	2.39E-04	1.43E-07	2.68E-02	4.09E-05
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 8-2
COMPARISON OF FIRST YEAR AND SECOND YEAR NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (FUTURE BASE WORKER SCENARIO)

	ON-BASE WORKER (2nd Year)				ON-BASE WORKER (1st Year)			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	1.72E-06	1.36E-12	5.51E-05	2.45E-10	5.60E-06	5.14E-10	2.47E-04	5.56E-08
SURFACE WATER DERMAL EXPOSURE	1.08E-06	0.00E+00	8.37E-05	0.00E+00	4.27E-06	1.44E-09	4.50E-04	3.60E-07
SEDIMENT INGESTION	4.40E-04	4.72E-09	2.97E-02	5.99E-07	8.26E-05	3.22E-09	1.46E-02	4.35E-07
SEDIMENTS DERMAL EXPOSURE	5.83E-05	1.86E-09	4.20E-02	1.15E-06	2.43E-05	1.25E-09	2.63E-02	8.25E-07
TOTAL	5.01E-04	6.58E-09	7.18E-02	1.75E-06	1.17E-04	6.42E-09	4.16E-02	1.68E-06
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	2.53E-06	7.72E-09	5.98E-05	7.72E-07	1.51E-05	1.21E-10	5.39E-04	1.54E-08
SURFACE WATER DERMAL EXPOSURE	7.50E-06	8.03E-09	3.85E-04	1.97E-06	1.91E-05	1.53E-10	1.94E-03	1.88E-07
SEDIMENT INGESTION	4.01E-04	3.87E-09	1.23E-02	5.91E-07	1.18E-04	7.75E-08	7.78E-03	1.00E-05
SEDIMENTS DERMAL EXPOSURE	4.38E-05	1.53E-09	9.27E-03	1.15E-06	3.73E-05	3.10E-08	1.28E-02	1.97E-05
TOTAL	4.55E-04	2.12E-08	2.20E-02	4.48E-06	1.89E-04	1.09E-07	2.30E-02	2.99E-05
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 8-3
COMPARISON OF FIRST YEAR AND SECOND YEAR NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (CURRENT AND FUTURE OFF-BASE RESIDENTIAL SCENARIO)

	OFF-BASE RESIDENT (2nd Year)				OFF-BASE RESIDENT (1st Year)			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	1.09E-05	0.00E+00	1.57E-04	0.00E+00	5.28E-05	4.57E-09	2.20E-04	3.78E-08
SURFACE WATER DERMAL EXPOSURE	2.42E-05	0.00E+00	2.06E-04	0.00E+00	1.29E-04	3.31E-09	9.30E-04	4.96E-08
SEDIMENT INGESTION	1.55E-02	2.89E-07	7.83E-02	1.32E-06	6.18E-03	1.77E-07	2.61E-02	1.82E-06
SEDIMENTS DERMAL EXPOSURE	5.02E-04	1.07E-08	2.46E-02	4.43E-07	1.74E-04	5.95E-09	7.25E-03	5.86E-07
TOTAL	1.60E-02	3.00E-07	1.03E-01	1.76E-06	6.53E-03	1.91E-07	3.45E-02	2.49E-06
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	4.28E-04	2.96E-10	2.15E-03	2.65E-09	2.46E-03	5.22E-08	9.21E-03	4.19E-07
SURFACE WATER DERMAL EXPOSURE	2.29E-03	3.33E-08	4.83E-03	1.58E-07	7.85E-04	2.26E-08	1.76E-03	1.19E-07
SEDIMENT INGESTION	2.73E-03	1.14E-07	1.28E-02	7.13E-07	5.80E-03	3.07E-07	1.43E-01	1.29E-06
SEDIMENTS DERMAL EXPOSURE	1.18E-04	9.96E-09	1.41E-03	1.86E-07	1.00E-04	3.77E-08	2.01E-03	2.76E-06
TOTAL	5.57E-03	1.58E-07	2.12E-02	1.06E-06	9.15E-03	4.20E-07	1.56E-01	4.59E-06

9.0
SUMMARY AND CONCLUSION

This RA has evaluated potential health hazards (i.e., noncarcinogenic effects) and cancer risks associated with exposure to surface water and sediment from portions of East and West Soldier Creek that may have been impacted by contaminant releases from Tinker AFB. based on difference in contaminant sources and exposed populations, the following four different stream segments were evaluated quantitatively in this RA:

- West Soldier Creek, on-base
- West Soldier Creek, off-base
- East Soldier Creek, on-base
- East Soldier Creek, off-base

Chemicals of concern were identified based on the evaluation of chemical data from surface water and sediment samples collected by Woodward-Clyde in the four quarterly sampling events of 1996. An evaluation of potential health risks has been performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-base portion of the creeks

- Residents wading or swimming in the off-base portion of West and East Soldier Creeks (swimming was only evaluated for the child scenario for East Soldier Creek, while all other scenarios assume wading only)

Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that potential cancer risks and noncarcinogenic health hazards for all scenarios are less than the advisory range of 10^{-6} to 10^{-4} and 1.0, respectively. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not

likely to result in an unacceptable cancer risk or noncarcinogenic hazard for any on-base or off-base populations under current or future stream use conditions.

As part of the RA, a set of cleanup goals was developed to identify health-protective levels for each COC. Although remediation does not appear to be warranted at the present time (based on risk to human health), these cleanup goals provide a set of "action criteria," should remedial action be required in the future.

A trend analysis was also done as part of this RA. The results of the comparison between the first year and second year RAs showed no dramatic changes. Therefore, no firm statement can be made regarding potential risk trends at Soldier Creek.

10.0
REFERENCES

Black and Veatch Waste Science Technology (B&V). 1993. Final Remedial Investigation Report, Tinker AFB - Soldier Creek RI/FS. April.

Environmental Criteria Assessment Office (ECAO). 1993.

National Research Council (NRC). 1989. Recommended Dietary Allowances, Food and Nutrition Board, National Academy of Sciences.

Nelson, W.E. 1992. Nelson Textbook of Pediatrics. 14th edition. W.B. Saunders Co., Philadelphia, PA.

NUS Corporation (NUS). 1989. Final Storm Sewer Investigation for Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK. October.

Parson Engineering Science (PES). 1996. Tinker AFB Soldier Creek/Off-base Groundwater Operable Unit - Remedial Investigation: Final. March.

Radian Corporation (Radian). 1985. Installation Restoration Program, Phase II - Confirmation/ Quantification, State 1, Final Report. September.

U.S. Department of Labor. 1987. Distribution of workers by years of tenure with current employer. Bulletin dated Thursday, October 22, 1987. Document USDL 87-452.

U.S. Environmental Protection Agency (USEPA). 1988. Federal Facilities Agreement Under CERCLA Section 120, In the Matter of: U.S. Environmental Protection Agency and Tinker Air Force Base, Oklahoma. Administrative Docket Number: NPL-U3-2-27. December 9.

U.S. Environmental Protection Agency (USEPA). 1989a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A. Interim Final (RAGS). EPA/540/1-89/002.

U.S. Environmental Protection Agency (USEPA). 1989b. Exposure Factors Handbook. May.

U.S. Environmental Protection Agency (USEPA). 1990. National Oil and Hazardous Substances Pollution Contingency Plan. Code of Federal Regulations, Chapter 40, Part 300.

U.S. Environmental Protection Agency (USEPA). 1991a. Standard Default Exposure Factors. OSWER Directive 9285.6-03. March

U.S. Environmental Protection Agency (USEPA). 1991b. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation, Part B, Development of Risk-based Preliminary Remediation Goals. EPA/540/R-92/003. December.

U.S. Environmental Protection Agency (USEPA). 1991c. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April 22.

U.S. Environmental Protection Agency (USEPA). 1991d. Supplemental Region IV Risk Assessment Guidance. March 26.

U.S. Environmental Protection Agency (USEPA). 1992a. Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B. January.

U.S. Environmental Protection Agency (USEPA). 1992b. Supplemental Region IV Risk Assessment Guidance. February 11.

U.S. Environmental Protection Agency (USEPA). 1992c. Supplemental Guidance to RAGS: Calculating the Concentration Term. OSWER Directive 9285.7-080. May.

U.S. Environmental Protection Agency (USEPA). 1992d. Health Effects Assessment Summary Tables, FY-1992.

U.S. Environmental Protection Agency (USEPA). 1994. Health Effects Assessment Summary Tables, FY-1994.

U.S. Environmental Protection Agency (USEPA). 1996a. Drinking Water Regulations and Health Advisories. February.

U.S. Environmental Protection Agency (USEPA). 1996b. Integrated Risk Information System (IRIS) on-line database.

U.S. Environmental Protection Agency (USEPA). 1996c. Region III Risk-based Concentration Table.

Woodward-Clyde Federal Services (WCFS). 1994. Final Work Plans for Long-Term Monitoring and Ecological Assessment of Soldier Creek Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June.

Woodward-Clyde Federal Services (WCFS). 1996a. First Quarter Second Year Sampling Report, October 1995 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January 1996.

Woodward-Clyde Federal Services (WCFS). 1996b. Second Quarter Second Year Sampling Report, March 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1996.

Woodward-Clyde Federal Services (WCFS). 1996c. Third Quarter Second Year Sampling Report, May 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. September 1996.

Woodward-Clyde Federal Services (WCFS). 1996d. Fourth Quarter Second Year Sampling Report, August 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. November 1996.

Woodward-Clyde Federal Services (WCFS). 1996. Draft Human Health Risk Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January.

Woodward-Clyde Federal Services (WCFS). 1997. Draft Ecological Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January.

ATTACHMENTS

ATTACHMENT A
RISK CALCULATIONS

AREA 1
ON-BASE WEST SOLDIER CREEK

TABLE A-1

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.0025 L/hour
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	6.00E-04	2.35E-10	4.00E-04	5.87E-07	1.68E-11		
Cadmium	3.00E-04	1.17E-10	5.00E-04	2.35E-07	8.39E-12		
Cobalt	5.94E-04	2.33E-10	6.00E-02	3.88E-09	1.66E-11		
Nickel	1.90E-02	7.43E-09	2.00E-02	3.72E-07	5.31E-10		
Vanadium	2.61E-03	1.02E-09	7.00E-03	1.46E-07	7.30E-11		
Semivolatile Organics							
Benzoic acid	1.20E-03	4.70E-10	4.00E+00	1.17E-10	3.35E-11		
Dimethyl phthalate	1.00E-03	3.91E-10	1.00E+01	3.91E-11	2.80E-11		
Volatile Organics							
Acetone	5.10E-03	2.00E-09	1.00E-01	2.00E-08	1.43E-10		
Carbon disulfide	1.90E-03	7.44E-10	1.00E-01	7.44E-09	5.31E-11		
Tetrachloroethene	1.50E-03	5.87E-10	1.00E-02	5.87E-08	4.19E-11		
Toluene	2.62E-03	1.03E-09	2.00E-01	5.13E-09	7.33E-11		
Trichloroethene	4.43E-03	1.74E-09	6.00E-03	2.89E-07	1.24E-10	1.10E-02	1.36E-12
			HAZARD INDEX =	1.72E-06	TOTAL CANCER RISK =		1.36E-12

TABLE A-2

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.005 L/hour
ET = Exposure Time = 8 hours/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	6.00E-04	4.70E-09	4.00E-04	1.17E-05	1.68E-09		
Cadmium	6.41E-04	5.02E-09	5.00E-04	1.00E-05	1.79E-09		
Cobalt	9.17E-04	7.17E-09	6.00E-02	1.20E-07	2.56E-09		
Nickel	4.00E-02	3.13E-07	2.00E-02	1.57E-05	1.12E-07		
Vanadium	4.60E-03	3.60E-08	7.00E-03	5.14E-06	1.29E-08		
Semivolatile Organics							
Benzoic acid	1.20E-03	9.39E-09	4.00E+00	2.35E-09	3.35E-09		
Dimethyl phthalate	1.00E-03	7.83E-09	1.00E+01	7.83E-10	2.80E-09		
Volatile Organics							
Acetone	5.96E-03	4.67E-08	1.00E-01	4.67E-07	1.67E-08		
Carbon disulfide	2.47E-03	1.94E-08	1.00E-01	1.94E-07	6.92E-09		
Tetrachloroethene	1.50E-03	1.17E-08	1.00E-02	1.17E-06	4.19E-09		
Toluene	2.85E-03	2.23E-08	2.00E-01	1.11E-07	7.96E-09		
Trichloroethene	7.98E-03	6.24E-08	6.00E-03	1.04E-05	2.23E-08	1.10E-02	2.45E-10
			HAZARD INDEX =	5.51E-05	TOTAL CANCER RISK =		2.45E-10

TABLE A-3

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIOS)

Equation : **CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 2,000 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	6.00E-04	1.00E-03	1.88E-10	4.00E-04	4.70E-07	1.34E-11		
Cadmium	3.00E-04	1.00E-03	9.39E-11	5.00E-04	1.88E-07	6.71E-12		
Cobalt	5.94E-04	1.00E-03	1.86E-10	6.00E-02	3.10E-09	1.33E-11		
Nickel	1.90E-02	1.00E-03	5.95E-09	2.00E-02	2.97E-07	4.25E-10		
Vanadium	2.61E-03	1.00E-03	8.18E-10	7.00E-03	1.17E-07	5.84E-11		
Semivolatile Organics								
Benzoic acid	1.20E-03	7.30E-03	2.74E-09	4.00E+00	6.86E-10	1.96E-10		
Dimethyl phthalate	1.00E-03	1.60E-03	5.01E-10	1.00E+01	5.01E-11	3.58E-11		
Volatile Organics								
Acetone	5.10E-03			1.00E-01				
Carbon disulfide	1.90E-03			1.00E-01				
Tetrachloroethene	1.50E-03			1.00E-02				
Toluene	2.62E-03			2.00E-01				
Trichloroethene	4.43E-03			6.00E-03			1.10E-02	
				HAZARD INDEX =	1.08E-06	TOTAL CANCER RISK =		0.00E+00

Note:
a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-4

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 9,800 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 8 hours per day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	6.00E-04	1.00E-03	9.21E-09	4.00E-04	2.30E-05	3.29E-09		
Cadmium	6.41E-04	1.00E-03	9.83E-09	5.00E-04	1.97E-05	3.51E-09		
Cobalt	9.17E-04	1.00E-03	1.41E-08	6.00E-02	2.34E-07	5.02E-09		
Nickel	4.00E-02	1.00E-03	6.14E-07	2.00E-02	3.07E-05	2.19E-07		
Vanadium	4.60E-03	1.00E-03	7.06E-08	7.00E-03	1.01E-05	2.52E-08		
Semivolatile Organics								
Benzoic acid	1.20E-03	7.30E-03	1.34E-07	4.00E+00	3.36E-08	4.80E-08		
Dimethyl phthalate	1.00E-03	1.60E-03	2.45E-08	1.00E+01	2.45E-09	8.77E-09		
Volatile Organics								
Acetone	5.96E-03			1.00E-01				
Carbon disulfide	2.47E-03			1.00E-01				
Tetrachloroethene	1.50E-03			1.00E-02				
Toluene	2.85E-03			2.00E-01				
Trichloroethene	7.98E-03			6.00E-03			1.10E-02	
				HAZARD INDEX =	8.37E-05	TOTAL CANCER RISK =		0.00E+00

Note:
a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-5

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation : CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	8.17E-01	1.28E-11	5.00E-03	2.56E-09	9.13E-13	4.30E+00	3.93E-12
Cadmium	2.80E+01	4.39E-10	1.00E-03	4.39E-07	3.13E-11		
Chromium	4.44E+02	6.96E-09	1.00E+00	6.96E-09	4.97E-10		
Cobalt	2.72E+01	4.25E-10	6.00E-02	7.08E-09	3.04E-11		
Lead	1.09E+02	1.71E-09			1.22E-10		
Mercury	2.02E-01	3.16E-12	3.00E-04	1.05E-08	2.25E-13		
Nickel	5.80E+02	9.08E-09	2.00E-02	4.54E-07	6.48E-10		
Silver	2.55E+01	3.99E-10	5.00E-03	7.97E-08	2.85E-11		
Thallium	6.16E+01	9.64E-10	8.00E-05	1.21E-05	6.89E-11		
Vanadium	3.75E+01	5.88E-10	7.00E-03	8.40E-08	4.20E-11		
PCBs/Pesticides							
Aroclor 1254	4.81E+00	7.53E-10	2.00E-05	3.76E-05	5.38E-11		
Semivolatile Organics							
1,2,4-Trichlorobenzene	1.40E-01	2.19E-11	1.00E-02	2.19E-09	1.57E-12		
1,2-Dichlorobenzene	4.83E-01	7.56E-11	9.00E-02	8.40E-10	5.40E-12		
1,3-Dichlorobenzene	1.50E-01	2.35E-11	8.90E-02	2.64E-10	1.68E-12		
1,4-Dichlorobenzene	2.50E-01	3.91E-11			2.80E-12	2.40E-02	6.71E-14
2-Methylnaphthalene	4.20E-02	6.58E-12	3.00E-02	2.19E-10	4.70E-13		
4,6-Dinitro-2-methylphenol	2.91E+00	4.56E-10			3.25E-11		
Acenaphthene	3.70E-01	5.79E-11	6.00E-02	9.65E-10	4.14E-12		
Anthracene	3.14E-01	4.92E-11	3.00E-01	1.64E-10	3.51E-12		
Benzidine	3.50E-01	5.48E-11	3.00E-03	1.83E-08	3.91E-12	2.30E+02	9.00E-10
Benzo(a)anthracene	8.02E-01	1.26E-10			8.97E-12	7.30E-01	6.55E-12
Benzo(a)pyrene	8.89E-01	1.39E-10			9.94E-12	7.30E+00	7.26E-11
Benzo(b)fluoranthene	1.29E+00	2.02E-10			1.44E-11	7.30E-01	1.05E-11
Benzo(g,h,i)perylene	7.09E-01	1.11E-10	3.00E-02	3.70E-09	7.92E-12		
Benzo(k)fluoranthene	4.90E-01	7.68E-11			5.48E-12	7.30E-02	4.00E-13
Chrysene	1.03E+00	1.61E-10			1.15E-11	7.30E-03	8.39E-14
Di-n-butyl phthalate	4.02E-01	6.30E-11	1.00E-01	6.30E-10	4.50E-12		
Dibenz(a,h)anthracene	2.89E-01	4.52E-11			3.23E-12	7.30E+00	2.36E-11
Dibenzofuran	2.50E-01	3.91E-11	4.00E-03	9.78E-09	2.80E-12		
Fluoranthene	1.78E+00	2.79E-10	4.00E-02	6.98E-09	1.99E-11		
Fluorene	3.20E-01	5.01E-11	4.00E-02	1.25E-09	3.58E-12		
Indeno(1,2,3-cd)pyrene	6.27E-01	9.82E-11			7.01E-12	7.30E-01	5.12E-12
Naphthalene	3.20E-01	5.01E-11	3.00E-02	1.67E-09	3.58E-12		
Phenanthrene	1.17E+00	1.83E-10	3.00E-02	6.11E-09	1.31E-11		
Pyrene	1.62E+00	2.53E-10	3.00E-02	8.44E-09	1.81E-11		
bis(2-Ethylhexyl)phthalate	7.09E-01	1.11E-10	2.00E-02	5.55E-09	7.93E-12	1.40E-02	1.11E-13
Volatile Organics							
2-Butanone (MEK)	1.03E-02	1.61E-12	6.00E-01	2.68E-12	1.15E-13		
Acetone	1.70E-02	2.66E-12	1.00E-01	2.66E-11	1.90E-13		
Carbon disulfide	3.67E-03	5.74E-13	1.00E-01	5.74E-12	4.10E-14		
Tetrachloroethene	8.39E-03	1.31E-12	1.00E-02	1.31E-10	9.38E-14		
Toluene	4.35E-03	6.81E-13	2.00E-01	3.40E-12	4.86E-14		
Trichloroethene	4.83E-03	7.57E-13	6.00E-03	1.26E-10	5.40E-14	1.10E-02	5.95E-16
			HAZARD INDEX =	5.08E-05	TOTAL CANCER RISK =		1.02E-09

TABLE A-6

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	1.14E+00	2.19E-09	5.00E-03	4.37E-07	7.81E-10	4.30E+00	3.36E-09
Cadmium	1.90E+02	3.64E-07	1.00E-03	3.64E-04	1.30E-07		
Chromium	2.23E+03	4.28E-06	1.00E+00	4.28E-06	1.53E-06		
Cobalt	5.17E+01	9.92E-08	6.00E-02	1.65E-06	3.54E-08		
Lead	2.66E+02	5.10E-07			1.82E-07		
Mercury	3.21E-01	6.16E-10	3.00E-04	2.05E-06	2.20E-10		
Nickel	3.69E+03	7.08E-06	2.00E-02	3.54E-04	2.53E-06		
Silver	1.31E+02	2.51E-07	5.00E-03	5.02E-05	8.97E-08		
Thallium	6.16E+01	1.18E-07	8.00E-05	1.48E-03	4.22E-08		
Vanadium	4.95E+01	9.50E-08	7.00E-03	1.36E-05	3.39E-08		
PCBs/Pesticides							
Aroclor 1254	6.10E+01	1.17E-06	2.00E-05	5.85E-02	4.18E-07		
Semivolatile Organics							
1,2,4-Trichlorobenzene	1.40E-01	2.68E-09	1.00E-02	2.68E-07	9.59E-10		
1,2-Dichlorobenzene	8.21E-01	1.57E-08	9.00E-02	1.75E-07	5.62E-09		
1,3-Dichlorobenzene	1.50E-01	2.88E-09	8.90E-02	3.23E-08	1.03E-09		
1,4-Dichlorobenzene	2.50E-01	4.79E-09			1.71E-09	2.40E-02	4.11E-11
2-Methylnaphthalene	4.20E-02	8.05E-10	3.00E-02	2.68E-08	2.88E-10		
4,6-Dinitro-2-methylphenol	4.42E+00	8.48E-08			3.03E-08		
Acenaphthene	3.70E-01	7.10E-09	6.00E-02	1.18E-07	2.53E-09		
Anthracene	4.22E-01	8.09E-09	3.00E-01	2.70E-08	2.89E-09		
Benzidine	3.50E-01	6.71E-09	3.00E-03	2.24E-06	2.40E-09	2.30E+02	5.51E-07
Benzo(a)anthracene	1.98E+00	3.79E-08			1.35E-08	7.30E-01	9.88E-09
Benzo(a)pyrene	2.03E+00	3.90E-08			1.39E-08	7.30E+00	1.02E-07
Benzo(b)fluoranthene	5.33E+00	1.02E-07			3.65E-08	7.30E-01	2.66E-08
Benzo(g,h,i)perylene	1.34E+00	2.57E-08	3.00E-02	8.56E-07	9.18E-09		
Benzo(k)fluoranthene	7.01E-01	1.34E-08			4.80E-09	7.30E-02	3.50E-10
Chrysene	3.02E+00	5.80E-08			2.07E-08	7.30E-03	1.51E-10
Di-n-butyl phthalate	5.10E-01	9.78E-09	1.00E-01	9.78E-08	3.49E-09		
Dibenz(a,h)anthracene	3.98E-01	7.63E-09			2.73E-09	7.30E+00	1.99E-08
Dibenzofuran	2.50E-01	4.79E-09	4.00E-03	1.20E-06	1.71E-09		
Fluoranthene	7.60E+00	1.46E-07	4.00E-02	3.64E-06	5.21E-08		
Fluorene	3.20E-01	6.14E-09	4.00E-02	1.53E-07	2.19E-09		
Indeno(1,2,3-cd)pyrene	1.14E+00	2.19E-08			7.81E-09	7.30E-01	5.70E-09
Naphthalene	3.20E-01	6.14E-09	3.00E-02	2.05E-07	2.19E-09		
Phenanthrene	3.48E+00	6.68E-08	3.00E-02	2.23E-06	2.39E-08		
Pyrene	8.36E+00	1.60E-07	3.00E-02	5.35E-06	5.73E-08		
bis(2-Ethylhexyl)phthalate	1.85E+00	3.55E-08	2.00E-02	1.78E-06	1.27E-08	1.40E-02	1.78E-10
Volatile Organics							
2-Butanone (MEK)	1.20E-02	2.31E-10	6.00E-01	3.85E-10	8.25E-11		
Acetone	2.66E-02	5.11E-10	1.00E-01	5.11E-09	1.82E-10		
Carbon disulfide	4.03E-03	7.72E-11	1.00E-01	7.72E-10	2.76E-11		
Tetrachloroethene	9.43E-03	1.81E-10	1.00E-02	1.81E-08	6.46E-11		
Toluene	5.40E-03	1.04E-10	2.00E-01	5.18E-10	3.70E-11		
Trichloroethene	6.89E-03	1.32E-10	6.00E-03	2.20E-08	4.72E-11	1.10E-02	5.19E-13
			HAZARD INDEX =	6.08E-02		TOTAL CANCER RISK =	7.19E-07

TABLE A-7

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	8.17E-01	3.20E-10	5.00E-03	6.39E-08	2.28E-11	4.30E+00	9.82E-11
Cadmium	2.80E+01	1.10E-08	1.00E-03	1.10E-05	7.83E-10		
Chromium	4.44E+02	1.74E-07	1.00E+00	1.74E-07	1.24E-08		
Cobalt	2.72E+01	1.06E-08	6.00E-02	1.77E-07	7.59E-10		
Lead	1.09E+02	4.27E-08			3.05E-09		
Mercury	2.02E-01	7.89E-11	3.00E-04	2.63E-07	5.63E-12		
Nickel	5.80E+02	2.27E-07	2.00E-02	1.13E-05	1.62E-08		
Silver	2.55E+01	9.96E-09	5.00E-03	1.99E-06	7.12E-10		
Thallium	6.16E+01	2.41E-08	8.00E-05	3.01E-04	1.72E-09		
Vanadium	3.75E+01	1.47E-08	7.00E-03	2.10E-06	1.05E-09		
PCBs/Pesticides							
Aroclor 1254	4.81E+00	1.88E-09	2.00E-05	9.41E-05	1.34E-10		
Semivolatile Organics							
1,2,4-Trichlorobenzene	1.40E-01	5.48E-11	1.00E-02	5.48E-09	3.91E-12		
1,2-Dichlorobenzene	4.83E-01	1.89E-10	9.00E-02	2.10E-09	1.35E-11		
1,3-Dichlorobenzene	1.50E-01	5.87E-11	8.90E-02	6.60E-10	4.19E-12		
1,4-Dichlorobenzene	2.50E-01	9.78E-11			6.99E-12	2.40E-02	1.68E-13
2-Methylnaphthalene	4.20E-02	1.64E-11	3.00E-02	5.48E-10	1.17E-12		
4,6-Dinitro-2-methylphenol	2.91E+00	1.14E-09			8.14E-11		
Acenaphthene	3.70E-01	1.45E-10	6.00E-02	2.41E-09	1.03E-11		
Anthracene	3.14E-01	1.23E-10	3.00E-01	4.10E-10	8.78E-12		
Benzidine	3.50E-01	1.37E-10	3.00E-03	4.57E-08	9.78E-12	2.30E+02	2.25E-09
Benzo(a)anthracene	8.02E-01	3.14E-10			2.24E-11	7.30E-01	1.64E-11
Benzo(a)pyrene	8.89E-01	3.48E-10			2.49E-11	7.30E+00	1.81E-10
Benzo(b)fluoranthene	1.29E+00	5.05E-10			3.61E-11	7.30E-01	2.63E-11
Benzo(g,h,i)perylene	7.09E-01	2.77E-10	3.00E-02	9.24E-09	1.98E-11		
Benzo(k)fluoranthene	4.90E-01	1.92E-10			1.37E-11	7.30E-02	1.00E-12
Chrysene	1.03E+00	4.02E-10			2.87E-11	7.30E-03	2.10E-13
Di-n-butyl phthalate	4.02E-01	1.57E-10	1.00E-01	1.57E-09	1.12E-11		
Dibenz(a,h)anthracene	2.89E-01	1.13E-10			8.08E-12	7.30E+00	5.90E-11
Dibenzofuran	2.50E-01	9.78E-11	4.00E-03	2.45E-08	6.99E-12		
Fluoranthene	1.78E+00	6.98E-10	4.00E-02	1.75E-08	4.99E-11		
Fluorene	3.20E-01	1.25E-10	4.00E-02	3.13E-09	8.95E-12		
Indeno(1,2,3-cd)pyrene	6.27E-01	2.46E-10			1.75E-11	7.30E-01	1.28E-11
Naphthalene	3.20E-01	1.25E-10	3.00E-02	4.17E-09	8.95E-12		
Phenanthrene	1.17E+00	4.59E-10	3.00E-02	1.53E-08	3.28E-11		
Pyrene	1.62E+00	6.33E-10	3.00E-02	2.11E-08	4.52E-11		
bis(2-Ethylhexyl)phthalate	7.09E-01	2.77E-10	2.00E-02	1.39E-08	1.98E-11	1.40E-02	2.77E-13
Volatile Organics							
2-Butanone (MEK)	1.03E-02	4.01E-12	6.00E-01	6.69E-12	2.87E-13		
Acetone	1.70E-02	6.65E-12	1.00E-01	6.65E-11	4.75E-13		
Carbon disulfide	3.67E-03	1.44E-12	1.00E-01	1.44E-11	1.03E-13		
Tetrachloroethene	8.39E-03	3.28E-12	1.00E-02	3.28E-10	2.34E-13		
Toluene	4.35E-03	1.70E-12	2.00E-01	8.51E-12	1.22E-13		
Trichloroethene	4.83E-03	1.89E-12	6.00E-03	3.15E-10	1.35E-13	1.10E-02	1.49E-15
			HAZARD INDEX =	4.23E-04		TOTAL CANCER RISK =	2.65E-09

TABLE A-8

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	1.14E+00	1.12E-08	5.00E-03	2.23E-06	3.98E-09	4.30E+00	1.71E-08
Cadmium	1.90E+02	1.86E-06	1.00E-03	1.86E-03	6.64E-07		
Chromium	2.23E+03	2.18E-05	1.00E+00	2.18E-05	7.79E-06		
Cobalt	5.17E+01	5.06E-07	6.00E-02	8.43E-06	1.81E-07		
Lead	2.66E+02	2.60E-06			9.29E-07		
Mercury	3.21E-01	3.14E-09	3.00E-04	1.05E-05	1.12E-09		
Nickel	3.69E+03	3.61E-05	2.00E-02	1.81E-03	1.29E-05		
Silver	1.31E+02	1.28E-06	5.00E-03	2.56E-04	4.58E-07		
Thallium	6.16E+01	6.03E-07	8.00E-05	7.53E-03	2.15E-07		
Vanadium	4.95E+01	4.85E-07	7.00E-03	6.93E-05	1.73E-07		
PCBs/Pesticides							
Aroclor 1254	6.10E+01	5.97E-07	2.00E-05	2.98E-02	2.13E-07		
Semivolatile organics							
1,2,4-Trichlorobenzene	1.40E-01	1.37E-09	1.00E-02	1.37E-07	4.89E-10		
1,2-Dichlorobenzene	8.21E-01	8.03E-09	9.00E-02	8.92E-08	2.87E-09		
1,3-Dichlorobenzene	1.50E-01	1.47E-09	8.90E-02	1.65E-08	5.24E-10		
1,4-Dichlorobenzene	2.50E-01	2.45E-09			8.74E-10	2.40E-02	2.10E-11
2-Methylnaphthalene	4.20E-02	4.11E-10	3.00E-02	1.37E-08	1.47E-10		
4,6-Dinitro-2-methylphenol	4.42E+00	4.32E-08			1.54E-08		
Acenaphthene	3.70E-01	3.62E-09	6.00E-02	6.03E-08	1.29E-09		
Anthracene	4.22E-01	4.13E-09	3.00E-01	1.38E-08	1.47E-09		
Benzidine	3.50E-01	3.42E-09	3.00E-03	1.14E-06	1.22E-09	2.30E+02	2.81E-07
Benzo(a)anthracene	1.98E+00	1.93E-08			6.91E-09	7.30E-01	5.04E-09
Benzo(a)pyrene	2.03E+00	1.99E-08			7.11E-09	7.30E+00	5.19E-08
Benzo(b)fluoranthene	5.33E+00	5.21E-08			1.86E-08	7.30E-01	1.36E-08
Benzo(g,h,i)perylene	1.34E+00	1.31E-08	3.00E-02	4.37E-07	4.68E-09		
Benzo(k)fluoranthene	7.01E-01	6.86E-09			2.45E-09	7.30E-02	1.79E-10
Chrysene	3.02E+00	2.96E-08			1.06E-08	7.30E-03	7.72E-11
Di-n-butyl phthalate	5.10E-01	4.99E-09	1.00E-01	4.99E-08	1.78E-09		
Dibenz(a,h)anthracene	3.98E-01	3.89E-09			1.39E-09	7.30E+00	1.02E-08
Dibenzofuran	2.50E-01	2.45E-09	4.00E-03	6.12E-07	8.74E-10		
Fluoranthene	7.60E+00	7.44E-08	4.00E-02	1.86E-06	2.66E-08		
Fluorene	3.20E-01	3.13E-09	4.00E-02	7.83E-08	1.12E-09		
Indeno(1,2,3-cd)pyrene	1.14E+00	1.12E-08			3.99E-09	7.30E-01	2.91E-09
Naphthalene	3.20E-01	3.13E-09	3.00E-02	1.04E-07	1.12E-09		
Phenanthrene	3.48E+00	3.41E-08	3.00E-02	1.14E-06	1.22E-08		
Pyrene	8.36E+00	8.18E-08	3.00E-02	2.73E-06	2.92E-08		
bis(2-Ethylhexyl)phthalate	1.85E+00	1.81E-08	2.00E-02	9.06E-07	6.47E-09	1.40E-02	9.06E-11
Volatile Organics							
2-Butanone (MEK)	1.20E-02	1.18E-10	6.00E-01	1.96E-10	4.21E-11		
Acetone	2.66E-02	2.61E-10	1.00E-01	2.61E-09	9.30E-11		
Carbon disulfide	4.03E-03	3.94E-11	1.00E-01	3.94E-10	1.41E-11		
Tetrachloroethene	9.43E-03	9.23E-11	1.00E-02	9.23E-09	3.30E-11		
Toluene	5.40E-03	5.29E-11	2.00E-01	2.64E-10	1.89E-11		
Trichloroethene	6.89E-03	6.75E-11	6.00E-03	1.12E-08	2.41E-11	1.10E-02	2.65E-13
			HAZARD INDEX =	4.14E-02		TOTAL CANCER RISK =	3.82E-07

TABLE A-9

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER -AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)**

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake

CS = Concentration in Sediments

CF = Conversion Factor (10^{-6} kg/mg)

SA = Skin Surface Area Available for Contact = 2,000 cm^2

AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2

ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics

EF = Exposure Frequency = 1 day per year

ED = Exposure Duration = 5 years

BW = Body Weight = 70 kg

AT1 = Days Per Year = 365 days

AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenic)

SF = Slope Factor

RfD = Reference Dose

CONTAMINANTS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Barium	5.20E+02	8.14E-09	7.00E-02	1.16E-07	5.82E-10		
Beryllium	7.18E-01	1.12E-11	5.00E-03	2.25E-09	8.03E-13	4.30E+00	3.45E-12
Cadmium	2.30E+01	3.61E-10	1.00E-03	3.61E-07	2.58E-11		
Chromium	3.72E+02	5.83E-09	1.00E+00	5.83E-09	4.17E-10		
Cobalt	1.95E+01	3.06E-10	6.00E-02	5.09E-09	2.18E-11		
Lead	7.80E+01	1.22E-09			8.72E-11		
Mercury	1.50E-01	2.35E-12	3.00E-04	7.83E-09	1.68E-13		
Nickel	5.13E+02	8.03E-09	2.00E-02	4.01E-07	5.73E-10		
Silver	2.00E+01	3.14E-10	5.00E-03	6.27E-08	2.24E-11		
Thallium	6.16E+01	9.64E-10	8.00E-05	1.21E-05	6.89E-11		
Vanadium	3.25E+01	5.09E-10	7.00E-03	7.28E-08	3.64E-11		
PCBs/Pesticides							
Aroclor 1254	5.77E+00	9.04E-10	2.00E-05	4.52E-05	6.46E-11		
Semivolatile Organics							
1,2,4-Trichlorobenzene	1.40E-01	2.19E-11	1.00E-02	2.19E-09	1.57E-12		
1,2-Dichlorobenzene	7.33E-01	1.15E-10	9.00E-02	1.28E-09	8.20E-12		
1,3-Dichlorobenzene	1.50E-01	2.35E-11	8.90E-02	2.64E-10	1.68E-12		
1,4-Dichlorobenzene	3.00E-01	4.70E-11			3.35E-12	2.40E-02	8.05E-14
1-Naphthylamine	5.60E-01				6.26E-12	1.30E+02	8.14E-10
2-Methylnaphthalene	5.96E-01	9.34E-11	3.00E-02	3.11E-09	6.67E-12		
4,6-Dinitro-2-methylphenol	2.91E+00				3.25E-11		
Acenaphthene	3.70E-01	5.79E-11	6.00E-02	9.65E-10	4.14E-12		
Anthracene	4.89E-01	7.65E-11	3.00E-01	2.55E-10	5.47E-12		
Benzidine	3.50E-01		3.00E-03		3.91E-12	2.30E+02	9.00E-10
Benzo(a)anthracene	8.80E-01	1.38E-10			9.84E-12	7.30E-01	7.18E-12
Benzo(a)pyrene	9.32E-01	1.46E-10			1.04E-11	7.30E+00	7.61E-11
Benzo(b)fluoranthene	8.20E-01	1.28E-10			9.17E-12	7.30E-01	6.69E-12
Benzo(g,h,i)perylene	8.30E-01	1.30E-10	3.00E-02	4.33E-09	9.28E-12		
Benzo(k)fluoranthene	6.65E-01	1.04E-10			7.43E-12	7.30E-02	5.43E-13
Chrysene	6.59E-01	1.03E-10			7.37E-12	7.30E-03	5.38E-14
Di-n-butyl phthalate	5.10E-01	7.98E-11	1.00E-01	7.98E-10	5.70E-12		
Dibenz(a,h)anthracene	4.93E-01	7.73E-11			5.52E-12	7.30E+00	4.03E-11
Dibenzofuran	3.10E-01	4.85E-11	4.00E-03	1.21E-08	3.47E-12		
Fluoranthene	1.02E+00	1.60E-10	4.00E-02	3.99E-09	1.14E-11		
Fluorene	3.20E-01	5.01E-11	4.00E-02	1.25E-09	3.58E-12		
Indeno(1,2,3-cd)pyrene	7.88E-01	1.23E-10			8.81E-12	7.30E-01	6.43E-12
Naphthalene	5.10E-01	7.98E-11	3.00E-02	2.66E-09	5.70E-12		
Phenanthrene	1.08E+00	1.68E-10	3.00E-02	5.61E-09	1.20E-11		
Pyrene	9.89E-01	1.55E-10	3.00E-02	5.16E-09	1.11E-11		
bis(2-Ethylhexyl)phthalate	1.04E+00	1.62E-10	2.00E-02	8.11E-09	1.16E-11	1.40E-02	1.62E-13
Volatile Organics							
2-Butanone (MEK)	8.38E-03	1.31E-12	6.00E-01	2.19E-12	9.37E-14		
Acetone	1.32E-02	2.07E-12	1.00E-01	2.07E-11	1.48E-13		
Carbon disulfide	3.64E-03	5.69E-13	1.00E-01	5.69E-12	4.07E-14		
Chlorobenzene	3.52E-03	5.52E-13	2.00E-02	2.76E-11	3.94E-14		
Tetrachloroethene	6.87E-03	1.08E-12	1.00E-02	1.08E-10	7.69E-14		
Toluene	3.86E-03	6.04E-13	2.00E-01	3.02E-12	4.32E-14		
Trichloroethene	4.95E-03	7.75E-13	6.00E-03	1.29E-10	5.54E-14	1.10E-02	6.09E-16
			HAZARD INDEX =	5.83E-05	TOTAL CANCER RISK =		1.86E-09

TABLE A-10

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation : CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Barium	6.18E+02	1.19E-06	7.00E-02	1.69E-05	4.23E-07		
Beryllium	8.97E-01	1.72E-09	5.00E-03	3.44E-07	6.14E-10	4.30E+00	2.64E-09
Cadmium	1.01E+02	1.94E-07	1.00E-03	1.94E-04	6.91E-08		
Chromium	6.11E+02	1.17E-06	1.00E+00	1.17E-06	4.18E-07		
Cobalt	2.41E+01	4.62E-08	6.00E-02	7.71E-07	1.65E-08		
Lead	1.11E+02	2.13E-07			7.60E-08		
Mercury	1.78E-01	3.41E-10	3.00E-04	1.14E-06	1.22E-10		
Nickel	9.41E+02	1.80E-06	2.00E-02	9.02E-05	6.44E-07		
Silver	4.94E+01	9.48E-08	5.00E-03	1.90E-05	3.39E-08		
Thallium	6.16E+01	1.18E-07	8.00E-05	1.48E-03	4.22E-08		
Vanadium	3.74E+01	7.17E-08	7.00E-03	1.02E-05	2.56E-08		
PCBs/Pesticides							
Aroclor 1254	4.19E+01	8.03E-07	2.00E-05	4.01E-02	2.87E-07		
Semivolatile Organics							
1,2,4-Trichlorobenzene	1.40E-01	2.68E-09	1.00E-02	2.68E-07	9.59E-10		
1,2-Dichlorobenzene	7.33E-01	1.41E-08	9.00E-02	1.56E-07	5.02E-09		
1,3-Dichlorobenzene	1.50E-01	2.88E-09	8.90E-02	3.23E-08	1.03E-09		
1,4-Dichlorobenzene	3.00E-01	5.75E-09			2.05E-09	2.40E-02	4.93E-11
1-Naphthylamine	5.60E-01	1.07E-08			3.84E-09	1.30E+02	4.99E-07
2-Methylnaphthalene	5.96E-01	1.14E-08	3.00E-02	3.81E-07	4.09E-09		
4,6-Dinitro-2-methylphenol	4.42E+00	8.48E-08			3.03E-08		
Acenaphthene	3.70E-01	7.10E-09	6.00E-02	1.18E-07	2.53E-09		
Anthracene	4.89E-01	9.38E-09	3.00E-01	3.13E-08	3.35E-09		
Benzidine	3.50E-01	6.71E-09	3.00E-03	2.24E-06	2.40E-09	2.30E+02	5.51E-07
Benzo(a)anthracene	1.01E+00	1.94E-08			6.95E-09	7.30E-01	5.07E-09
Benzo(a)pyrene	1.14E+00	2.19E-08			7.83E-09	7.30E+00	5.71E-08
Benzo(b)fluoranthene	1.35E+00	2.59E-08			9.25E-09	7.30E-01	6.75E-09
Benzo(g,h,i)perylene	8.84E-01	1.70E-08	3.00E-02	5.65E-07	6.06E-09		
Benzo(k)fluoranthene	6.65E-01	1.27E-08			4.55E-09	7.30E-02	3.32E-10
Chrysene	9.08E-01	1.74E-08			6.22E-09	7.30E-03	4.54E-11
Di-n-butyl phthalate	5.10E-01	9.78E-09	1.00E-01	9.78E-08	3.49E-09		
Dibenz(a,h)anthracene	4.93E-01	9.46E-09			3.38E-09	7.30E+00	2.47E-08
Dibenzofuran	3.10E-01	5.95E-09	4.00E-03	1.49E-06	2.12E-09		
Fluoranthene	1.80E+00	3.45E-08	4.00E-02	8.62E-07	1.23E-08		
Fluorene	3.20E-01	6.14E-09	4.00E-02	1.53E-07	2.19E-09		
Indeno(1,2,3-cd)pyrene	7.93E-01	1.52E-08			5.43E-09	7.30E-01	3.96E-09
Naphthalene	5.10E-01	9.78E-09	3.00E-02	3.26E-07	3.49E-09		
Phenanthrene	1.45E+00	2.78E-08	3.00E-02	9.28E-07	9.94E-09		
Pyrene	1.66E+00	3.19E-08	3.00E-02	1.06E-06	1.14E-08		
bis(2-Ethylhexyl)phthalate	1.26E+00	2.42E-08	2.00E-02	1.21E-06	8.66E-09	1.40E-02	1.21E-10
Volatile Organics							
2-Butanone (MEK)	8.78E-03	1.68E-10	6.00E-01	2.81E-10	6.01E-11		
Acetone	1.66E-02	3.19E-10	1.00E-01	3.19E-09	1.14E-10		
Carbon disulfide	3.85E-03	7.39E-11	1.00E-01	7.39E-10	2.64E-11		
Chlorobenzene	3.71E-03	7.12E-11	2.00E-02	3.56E-09	2.54E-11		
Tetrachloroethene	6.87E-03	1.32E-10	1.00E-02	1.32E-08	4.71E-11		
Toluene	4.30E-03	8.25E-11	2.00E-01	4.13E-10	2.95E-11		
Trichloroethene	6.06E-03	1.16E-10	6.00E-03	1.94E-08	4.15E-11	1.10E-02	4.57E-13
			HAZARD INDEX =	4.20E-02		TOTAL CANCER RISK =	1.15E-06

TABLE A-11

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Barium	5.20E+02	2.04E-07	7.00E-02	2.91E-06	1.45E-08		
Beryllium	7.18E-01	2.81E-10	5.00E-03	5.62E-08	2.01E-11	4.30E+00	8.63E-11
Cadmium	2.30E+01	9.02E-09	1.00E-03	9.02E-06	6.44E-10		
Chromium	3.72E+02	1.46E-07	1.00E+00	1.46E-07	1.04E-08		
Cobalt	1.95E+01	7.64E-09	6.00E-02	1.27E-07	5.46E-10		
Lead	7.80E+01	3.05E-08			2.18E-09		
Mercury	1.50E-01	5.88E-11	3.00E-04	1.96E-07	4.20E-12		
Nickel	5.13E+02	2.01E-07	2.00E-02	1.00E-05	1.43E-08		
Silver	2.00E+01	7.84E-09	5.00E-03	1.57E-06	5.60E-10		
Thallium	6.16E+01	2.41E-08	8.00E-05	3.01E-04	1.72E-09		
Vanadium	3.25E+01	1.27E-08	7.00E-03	1.82E-06	9.10E-10		
PCBs/Pesticides							
Aroclor 1254	5.77E+00	2.26E-09	2.00E-05	1.13E-04	1.61E-10		
Semivolatile organics							
1,2,4-Trichlorobenzene	1.40E-01	5.48E-11	1.00E-02	5.48E-09	3.91E-12		
1,2-Dichlorobenzene	7.33E-01	2.87E-10	9.00E-02	3.19E-09	2.05E-11		
1,3-Dichlorobenzene	1.50E-01	5.87E-11	8.90E-02	6.60E-10	4.19E-12		
1,4-Dichlorobenzene	3.00E-01	1.17E-10			8.39E-12	2.40E-02	2.01E-13
1-Naphthylamine	5.60E-01	2.19E-10			1.57E-11	1.30E+02	2.04E-09
2-Methylnaphthalene	5.96E-01	2.33E-10	3.00E-02	7.78E-09	1.67E-11		
4,6-Dinitro-2-methylphenol	2.91E+00	1.14E-09			8.14E-11		
Acenaphthene	3.70E-01	1.45E-10	6.00E-02	2.41E-09	1.03E-11		
Anthracene	4.89E-01	1.91E-10	3.00E-01	6.38E-10	1.37E-11		
Benzidine	3.50E-01	1.37E-10	3.00E-03	4.57E-08	9.78E-12	2.30E+02	2.25E-09
Benzo(a)anthracene	8.80E-01	3.44E-10			2.46E-11	7.30E-01	1.80E-11
Benzo(a)pyrene	9.32E-01	3.65E-10			2.61E-11	7.30E+00	1.90E-10
Benzo(b)fluoranthene	8.20E-01	3.21E-10			2.29E-11	7.30E-01	1.67E-11
Benzo(g,h,i)perylene	8.30E-01	3.25E-10	3.00E-02	1.08E-08	2.32E-11		
Benzo(k)fluoranthene	6.65E-01	2.60E-10			1.86E-11	7.30E-02	1.36E-12
Chrysene	6.59E-01	2.58E-10			1.84E-11	7.30E-03	1.34E-13
Di-n-butyl phthalate	5.10E-01	2.00E-10	1.00E-01	2.00E-09	1.43E-11		
Dibenz(a,h)anthracene	4.93E-01	1.93E-10			1.38E-11	7.30E+00	1.01E-10
Dibenzofuran	3.10E-01	1.21E-10	4.00E-03	3.03E-08	8.67E-12		
Fluoranthene	1.02E+00	3.99E-10	4.00E-02	9.98E-09	2.85E-11		
Fluorene	3.20E-01	1.25E-10	4.00E-02	3.13E-09	8.95E-12		
Indeno(1,2,3-cd)pyrene	7.88E-01	3.08E-10			2.20E-11	7.30E-01	1.61E-11
Naphthalene	5.10E-01	2.00E-10	3.00E-02	6.65E-09	1.43E-11		
Phenanthrene	1.08E+00	4.21E-10	3.00E-02	1.40E-08	3.01E-11		
Pyrene	9.89E-01	3.87E-10	3.00E-02	1.29E-08	2.76E-11		
bis(2-Ethylhexyl)phthalate	1.04E+00	4.05E-10	2.00E-02	2.03E-08	2.90E-11	1.40E-02	4.05E-13
Volatile Organics							
2-Butanone (MEK)	8.38E-03	3.28E-12	6.00E-01	5.46E-12	2.34E-13		
Acetone	1.32E-02	5.17E-12	1.00E-01	5.17E-11	3.69E-13		
Carbon disulfide	3.64E-03	1.42E-12	1.00E-01	1.42E-11	1.02E-13		
Chlorobenzene	3.52E-03	1.38E-12	2.00E-02	6.90E-11	9.85E-14		
Tetrachloroethene	6.87E-03	2.69E-12	1.00E-02	2.69E-10	1.92E-13		
Toluene	3.86E-03	1.51E-12	2.00E-01	7.55E-12	1.08E-13		
Trichloroethene	4.95E-03	1.94E-12	6.00E-03	3.23E-10	1.38E-13	1.10E-02	1.52E-15
			HAZARD INDEX =	4.40E-04		TOTAL CANCER RISK =	4.72E-09

TABLE A-12

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Barium	6.18E+02	6.05E-06	7.00E-02	8.64E-05	2.16E-06		
Beryllium	8.97E-01	8.78E-09	5.00E-03	1.76E-06	3.13E-09	4.30E+00	1.35E-08
Cadmium	1.01E+02	9.87E-07	1.00E-03	9.87E-04	3.53E-07		
Chromium	6.11E+02	5.98E-06	1.00E+00	5.98E-06	2.13E-06		
Cobalt	2.41E+01	2.36E-07	6.00E-02	3.93E-06	8.42E-08		
Lead	1.11E+02	1.09E-06			3.88E-07		
Mercury	1.78E-01	1.74E-09	3.00E-04	5.79E-06	6.21E-10		
Nickel	9.41E+02	9.21E-06	2.00E-02	4.60E-04	3.29E-06		
Silver	4.94E+01	4.84E-07	5.00E-03	9.67E-05	1.73E-07		
Thallium	6.16E+01	6.03E-07	8.00E-05	7.53E-03	2.15E-07		
Vanadium	3.74E+01	3.66E-07	7.00E-03	5.23E-05	1.31E-07		
PCBs/Pesticides							
Aroclor 1254	4.19E+01	4.10E-07	2.00E-05	2.05E-02	1.46E-07		
Semivolatile organics							
1,2,4-Trichlorobenzene	1.40E-01	1.37E-09	1.00E-02	1.37E-07	4.89E-10		
1,2-Dichlorobenzene	7.33E-01	7.18E-09	9.00E-02	7.97E-08	2.56E-09		
1,3-Dichlorobenzene	1.50E-01	1.47E-09	8.90E-02	1.65E-08	5.24E-10		
1,4-Dichlorobenzene	3.00E-01	2.94E-09			1.05E-09	2.40E-02	2.52E-11
1-Naphthylamine	5.60E-01	5.48E-09			1.96E-09	1.30E+02	2.54E-07
2-Methylnaphthalene	5.96E-01	5.84E-09	3.00E-02	1.95E-07	2.08E-09		
4,6-Dinitro-2-methylphenol	4.42E+00	4.32E-08			1.54E-08		
Acenaphthene	3.70E-01	3.62E-09	6.00E-02	6.03E-08	1.29E-09		
Anthracene	4.89E-01	4.78E-09	3.00E-01	1.59E-08	1.71E-09		
Benzidine	3.50E-01	3.42E-09	3.00E-03	1.14E-06	1.22E-09	2.30E+02	2.81E-07
Benzo(a)anthracene	1.01E+00	9.92E-09			3.54E-09	7.30E-01	2.59E-09
Benzo(a)pyrene	1.14E+00	1.12E-08			3.99E-09	7.30E+00	2.92E-08
Benzo(b)fluoranthene	1.35E+00	1.32E-08			4.72E-09	7.30E-01	3.45E-09
Benzo(g,h,i)perylene	8.84E-01	8.65E-09	3.00E-02	2.88E-07	3.09E-09		
Benzo(k)fluoranthene	6.65E-01	6.50E-09			2.32E-09	7.30E-02	1.70E-10
Chrysene	9.08E-01	8.88E-09			3.17E-09	7.30E-03	2.32E-11
Di-n-butyl phthalate	5.10E-01	4.99E-09	1.00E-01	4.99E-08	1.78E-09		
Dibenz(a,h)anthracene	4.93E-01	4.83E-09			1.72E-09	7.30E+00	1.26E-08
Dibenzofuran	3.10E-01	3.03E-09	4.00E-03	7.58E-07	1.08E-09		
Fluoranthene	1.80E+00	1.76E-08	4.00E-02	4.40E-07	6.28E-09		
Fluorene	3.20E-01	3.13E-09	4.00E-02	7.83E-08	1.12E-09		
Indeno(1,2,3-cd)pyrene	7.93E-01	7.76E-09			2.77E-09	7.30E-01	2.02E-09
Naphthalene	5.10E-01	4.99E-09	3.00E-02	1.66E-07	1.78E-09		
Phenanthrene	1.45E+00	1.42E-08	3.00E-02	4.73E-07	5.07E-09		
Pyrene	1.66E+00	1.63E-08	3.00E-02	5.43E-07	5.81E-09		
bis(2-Ethylhexyl)phthalate	1.26E+00	1.24E-08	2.00E-02	6.18E-07	4.42E-09	1.40E-02	6.18E-11
Volatile Organics							
2-Butanone (MEK)	8.78E-03	8.59E-11	6.00E-01	1.43E-10	3.07E-11		
Acetone	1.66E-02	1.63E-10	1.00E-01	1.63E-09	5.81E-11		
Carbon disulfide	3.85E-03	3.77E-11	1.00E-01	3.77E-10	1.35E-11		
Chlorobenzene	3.71E-03	3.63E-11	2.00E-02	1.82E-09	1.30E-11		
Tetrachloroethene	6.87E-03	6.73E-11	1.00E-02	6.73E-09	2.40E-11		
Toluene	4.30E-03	4.21E-11	2.00E-01	2.11E-10	1.50E-11		
Trichloroethene	6.06E-03	5.93E-11	6.00E-03	9.88E-09	2.12E-11	1.10E-02	2.33E-13
			HAZARD INDEX =	2.97E-02		TOTAL CANCER RISK =	5.99E-07

AREA 2
OFF-BASE WEST SOLDIER CREEK

TABLE A-13

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.0025 L/hour
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.0025 L/hour
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	5.00E-04	8.42E-06	4.21E-09	4.00E-04	1.05E-05	1.68E-06	8.42E-10		
Cadmium	4.17E-04	8.42E-06	6.43E-11	5.00E-04	1.29E-07	1.68E-06	7.01E-10		
Cobalt	2.67E-04	8.42E-06	4.11E-11	6.00E-02	6.85E-10	1.68E-06	4.49E-10		
Nickel	7.85E-03	8.42E-06	1.21E-09	2.00E-02	6.05E-08	1.68E-06	1.32E-08		
Vanadium	1.03E-02	8.42E-06	1.58E-09	7.00E-03	2.26E-07	1.68E-06	1.73E-08		
Semivolatile Organics									
Benzoic acid	1.20E-03	8.42E-06	1.85E-10	4.00E+00	4.63E-11	1.68E-06	2.02E-09		
Volatile Organics									
Acetone	4.68E-03	8.42E-06	7.21E-10	1.00E-01	7.21E-09	1.68E-06	7.87E-09		
				HAZARD INDEX =	1.09E-05		TOTAL CANCER RISK =		0.00E+00

TABLE A-14

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.005 L/hour
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.005 L/hour
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	5.00E-04	3.24E-05	1.62E-08	4.00E-04	4.06E-05	1.39E-05	6.95E-09		
Cadmium	5.95E-04	3.24E-05	1.93E-08	5.00E-04	3.86E-05	1.39E-05	8.28E-09		
Cobalt	3.00E-04	3.24E-05	9.73E-09	6.00E-02	1.62E-07	1.39E-05	4.17E-09		
Nickel	1.00E-02	3.24E-05	3.24E-07	2.00E-02	1.62E-05	1.39E-05	1.39E-07		
Vanadium	1.30E-02	3.24E-05	4.22E-07	7.00E-03	6.03E-05	1.39E-05	1.81E-07		
Semivolatile Organics									
Benzoic acid	1.20E-03	3.24E-05	3.89E-08	4.00E+00	9.73E-09	1.39E-05	1.67E-08		
Volatile Organics									
Acetone	4.70E-03	3.24E-05	1.52E-07	1.00E-01	1.52E-06	1.39E-05	6.54E-08		
				HAZARD INDEX =	1.57E-04		TOTAL CANCER RISK =		0.00E+00

TABLE A-15

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : $HIF = \{ [(SAc \times ETc \times EFc \times EDc) / BWc + (SAa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)\} \times CF$

$CDI = CW \times PC \times HIF$

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
PC = Chemical-specific Dermal Permeability Constant
SAc = Child Skin Surface Area Available for Contact = 1,800 cm^2
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
CF = Conversion Factor (1L/1000cm^2)
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	5.00E-04	1.00E-03	6.12E-03	3.06E-09	4.00E-04	7.65E-06	1.22E-03	6.12E-10		
Cadmium	4.17E-04	1.00E-03	6.12E-03	2.55E-09	5.00E-04	5.10E-06				
Cobalt	2.67E-04	1.00E-03	6.12E-03	1.63E-09	6.00E-02	2.72E-08				
Nickel	7.85E-03	1.00E-03	6.12E-03	4.81E-08	2.00E-02	2.40E-06	1.22E-03	9.61E-09		
Vanadium	1.03E-02	1.00E-03	6.12E-03	6.27E-08	7.00E-03	8.96E-06	1.22E-03	1.25E-08		
Semivolatile Organics										
Benzoic acid	1.20E-03	7.30E-03	6.12E-03	5.36E-08	4.00E+00	1.34E-08	1.22E-03	1.07E-08		
Volatile Organics										
Acetone	4.68E-03		6.12E-03		1.00E-01		1.22E-03			
					HAZARD INDEX =	2.42E-05			TOTAL CANCER RISK =	0.00E+00

Note:

a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-16

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : $HIF = \{ [(SAc \times ETc \times EFc \times EDc) / BWc + (SAa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)\} \times CF$

$CDI = CW \times PC \times HIF$

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

HIF = Human Intake Factor

CDI = Chronic Daily Intake

CW = Concentration in Surface Water

PC = Chemical-specific Dermal Permeability Constant

SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2

ETc = Child Exposure Time = 6 hours/day

EFc = Child Exposure Frequency = 34 days per year

EDc = Child Exposure Duration = 5 years

BWc = Child Body Weight = 15.1 kg

SAa = Adult Skin Surface Area Available for Contact = 8,620 cm^2

ETa = Adult Exposure Time = 2 hour /day

EFa = Adult Exposure Frequency = 4 days per year

EDa = Adult Exposure Duration = 25 years

BW = Adult Body Weight = 57.1 kg

CF = Conversion Factor (1L/1000cm^2)

AT1 = Days Per Year = 365 days/year

AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)

SF = Slope Factor

RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg-dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	5.00E-04	1.00E-03	4.29E-02	2.14E-08	4.00E-04	5.36E-05	1.84E-02	9.18E-09		
Cadmium	5.95E-04	1.00E-03	4.29E-02	2.55E-08	5.00E-04	5.10E-05	1.84E-02	1.09E-08		
Cobalt	3.00E-04	1.00E-03	4.29E-02	1.29E-08	6.00E-02	2.14E-07	1.84E-02	5.51E-09		
Nickel	1.00E-02	1.00E-03	4.29E-02	4.29E-07	2.00E-02	2.14E-05	1.84E-02	1.84E-07		
Vanadium	1.30E-02	1.00E-03	4.29E-02	5.57E-07	7.00E-03	7.96E-05	1.84E-02	2.39E-07		
Semivolatile Organics										
Benzoic acid	1.20E-03	7.30E-03	4.29E-02	3.75E-07	4.00E+00	9.39E-08	1.84E-02	1.61E-07		
Volatile Organics										
Acetone	4.70E-03		4.29E-02		1.00E-01		1.84E-02			
					HAZARD INDEX =	2.06E-04			TOTAL CANCER RISK =	0.00E+00

Note:

a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-17

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)**
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	5.61E+00	1.11E-07	6.22E-07	4.00E-04	1.55E-03	2.22E-08	1.24E-07		
Beryllium	1.82E-01	1.11E-07	2.01E-08	5.00E-03	4.03E-06	2.22E-08	4.03E-09	4.30E+00	1.73E-08
Cadmium	8.92E+00	1.11E-07	9.89E-07	1.00E-03	9.89E-04	2.22E-08	1.98E-07		
Cobalt	9.18E+00	1.11E-07	1.02E-06	6.00E-02	1.69E-05	2.22E-08	2.03E-07		
Lead	1.11E+02	1.11E-07	1.23E-05			2.22E-08	2.46E-06		
Silver	4.08E+00	1.11E-07	4.51E-07	5.00E-03	9.03E-05	2.22E-08	9.03E-08		
Vanadium	1.35E+01	1.11E-07	1.49E-06	7.00E-03	2.13E-04	2.22E-08	2.99E-07		
Pesticides/PCBs									
Aroclor 1254	2.28E+00	1.11E-07	2.52E-07	2.00E-05	1.26E-02	2.22E-08	5.05E-08		
Semivolatile Organics									
Benzidine	4.60E-02	1.11E-07	5.10E-09	3.00E-03	1.70E-06	2.22E-08	1.02E-09	2.30E+02	2.34E-07
Benzo(a)anthracene	1.95E-01	1.11E-07	2.16E-08			2.22E-08	4.32E-09	7.30E-01	3.16E-09
Benzo(a)pyrene	1.83E-01	1.11E-07	2.02E-08			2.22E-08	4.04E-09	7.30E+00	2.95E-08
Benzo(b)fluoranthene	1.57E-01	1.11E-07	1.73E-08			2.22E-08	3.47E-09	7.30E-01	2.53E-09
Benzo(g,h,i)perylene	1.10E-01	1.11E-07	1.22E-08	3.00E-02	4.06E-07	2.22E-08	2.44E-09		
Benzo(k)fluoranthene	1.99E-01	1.11E-07	2.20E-08			2.22E-08	4.40E-09	7.30E-02	3.21E-10
Benzyl alcohol	7.90E-02	1.11E-07	8.75E-09	3.00E-01	2.92E-08	2.22E-08	1.75E-09		
Butyl benzyl phthalate	1.10E-01	1.11E-07	1.22E-08	2.00E-01	6.09E-08	2.22E-08	2.44E-09		
Chrysene	2.09E-01	1.11E-07	2.32E-08			2.22E-08	4.63E-09	7.30E-03	3.38E-11
Fluoranthene	1.91E-01	1.11E-07	2.12E-08	4.00E-02	5.29E-07	2.22E-08	4.23E-09		
Indeno(1,2,3-cd)pyrene	1.20E-01	1.11E-07	1.33E-08			2.22E-08	2.66E-09	7.30E-01	1.94E-09
Phenanthrene	7.80E-02	1.11E-07	8.64E-09	3.00E-02	2.88E-07	2.22E-08	1.73E-09		
Pyrene	2.11E-01	1.11E-07	2.34E-08	3.00E-02	7.81E-07	2.22E-08	4.68E-09		
bis(2-Ethylhexyl)phthalate	2.25E-01	1.11E-07	2.49E-08	2.00E-02	1.24E-06	2.22E-08	4.98E-09	1.40E-02	6.97E-11
Volatile Organics									
Acetone	6.40E-03	1.11E-07	7.09E-10	1.00E-01	7.09E-09	2.22E-08	1.42E-10		
				HAZARD INDEX =	1.55E-02			TOTAL CANCER RISK =	2.89E-07

TABLE A-18

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)**
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	9.32E+00	2.22E-07	2.06E-06	4.00E-04	5.16E-03	9.50E-08	8.85E-07		
Beryllium	2.78E-01	2.22E-07	6.17E-08	5.00E-03	1.23E-05	9.50E-08	2.64E-08	4.30E+00	1.14E-07
Cadmium	2.34E+01	2.22E-07	5.19E-06	1.00E-03	5.19E-03	9.50E-08	2.22E-06		
Cobalt	2.43E+01	2.22E-07	5.39E-06	6.00E-02	8.99E-05	9.50E-08	2.31E-06		
Lead	6.40E+02	2.22E-07	1.42E-04			9.50E-08	6.08E-05		
Silver	1.55E+01	2.22E-07	3.44E-06	5.00E-03	6.87E-04	9.50E-08	1.47E-06		
Vanadium	2.16E+01	2.22E-07	4.78E-06	7.00E-03	6.82E-04	9.50E-08	2.05E-06		
PCBs/Pesticides									
Aroclor 1254	6.00E+00	2.22E-07	1.33E-06	2.00E-05	6.65E-02	9.50E-08	5.70E-07		
Semivolatile Organics									
Benzidine	4.60E-02	2.22E-07	1.02E-08	3.00E-03	3.40E-06	9.50E-08	4.37E-09	2.30E+02	1.00E-06
Benzo(a)anthracene	2.62E-01	2.22E-07	5.81E-08			9.50E-08	2.49E-08	7.30E-01	1.82E-08
Benzo(a)pyrene	2.10E-01	2.22E-07	4.65E-08			9.50E-08	1.99E-08	7.30E+00	1.46E-07
Benzo(b)fluoranthene	4.00E-01	2.22E-07	8.86E-08			9.50E-08	3.80E-08	7.30E-01	2.77E-08
Benzo(g,h,i)perylene	1.10E-01	2.22E-07	2.44E-08	3.00E-02	8.13E-07	9.50E-08	1.04E-08		
Benzo(k)fluoranthene	2.05E-01	2.22E-07	4.55E-08			9.50E-08	1.95E-08	7.30E-02	1.42E-09
Benzyl alcohol	7.90E-02	2.22E-07	1.75E-08	3.00E-01	5.84E-08	9.50E-08	7.50E-09		
Butyl benzyl phthalate	1.10E-01	2.22E-07	2.44E-08	2.00E-01	1.22E-07	9.50E-08	1.04E-08		
Chrysene	2.89E-01	2.22E-07	6.40E-08			9.50E-08	2.74E-08	7.30E-03	2.00E-10
Fluoranthene	6.24E-01	2.22E-07	1.38E-07	4.00E-02	3.46E-06	9.50E-08	5.93E-08		
Indeno(1,2,3-cd)pyrene	1.20E-01	2.22E-07	2.66E-08			9.50E-08	1.14E-08	7.30E-01	8.32E-09
Phenanthrene	7.80E-02	2.22E-07	1.73E-08	3.00E-02	5.76E-07	9.50E-08	7.41E-09		
Pyrene	4.01E-01	2.22E-07	8.90E-08	3.00E-02	2.97E-06	9.50E-08	3.81E-08		
bis(2-Ethylhexyl)phthalate	3.74E-01	2.22E-07	8.30E-08	2.00E-02	4.15E-06	9.50E-08	3.56E-08	1.40E-02	4.98E-10
Volatile Organics									
Acetone	9.74E-03	2.22E-07	2.16E-09	1.00E-01	2.16E-08	9.50E-08	9.25E-10		
				HAZARD INDEX =	7.83E-02			TOTAL CANCER RISK =	1.32E-06

TABLE A-19

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 0.2
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	5.61E+00	2.16E-09	2.42E-09	4.00E-04	6.05E-06	4.31E-10	4.84E-10		
Beryllium	1.82E-01	2.16E-09	7.84E-11	5.00E-03	1.57E-08	4.31E-10	1.57E-11	4.30E+00	6.74E-11
Cadmium	8.92E+00	2.16E-09	3.85E-09	1.00E-03	3.85E-06	4.31E-10	7.69E-10		
Cobalt	9.18E+00	2.16E-09	3.96E-09	6.00E-02	6.59E-08	4.31E-10	7.91E-10		
Lead	1.11E+02	2.16E-09	4.78E-08			4.31E-10	9.57E-09		
Silver	4.08E+00	2.16E-09	1.76E-09	5.00E-03	3.51E-07	4.31E-10	3.51E-10		
Vanadium	1.35E+01	2.16E-09	5.81E-09	7.00E-03	8.30E-07	4.31E-10	1.16E-09		
PCBs/Pesticides									
Aroclor 1254	2.28E+00	2.16E-08	9.82E-09	2.00E-05	4.91E-04	4.31E-09	1.96E-09		
Semivolatile Organics									
Benzidine	4.60E-02	2.16E-08	1.98E-10	3.00E-03	6.61E-08	4.31E-09	3.97E-11	2.30E+02	9.12E-09
Benzo(a)anthracene	1.95E-01	2.16E-08	8.41E-10			4.31E-09	1.68E-10	7.30E-01	1.23E-10
Benzo(a)pyrene	1.83E-01	2.16E-08	7.87E-10			4.31E-09	1.57E-10	7.30E+00	1.15E-09
Benzo(b)fluoranthene	1.57E-01	2.16E-08	6.75E-10			4.31E-09	1.35E-10	7.30E-01	9.85E-11
Benzo(g,h,i)perylene	1.10E-01	2.16E-08	4.74E-10	3.00E-02	1.58E-08	4.31E-09	9.48E-11		
Benzo(k)fluoranthene	1.99E-01	2.16E-08	8.57E-10			4.31E-09	1.71E-10	7.30E-02	1.25E-11
Benzyl alcohol	7.90E-02	2.16E-08	3.41E-10	3.00E-01	1.14E-09	4.31E-09	6.81E-11		
Butyl benzyl phthalate	1.10E-01	2.16E-08	4.74E-10	2.00E-01	2.37E-09	4.31E-09	9.48E-11		
Chrysene	2.09E-01	2.16E-08	9.02E-10			4.31E-09	1.80E-10	7.30E-03	1.32E-12
Fluoranthene	1.91E-01	2.16E-08	8.23E-10	4.00E-02	2.06E-08	4.31E-09	1.65E-10		
Indeno(1,2,3-cd)pyrene	1.20E-01	2.16E-08	5.17E-10			4.31E-09	1.03E-10	7.30E-01	7.55E-11
Phenanthrene	7.80E-02	2.16E-08	3.36E-10	3.00E-02	1.12E-08	4.31E-09	6.73E-11		
Pyrene	2.11E-01	2.16E-08	9.11E-10	3.00E-02	3.04E-08	4.31E-09	1.82E-10		
bis(2-Ethylhexyl)phthalate	2.25E-01	2.16E-08	9.68E-10	2.00E-02	4.84E-08	4.31E-09	1.94E-10	1.40E-02	2.71E-12
Volatile Organics									
Acetone	6.40E-03	2.16E-08	2.76E-11	1.00E-01	2.76E-10	4.31E-09	5.52E-12		
				HAZARD INDEX =	5.02E-04			TOTAL CANCER RISK =	1.07E-08

TABLE A-20

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 8,600 cm^2
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 1.0
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	9.32E+00	8.06E-09	7.51E-08	4.00E-04	1.88E-04	3.45E-09	3.22E-08		
Beryllium	2.78E-01	8.06E-09	2.24E-09	5.00E-03	4.49E-07	3.45E-09	9.62E-10	4.30E+00	4.13E-09
Cadmium	2.34E+01	8.06E-09	1.89E-07	1.00E-03	1.89E-04	3.45E-09	8.08E-08		
Cobalt	2.43E+01	8.06E-09	1.96E-07	6.00E-02	3.27E-06	3.45E-09	8.40E-08		
Lead	6.40E+02	8.06E-09	5.16E-06			3.45E-09	2.21E-06		
Silver	1.55E+01	8.06E-09	1.25E-07	5.00E-03	2.50E-05	3.45E-09	5.36E-08		
Vanadium	2.16E+01	8.06E-09	1.74E-07	7.00E-03	2.48E-05	3.45E-09	7.45E-08		
PCBs/Pesticides									
Aroclor 1254	6.00E+00	8.06E-08	4.84E-07	2.00E-05	2.42E-02	3.45E-08	2.07E-07		
Semivolatile Organics									
Benzidine	4.60E-02	8.06E-08	3.71E-09	3.00E-03	1.24E-06	3.45E-08	1.59E-09	2.30E+02	3.66E-07
Benzo(a)anthracene	2.62E-01	8.06E-08	2.11E-08			3.45E-08	9.05E-09	7.30E-01	6.61E-09
Benzo(a)pyrene	2.10E-01	8.06E-08	1.69E-08			3.45E-08	7.26E-09	7.30E+00	5.30E-08
Benzo(b)fluoranthene	4.00E-01	8.06E-08	3.22E-08			3.45E-08	1.38E-08	7.30E-01	1.01E-08
Benzo(g,h,i)perylene	1.10E-01	8.06E-08	8.87E-09	3.00E-02	2.96E-07	3.45E-08	3.80E-09		
Benzo(k)fluoranthene	2.05E-01	8.06E-08	1.66E-08			3.45E-08	7.10E-09	7.30E-02	5.18E-10
Benzyl alcohol	7.90E-02	8.06E-08	6.37E-09	3.00E-01	2.12E-08	3.45E-08	2.73E-09		
Butyl benzyl phthalate	1.10E-01	8.06E-08	8.87E-09	2.00E-01	4.43E-08	3.45E-08	3.80E-09		
Chrysene	2.89E-01	8.06E-08	2.33E-08			3.45E-08	9.97E-09	7.30E-03	7.28E-11
Fluoranthene	6.24E-01	8.06E-08	5.03E-08	4.00E-02	1.26E-06	3.45E-08	2.16E-08		
Indeno(1,2,3-cd)pyrene	1.20E-01	8.06E-08	9.67E-09			3.45E-08	4.15E-09	7.30E-01	3.03E-09
Phenanthrene	7.80E-02	8.06E-08	6.29E-09	3.00E-02	2.10E-07	3.45E-08	2.69E-09		
Pyrene	4.01E-01	8.06E-08	3.24E-08	3.00E-02	1.08E-06	3.45E-08	1.39E-08		
bis(2-Ethylhexyl)phthalate	3.74E-01	8.06E-08	3.02E-08	2.00E-02	1.51E-06	3.45E-08	1.29E-08	1.40E-02	1.81E-10
Volatile Organics									
Acetone	9.74E-03	8.06E-08	7.85E-10	1.00E-01	7.85E-09	3.45E-08	3.37E-10		
				HAZARD INDEX =	2.46E-02			TOTAL CANCER RISK =	4.43E-07

AREA 3
ON-BASE EAST SOLDIER CREEK

TABLE A-21

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.0025 L/hour
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	6.00E-04	2.35E-10	4.00E-04	5.87E-07	1.68E-11		
Cadmium	5.76E-04	2.25E-10	5.00E-04	4.51E-07	1.61E-11		
Cobalt	3.11E-04	1.22E-10	6.00E-02	2.03E-09	8.70E-12		
Nickel	4.77E-03	1.87E-09	2.00E-02	9.34E-08	1.33E-10		
Vanadium	1.63E-02	6.38E-09	7.00E-03	9.11E-07	4.55E-10		
Semivolatile Organics							
1,2-Dichlorobenzene	1.70E-03	6.65E-10	9.00E-02	7.39E-09	4.75E-11		
4-Nitrophenol	1.30E-03	5.09E-10	8.00E-03	6.36E-08	3.63E-11		
Aniline	4.00E-03	1.57E-09			1.12E-10	5.70E-03	6.37E-13
Benzidine	1.20E-03	4.70E-10	3.00E-03	1.57E-07	3.35E-11	2.30E+02	7.72E-09
Benzoic acid	1.60E-03	6.26E-10	4.00E+00	1.57E-10	4.47E-11		
Butyl benzyl phthalate	3.20E-03	1.25E-09	2.00E-01	6.26E-09	8.95E-11		
Di-n-butyl phthalate	1.40E-03	5.48E-10	1.00E-01	5.48E-09	3.91E-11		
Fluoranthene	1.60E-03	6.26E-10	4.00E-02	1.57E-08	4.47E-11		
Phenol	2.00E-03	7.83E-10	6.00E-01	1.30E-09	5.59E-11		
Volatile Organics							
2-Butanone (MEK)	4.57E-03	1.79E-09	6.00E-01	2.98E-09	1.28E-10		
2-Hexanone	5.01E-03	1.96E-09			1.40E-10		
Acetone	7.96E-03	3.11E-09	1.00E-01	3.11E-08	2.22E-10		
Bromoform	2.40E-03	9.40E-10	2.00E-02	4.70E-08	6.72E-11	7.90E-03	5.31E-13
Chloroform	2.46E-03	9.62E-10	1.00E-02	9.62E-08	6.87E-11	6.10E-03	4.19E-13
Dibromochloromethane	2.46E-03	9.63E-10	2.00E-02	4.82E-08	6.88E-11	8.40E-02	5.78E-12
			HAZARD INDEX=	2.53E-06		TOTAL CANCER RISK=	7.72E-09

TABLE A-22

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.005 L/hour
ET = Exposure Time = 8 hours/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	6.00E-04	4.70E-09	4.00E-04	1.17E-05	1.68E-09		
Cadmium	8.54E-04	6.69E-09	5.00E-04	1.34E-05	2.39E-09		
Cobalt	3.53E-04	2.76E-09	6.00E-02	4.61E-08	9.87E-10		
Nickel	5.76E-03	4.51E-08	2.00E-02	2.25E-06	1.61E-08		
Vanadium	2.02E-02	1.58E-07	7.00E-03	2.26E-05	5.64E-08		
Semivolatile Organics							
1,2-Dichlorobenzene	1.70E-03	1.33E-08	9.00E-02	1.48E-07	4.75E-09		
4-Nitrophenol	1.30E-03	1.02E-08	8.00E-03	1.27E-06	3.63E-09		
Aniline	4.00E-03	3.13E-08			1.12E-08	5.70E-03	6.37E-11
Benzidine	1.20E-03	9.39E-09	3.00E-03	3.13E-06	3.35E-09	2.30E+02	7.72E-07
Benzoic acid	1.60E-03	1.25E-08	4.00E+00	3.13E-09	4.47E-09		
Butyl benzyl phthalate	3.20E-03	2.50E-08	2.00E-01	1.25E-07	8.95E-09		
Di-n-butyl phthalate	1.40E-03	1.10E-08	1.00E-01	1.10E-07	3.91E-09		
Fluoranthene	1.60E-03	1.25E-08	4.00E-02	3.13E-07	4.47E-09		
Phenol	2.00E-03	1.57E-08	6.00E-01	2.61E-08	5.59E-09		
Volatile Organics							
2-Butanone (MEK)	5.03E-03	3.93E-08	6.00E-01	6.56E-08	1.40E-08		
2-Hexanone	5.03E-03	3.94E-08			1.41E-08		
Acetone	9.24E-03	7.23E-08	1.00E-01	7.23E-07	2.58E-08		
Bromoform	2.59E-03	2.03E-08	2.00E-02	1.01E-06	7.24E-09	7.90E-03	5.72E-11
Chloroform	2.50E-03	1.96E-08	1.00E-02	1.96E-06	6.99E-09	6.10E-03	4.26E-11
Dibromochloromethane	2.50E-03	1.96E-08	2.00E-02	9.78E-07	6.99E-09	8.40E-02	5.87E-10
			HAZARD INDEX=	5.98E-05		TOTAL CANCER RISK=	7.72E-07

TABLE A-23

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 2,000 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	6.00E-04	0.001	1.88E-10	4.00E-04	4.70E-07	1.34E-11		
Cadmium	5.76E-04	0.001	1.80E-10	5.00E-04	3.61E-07	1.29E-11		
Cobalt	3.11E-04	0.001	9.74E-11	6.00E-02	1.62E-09	6.96E-12		
Nickel	4.77E-03	0.001	1.49E-09	2.00E-02	7.47E-08	1.07E-10		
Vanadium	1.63E-02	0.001	5.10E-09	7.00E-03	7.29E-07	3.64E-10		
Semivolatile Organics								
1,2-Dichlorobenzene	1.70E-03	0.061	3.25E-08	9.00E-02	3.61E-07	2.32E-09		
4-Nitrophenol	1.30E-03	0.0061	2.48E-09	8.00E-03	3.10E-07	1.77E-10		
Aniline	4.00E-03	0.0022	2.76E-09			1.97E-10	5.70E-03	1.12E-12
Benzidine	1.20E-03	0.0013	4.88E-10	3.00E-03	1.63E-07	3.49E-11	2.30E+02	8.02E-09
Benzoic acid	1.60E-03	0.0073	3.66E-09	4.00E+00	9.14E-10	2.61E-10		
Butyl benzyl phthalate	3.20E-03	0.073	7.31E-08	2.00E-01	3.66E-07	5.22E-09		
Di-n-butyl phthalate	1.40E-03	0.033	1.45E-08	1.00E-01	1.45E-07	1.03E-09		
Fluoranthene	1.60E-03	0.36	1.80E-07	4.00E-02	4.51E-06	1.29E-08		
Phenol	2.00E-03	0.0055	3.44E-09	6.00E-01	5.74E-09	2.46E-10		
Volatile Organics								
2-Butanone (MEK)	4.57E-03			6.00E-01				
2-Hexanone	5.01E-03							
Acetone	7.96E-03			1.00E-01				
Bromoform	2.40E-03			2.00E-02			7.90E-03	
Chloroform	2.46E-03			1.00E-02			6.10E-03	
Dibromochloromethane	2.46E-03			2.00E-02			8.40E-02	
				HAZARD INDEX=	7.50E-06	TOTAL CANCER RISK=		8.03E-09

Note:
a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-24

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact =9,800 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 8 hours per day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	6.00E-04	0.001	9.21E-09	4.00E-04	2.30E-05	3.29E-09		
Cadmium	8.54E-04	0.001	1.31E-08	5.00E-04	2.62E-05	4.68E-09		
Cobalt	3.53E-04	0.001	5.42E-09	6.00E-02	9.03E-08	1.93E-09		
Nickel	5.76E-03	0.001	8.83E-08	2.00E-02	4.42E-06	3.15E-08		
Vanadium	2.02E-02	0.001	3.09E-07	7.00E-03	4.42E-05	1.11E-07		
Semivolatile Organics								
1,2-Dichlorobenzene	1.70E-03	0.061	1.59E-06	9.00E-02	1.77E-05	5.68E-07		
4-Nitrophenol	1.30E-03	0.0061	1.22E-07	8.00E-03	1.52E-05	4.35E-08		
Aniline	4.00E-03	0.0022	1.35E-07			4.82E-08	5.70E-03	2.75E-10
Benzidine	1.20E-03	0.0013	2.39E-08	3.00E-03	7.98E-06	8.55E-09	2.30E+02	1.97E-06
Benzoic acid	1.60E-03	0.0073	1.79E-07	4.00E+00	4.48E-08	6.40E-08		
Butyl benzyl phthalate	3.20E-03	0.073	3.58E-06	2.00E-01	1.79E-05	1.28E-06		
Di-n-butyl phthalate	1.40E-03	0.033	7.09E-07	1.00E-01	7.09E-06	2.53E-07		
Fluoranthene	1.60E-03	0.36	8.84E-06	4.00E-02	2.21E-04	3.16E-06		
Phenol	2.00E-03	0.0055	1.69E-07	6.00E-01	2.81E-07	6.03E-08		
Volatile Organics								
2-Butanone (MEK)	5.03E-03			6.00E-01				
2-Hexanone	5.03E-03							
Acetone	9.24E-03			1.00E-01				
Bromoform	2.59E-03			2.00E-02			7.90E-03	
Chloroform	2.50E-03			1.00E-02			6.10E-03	
Dibromochloromethane	2.50E-03			2.00E-02			8.40E-02	
				HAZARD INDEX =	3.85E-04	TOTAL CANCER RISK =		1.97E-06

Note:
a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-25

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation: CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	3.45E-01	5.40E-12	5.00E-03	1.08E-09	3.86E-13	4.30E+00	1.66E-12
Cadmium	2.93E+01	4.59E-10	1.00E-03	4.59E-07	3.28E-11		
Chromium	3.44E+02	5.39E-09	1.00E+00	5.39E-09	3.85E-10		
Cobalt	1.03E+01	1.61E-10	6.00E-02	2.68E-09	1.15E-11		
Lead	1.59E+02	2.48E-09			1.77E-10		
Mercury	5.66E-01	8.86E-12	3.00E-04	2.95E-08	6.33E-13		
Nickel	1.59E+02	2.49E-09	2.00E-02	1.25E-07	1.78E-10		
Silver	4.23E+00	6.63E-11	5.00E-03	1.33E-08	4.74E-12		
Thallium	6.26E+01	9.80E-10	8.00E-05	1.23E-05	7.00E-11		
Vanadium	2.33E+01	3.65E-10	7.00E-03	5.22E-08	2.61E-11		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	1.13E-11			8.05E-13	3.40E-01	2.74E-13
Aldrin	1.66E-01	2.59E-11	3.00E-05	8.64E-07	1.85E-12	1.70E+01	3.15E-11
Aroclor 1254	4.21E+00	6.60E-10	2.00E-05	3.30E-05	4.71E-11		
Dieldrin	7.77E-01	1.22E-10	5.00E-05	2.43E-06	8.69E-12	1.60E+00	1.39E-11
Heptachlor	2.60E-01	4.07E-11	5.00E-04	8.14E-08	2.91E-12	4.50E+00	1.31E-11
alpha-Chlordane	4.93E-01	7.71E-11	6.00E-05	1.29E-06	5.51E-12	1.30E+00	7.16E-12
delta-BHC	1.21E-01	1.89E-11			1.35E-12		
Semivolatile Organics							
1,4-Dichlorobenzene	1.09E+00	1.71E-10			1.22E-11	2.40E-02	2.93E-13
1-Chloronaphthalene	1.50E+00	2.35E-10	3.00E-02	7.83E-09	1.68E-11		
2-Chloronaphthalene	3.10E-01	4.85E-11	8.00E-02	6.07E-10	3.47E-12		
2-Methylnaphthalene	1.03E+00	1.61E-10	3.00E-02	5.36E-09	1.15E-11		
Acenaphthene	1.27E+00	1.98E-10	6.00E-02	3.31E-09	1.42E-11		
Anthracene	2.41E+00	3.77E-10	3.00E-01	1.26E-09	2.70E-11		
Benzidine	2.90E-01	4.54E-11	3.00E-03	1.51E-08	3.24E-12	2.30E+02	7.46E-10
Benzo(a)anthracene	5.15E+00	8.07E-10			5.76E-11	7.30E-01	4.21E-11
Benzo(a)pyrene	4.46E+00	6.98E-10			4.98E-11	7.30E+00	3.64E-10
Benzo(b)fluoranthene	8.21E+00	1.28E-09			9.18E-11	7.30E-01	6.70E-11
Benzo(g,h,i)perylene	2.55E+00	3.99E-10	3.00E-02	1.33E-08	2.85E-11		
Benzo(k)fluoranthene	1.30E+00	2.04E-10			1.45E-11	7.30E-02	1.06E-12
Chrysene	5.65E+00	8.85E-10			6.32E-11	7.30E-03	4.61E-13
Di-n-octyl phthalate	1.12E+00	1.76E-10	2.00E-02	8.80E-09	1.26E-11		
Dibenz(a,h)anthracene	9.65E-01	1.51E-10			1.08E-11	7.30E+00	7.88E-11
Dibenzofuran	1.12E+00	1.76E-10	4.00E-03	4.40E-08	1.26E-11		
Fluoranthene	1.38E+01	2.16E-09	4.00E-02	5.40E-08	1.54E-10		
Fluorene	1.43E+00	2.25E-10	4.00E-02	5.61E-09	1.60E-11		
Indeno(1,2,3-cd)pyrene	2.29E+00	3.58E-10			2.56E-11	7.30E-01	1.87E-11
Naphthalene	1.54E+00	2.41E-10	3.00E-02	8.02E-09	1.72E-11		
Phenanthrene	1.03E+01	1.61E-09	3.00E-02	5.38E-08	1.15E-10		
Pyrene	1.14E+01	1.78E-09	3.00E-02	5.95E-08	1.27E-10		
bis(2-Ethylhexyl)phthalate	2.48E+00	3.89E-10	2.00E-02	1.94E-08	2.78E-11	1.40E-02	3.89E-13
Volatile Organics							
2-Butanone (MEK)	2.13E-02	3.34E-12	6.00E-01	5.56E-12	2.38E-13		
Acetone	5.65E-02	8.85E-12	1.00E-01	8.85E-11	6.32E-13		
Carbon disulfide	4.40E-03	6.89E-13	1.00E-01	6.89E-12	4.92E-14		
Chlorobenzene	2.09E-02	3.27E-12	2.00E-02	1.64E-10	2.34E-13		
Toluene	1.45E-02	2.27E-12	2.00E-01	1.13E-11	1.62E-13		
Xylenes (total)	2.60E-03	4.07E-13	2.00E+00	2.04E-13	2.91E-14		
			HAZARD INDEX =	5.09E-05	TOTAL CANCER RISK =		1.39E-09

TABLE A-26

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	4.27E-01	8.20E-10	5.00E-03	1.64E-07	2.93E-10	4.30E+00	1.26E-09
Cadmium	7.40E+01	1.42E-07	1.00E-03	1.42E-04	5.07E-08		
Chromium	7.36E+02	1.41E-06	1.00E+00	1.41E-06	5.04E-07		
Cobalt	1.34E+01	2.58E-08	6.00E-02	4.30E-07	9.21E-09		
Lead	3.15E+02	6.05E-07			2.16E-07		
Mercury	8.80E-01	1.69E-09	3.00E-04	5.62E-06	6.03E-10		
Nickel	3.57E+02	6.85E-07	2.00E-02	3.42E-05	2.45E-07		
Silver	6.40E+00	1.23E-08	5.00E-03	2.45E-06	4.38E-09		
Thallium	6.26E+01	1.20E-07	8.00E-05	1.50E-03	4.29E-08		
Vanadium	2.99E+01	5.73E-08	7.00E-03	8.19E-06	2.05E-08		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	1.38E-09			4.93E-10	3.40E-01	1.68E-10
Aldrin	3.88E-01	7.43E-09	3.00E-05	2.48E-04	2.66E-09	1.70E+01	4.51E-08
Aroclor 1254	2.07E+01	3.96E-07	2.00E-05	1.98E-02	1.42E-07		
Dieldrin	1.02E+00	1.96E-08	5.00E-05	3.93E-04	7.01E-09	1.60E+00	1.12E-08
Heptachlor	6.79E-01	1.30E-08	5.00E-04	2.60E-05	4.65E-09	4.50E+00	2.09E-08
alpha-Chlordane	5.96E-01	1.14E-08	6.00E-05	1.90E-04	4.08E-09	1.30E+00	5.30E-09
delta-BHC	1.96E-01	3.76E-09			1.34E-09		
Semivolatile Organics							
1,4-Dichlorobenzene	1.68E+00	3.22E-08			1.15E-08	2.40E-02	2.76E-10
1-Chloronaphthalene	1.50E+00	2.88E-08	3.00E-02	9.59E-07	1.03E-08		
2-Chloronaphthalene	3.10E-01	5.95E-09	8.00E-02	7.43E-08	2.12E-09		
2-Methylnaphthalene	1.75E+00	3.36E-08	3.00E-02	1.12E-06	1.20E-08		
Acenaphthene	1.79E+00	3.43E-08	6.00E-02	5.72E-07	1.23E-08		
Anthracene	3.45E+00	6.61E-08	3.00E-01	2.20E-07	2.36E-08		
Benzidine	2.90E-01	5.56E-09	3.00E-03	1.85E-06	1.99E-09	2.30E+02	4.57E-07
Benzo(a)anthracene	1.42E+01	2.72E-07			9.73E-08	7.30E-01	7.10E-08
Benzo(a)pyrene	1.16E+01	2.23E-07			7.97E-08	7.30E+00	5.82E-07
Benzo(b)fluoranthene	2.53E+01	4.84E-07			1.73E-07	7.30E-01	1.26E-07
Benzo(g,h,i)perylene	6.36E+00	1.22E-07	3.00E-02	4.06E-06	4.35E-08		
Benzo(k)fluoranthene	2.19E+00	4.20E-08			1.50E-08	7.30E-02	1.09E-09
Chrysene	1.46E+01	2.80E-07			1.00E-07	7.30E-03	7.31E-10
Di-n-octyl phthalate	1.40E+00	2.68E-08	2.00E-02	1.34E-06	9.59E-09		
Dibenz(a,h)anthracene	1.55E+00	2.98E-08			1.06E-08	7.30E+00	7.76E-08
Dibenzofuran	1.92E+00	3.69E-08	4.00E-03	9.23E-06	1.32E-08		
Fluoranthene	6.81E+01	1.31E-06	4.00E-02	3.27E-05	4.67E-07		
Fluorene	1.96E+00	3.76E-08	4.00E-02	9.39E-07	1.34E-08		
Indeno(1,2,3-cd)pyrene	5.87E+00	1.13E-07			4.02E-08	7.30E-01	2.94E-08
Naphthalene	2.65E+00	5.09E-08	3.00E-02	1.70E-06	1.82E-08		
Phenanthrene	3.66E+01	7.01E-07	3.00E-02	2.34E-05	2.50E-07		
Pyrene	4.65E+01	8.92E-07	3.00E-02	2.97E-05	3.19E-07		
bis(2-Ethylhexyl)phthalate	5.98E+00	1.15E-07	2.00E-02	5.74E-06	4.10E-08	1.40E-02	5.74E-10
Volatile Organics							
2-Butanone (MEK)	2.44E-02	4.68E-10	6.00E-01	7.81E-10	1.67E-10		
Acetone	8.16E-02	1.56E-09	1.00E-01	1.56E-08	5.59E-10		
Carbon disulfide	4.40E-03	8.44E-11	1.00E-01	8.44E-10	3.01E-11		
Chlorobenzene	2.26E-02	4.34E-10	2.00E-02	2.17E-08	1.55E-10		
Toluene	1.45E-02	2.78E-10	2.00E-01	1.39E-09	9.93E-11		
Xylenes (total)	2.60E-03	4.99E-11	2.00E+00	2.49E-11	1.78E-11		
			HAZARD INDEX =	2.25E-02	TOTAL CANCER RISK =		1.43E-06

TABLE A-27

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	3.45E-01	1.35E-10	5.00E-03	2.70E-08	9.64E-12	4.30E+00	4.15E-11
Cadmium	2.93E+01	1.15E-08	1.00E-03	1.15E-05	8.20E-10		
Chromium	3.44E+02	1.35E-07	1.00E+00	1.35E-07	9.63E-09		
Cobalt	1.03E+01	4.02E-09	6.00E-02	6.70E-08	2.87E-10		
Lead	1.59E+02	6.21E-08			4.43E-09		
Mercury	5.66E-01	2.22E-10	3.00E-04	7.38E-07	1.58E-11		
Nickel	1.59E+02	6.23E-08	2.00E-02	3.11E-06	4.45E-09		
Silver	4.23E+00	1.66E-09	5.00E-03	3.31E-07	1.18E-10		
Thallium	6.26E+01	2.45E-08	8.00E-05	3.06E-04	1.75E-09		
Vanadium	2.33E+01	9.13E-09	7.00E-03	1.30E-06	6.52E-10		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	2.82E-11			2.01E-12	3.40E-01	6.84E-13
Aldrin	1.66E-01	6.48E-11	3.00E-05	2.16E-06	4.63E-12	1.70E+01	7.87E-11
Aroclor 1254	4.21E+00	1.65E-09	2.00E-05	8.25E-05	1.18E-10		
Dieldrin	7.77E-01	3.04E-10	5.00E-05	6.08E-06	2.17E-11	1.60E+00	3.48E-11
Heptachlor	2.60E-01	1.02E-10	5.00E-04	2.03E-07	7.26E-12	4.50E+00	3.27E-11
alpha-Chlordane	4.93E-01	1.93E-10	6.00E-05	3.21E-06	1.38E-11	1.30E+00	1.79E-11
delta-BHC	1.21E-01	4.74E-11			3.38E-12		
Semivolatile Organics							
1,4-Dichlorobenzene	1.09E+00	4.28E-10			3.05E-11	2.40E-02	7.33E-13
1-Chloronaphthalene	1.50E+00	5.87E-10	3.00E-02	1.96E-08	4.19E-11		
2-Chloronaphthalene	3.10E-01	1.21E-10	8.00E-02	1.52E-09	8.67E-12		
2-Methylnaphthalene	1.03E+00	4.02E-10	3.00E-02	1.34E-08	2.87E-11		
Acenaphthene	1.27E+00	4.96E-10	6.00E-02	8.27E-09	3.54E-11		
Anthracene	2.41E+00	9.44E-10	3.00E-01	3.15E-09	6.74E-11		
Benzidine	2.90E-01	1.14E-10	3.00E-03	3.78E-08	8.11E-12	2.30E+02	1.86E-09
Benzo(a)anthracene	5.15E+00	2.02E-09			1.44E-10	7.30E-01	1.05E-10
Benzo(a)pyrene	4.46E+00	1.74E-09			1.25E-10	7.30E+00	9.09E-10
Benzo(b)fluoranthene	8.21E+00	3.21E-09			2.29E-10	7.30E-01	1.67E-10
Benzo(g,h,i)perylene	2.55E+00	9.97E-10	3.00E-02	3.32E-08	7.12E-11		
Benzo(k)fluoranthene	1.30E+00	5.09E-10			3.64E-11	7.30E-02	2.65E-12
Chrysene	5.65E+00	2.21E-09			1.58E-10	7.30E-03	1.15E-12
Di-n-octyl phthalate	1.12E+00	4.40E-10	2.00E-02	2.20E-08	3.14E-11		
Dibenz(a,h)anthracene	9.65E-01	3.78E-10			2.70E-11	7.30E+00	1.97E-10
Dibenzofuran	1.12E+00	4.40E-10	4.00E-03	1.10E-07	3.14E-11		
Fluoranthene	1.38E+01	5.40E-09	4.00E-02	1.35E-07	3.85E-10		
Fluorene	1.43E+00	5.61E-10	4.00E-02	1.40E-08	4.01E-11		
Indeno(1,2,3-cd)pyrene	2.29E+00	8.96E-10			6.40E-11	7.30E-01	4.67E-11
Naphthalene	1.54E+00	6.01E-10	3.00E-02	2.00E-08	4.30E-11		
Phenanthrene	1.03E+01	4.03E-09	3.00E-02	1.34E-07	2.88E-10		
Pyrene	1.14E+01	4.46E-09	3.00E-02	1.49E-07	3.19E-10		
bis(2-Ethylhexyl)phthalate	2.48E+00	9.72E-10	2.00E-02	4.86E-08	6.95E-11	1.40E-02	9.72E-13
Volatile Organics							
2-Butanone (MEK)	2.13E-02	8.35E-12	6.00E-01	1.39E-11	5.96E-13		
Acetone	5.65E-02	2.21E-11	1.00E-01	2.21E-10	1.58E-12		
Carbon disulfide	4.40E-03	1.72E-12	1.00E-01	1.72E-11	1.23E-13		
Chlorobenzene	2.09E-02	8.18E-12	2.00E-02	4.09E-10	5.85E-13		
Toluene	1.45E-02	5.67E-12	2.00E-01	2.84E-11	4.05E-13		
Xylenes (total)	2.60E-03	1.02E-12	2.00E+00	5.09E-13	7.27E-14		
			HAZARD INDEX =	4.18E-04	TOTAL CANCER RISK =		3.50E-09

TABLE A-28

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	4.27E-01	4.18E-09	5.00E-03	8.36E-07	1.49E-09	4.30E+00	6.42E-09
Cadmium	7.40E+01	7.24E-07	1.00E-03	7.24E-04	2.58E-07		
Chromium	7.36E+02	7.20E-06	1.00E+00	7.20E-06	2.57E-06		
Cobalt	1.34E+01	1.32E-07	6.00E-02	2.19E-06	4.70E-08		
Lead	3.15E+02	3.09E-06			1.10E-06		
Mercury	8.80E-01	8.61E-09	3.00E-04	2.87E-05	3.07E-09		
Nickel	3.57E+02	3.49E-06	2.00E-02	1.75E-04	1.25E-06		
Silver	6.40E+00	6.26E-08	5.00E-03	1.25E-05	2.24E-08		
Thallium	6.26E+01	6.13E-07	8.00E-05	7.66E-03	2.19E-07		
Vanadium	2.99E+01	2.92E-07	7.00E-03	4.18E-05	1.04E-07		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	7.05E-10			2.52E-10	3.40E-01	8.55E-11
Aldrin	3.88E-01	3.79E-09	3.00E-05	1.26E-04	1.35E-09	1.70E+01	2.30E-08
Aroclor 1254	2.07E+01	2.02E-07	2.00E-05	1.01E-02	7.22E-08		
Dieldrin	1.02E+00	1.00E-08	5.00E-05	2.00E-04	3.58E-09	1.60E+00	5.72E-09
Heptachlor	6.79E-01	6.64E-09	5.00E-04	1.33E-05	2.37E-09	4.50E+00	1.07E-08
alpha-Chlordane	5.96E-01	5.83E-09	6.00E-05	9.72E-05	2.08E-09	1.30E+00	2.71E-09
delta-BHC	1.96E-01	1.92E-09			6.85E-10		
Semivolatile Organics							
1,4-Dichlorobenzene	1.68E+00	1.64E-08			5.87E-09	2.40E-02	1.41E-10
1-Chloronaphthalene	1.50E+00	1.47E-08	3.00E-02	4.89E-07	5.24E-09		
2-Chloronaphthalene	3.10E-01	3.03E-09	8.00E-02	3.79E-08	1.08E-09		
2-Methylnaphthalene	1.75E+00	1.71E-08	3.00E-02	5.71E-07	6.11E-09		
Acenaphthene	1.79E+00	1.75E-08	6.00E-02	2.92E-07	6.26E-09		
Anthracene	3.45E+00	3.37E-08	3.00E-01	1.12E-07	1.20E-08		
Benzidine	2.90E-01	2.84E-09	3.00E-03	9.46E-07	1.01E-09	2.30E+02	2.33E-07
Benzo(a)anthracene	1.42E+01	1.39E-07			4.96E-08	7.30E-01	3.62E-08
Benzo(a)pyrene	1.16E+01	1.14E-07			4.07E-08	7.30E+00	2.97E-07
Benzo(b)fluoranthene	2.53E+01	2.47E-07			8.83E-08	7.30E-01	6.44E-08
Benzo(g,h,i)perylene	6.36E+00	6.22E-08	3.00E-02	2.07E-06	2.22E-08		
Benzo(k)fluoranthene	2.19E+00	2.14E-08			7.65E-09	7.30E-02	5.58E-10
Chrysene	1.46E+01	1.43E-07			5.11E-08	7.30E-03	3.73E-10
Di-n-octyl phthalate	1.40E+00	1.37E-08	2.00E-02	6.85E-07	4.89E-09		
Dibenz(a,h)anthracene	1.55E+00	1.52E-08			5.43E-09	7.30E+00	3.96E-08
Dibenzofuran	1.92E+00	1.88E-08	4.00E-03	4.71E-06	6.73E-09		
Fluoranthene	6.81E+01	6.67E-07	4.00E-02	1.67E-05	2.38E-07		
Fluorene	1.96E+00	1.92E-08	4.00E-02	4.79E-07	6.84E-09		
Indeno(1,2,3-cd)pyrene	5.87E+00	5.75E-08			2.05E-08	7.30E-01	1.50E-08
Naphthalene	2.65E+00	2.60E-08	3.00E-02	8.66E-07	9.28E-09		
Phenanthrene	3.66E+01	3.58E-07	3.00E-02	1.19E-05	1.28E-07		
Pyrene	4.65E+01	4.55E-07	3.00E-02	1.52E-05	1.63E-07		
bis(2-Ethylhexyl)phthalate	5.98E+00	5.85E-08	2.00E-02	2.93E-06	2.09E-08	1.40E-02	2.93E-10
Volatile Organics							
2-Butanone (MEK)	2.44E-02	2.39E-10	6.00E-01	3.98E-10	8.53E-11		
Acetone	8.16E-02	7.98E-10	1.00E-01	7.98E-09	2.85E-10		
Carbon disulfide	4.40E-03	4.31E-11	1.00E-01	4.31E-10	1.54E-11		
Chlorobenzene	2.26E-02	2.21E-10	2.00E-02	1.11E-08	7.90E-11		
Toluene	1.45E-02	1.42E-10	2.00E-01	7.09E-10	5.06E-11		
Xylenes (total)	2.60E-03	2.54E-11	2.00E+00	1.27E-11	9.09E-12		
			HAZARD INDEX =	1.93E-02	TOTAL CANCER RISK =		7.35E-07

TABLE A-29

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	3.58E-01	5.61E-12	5.00E-03	1.12E-09	4.01E-13	4.30E+00	1.72E-12
Cadmium	3.24E+01	5.07E-10	1.00E-03	5.07E-07	3.62E-11		
Chromium	3.60E+02	5.63E-09	1.00E+00	5.63E-09	4.02E-10		
Cobalt	1.01E+01	1.58E-10	6.00E-02	2.64E-09	1.13E-11		
Lead	1.30E+02	2.04E-09			1.45E-10		
Mercury	4.42E-01	6.93E-12	3.00E-04	2.31E-08	4.95E-13		
Nickel	1.46E+02	2.28E-09	2.00E-02	1.14E-07	1.63E-10		
Silver	4.28E+00	6.70E-11	5.00E-03	1.34E-08	4.79E-12		
Thallium	6.26E+01	9.80E-10	8.00E-05	1.23E-05	7.00E-11		
Vanadium	2.24E+01	3.51E-10	7.00E-03	5.01E-08	2.51E-11		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	1.13E-11			8.05E-13	3.40E-01	2.74E-13
Aldrin	1.46E-01	2.29E-11	3.00E-05	7.63E-07	1.63E-12	1.70E+01	2.78E-11
Aroclor 1254	3.41E+00	5.34E-10	2.00E-05	2.67E-05	3.82E-11		
Dieldrin	6.31E-01	9.88E-11	5.00E-05	1.98E-06	7.06E-12	1.60E+00	1.13E-11
Heptachlor	2.74E-01	4.28E-11	5.00E-04	8.56E-08	3.06E-12	4.50E+00	1.38E-11
alpha-Chlordane	3.92E-01	6.13E-11	6.00E-05	1.02E-06	4.38E-12	1.30E+00	5.69E-12
delta-BHC	9.60E-02	1.50E-11			1.07E-12		
Semivolatile Organics							
1,4-Dichlorobenzene	1.08E+00	1.69E-10			1.21E-11	2.40E-02	2.90E-13
1-Chloronaphthalene	2.60E+00	4.07E-10	3.00E-02	1.36E-08	2.91E-11		
2-Chloronaphthalene	1.06E+00	1.65E-10	8.00E-02	2.07E-09	1.18E-11		
2-Methylnaphthalene	1.11E+00	1.73E-10	3.00E-02	5.77E-09	1.24E-11		
2-Naphthylamine	1.40E-01	2.19E-11			1.57E-12	1.30E+02	2.04E-10
Acenaphthene	1.28E+00	2.01E-10	6.00E-02	3.35E-09	1.44E-11		
Anthracene	2.35E+00	3.68E-10	3.00E-01	1.23E-09	2.63E-11		
Benzidine	2.90E-01	4.54E-11	3.00E-03	1.51E-08	3.24E-12	2.30E+02	7.46E-10
Benzo(a)anthracene	4.68E+00	7.33E-10			5.23E-11	7.30E-01	3.82E-11
Benzo(a)pyrene	4.00E+00	6.26E-10			4.47E-11	7.30E+00	3.26E-10
Benzo(b)fluoranthene	6.91E+00	1.08E-09			7.72E-11	7.30E-01	5.64E-11
Benzo(g,h,i)perylene	2.31E+00	3.61E-10	3.00E-02	1.20E-08	2.58E-11		
Benzo(k)fluoranthene	1.55E+00	2.42E-10			1.73E-11	7.30E-02	1.26E-12
Chrysene	4.99E+00	7.81E-10			5.58E-11	7.30E-03	4.07E-13
Di-n-octyl phthalate	1.26E+00	1.98E-10	2.00E-02	9.90E-09	1.41E-11		
Dibenz(a,h)anthracene	9.82E-01	1.54E-10			1.10E-11	7.30E+00	8.02E-11
Dibenzofuran	1.13E+00	1.76E-10	4.00E-03	4.41E-08	1.26E-11		
Fluoranthene	1.30E+01	2.03E-09	4.00E-02	5.08E-08	1.45E-10		
Fluorene	1.42E+00	2.22E-10	4.00E-02	5.56E-09	1.59E-11		
Indeno(1,2,3-cd)pyrene	2.08E+00	3.26E-10			2.33E-11	7.30E-01	1.70E-11
Naphthalene	1.36E+00	2.13E-10	3.00E-02	7.11E-09	1.52E-11		
Phenanthrene	9.49E+00	1.49E-09	3.00E-02	4.95E-08	1.06E-10		
Pyrene	1.02E+01	1.60E-09	3.00E-02	5.33E-08	1.14E-10		
bis(2-Ethylhexyl)phthalate	3.46E+00	5.42E-10	2.00E-02	2.71E-08	3.87E-11	1.40E-02	5.42E-13
Volatile Organics							
2-Butanone (MEK)	3.68E-02	5.76E-12	6.00E-01	9.61E-12	4.12E-13		
Acetone	7.50E-02	1.17E-11	1.00E-01	1.17E-10	8.39E-13		
Carbon disulfide	1.02E-02	1.59E-12	1.00E-01	1.59E-11	1.14E-13		
Chlorobenzene	1.12E-01	1.76E-11	2.00E-02	8.78E-10	1.25E-12		
Toluene	2.23E-02	3.49E-12	2.00E-01	1.74E-11	2.49E-13		
Xylenes (total)	1.02E-02	1.59E-12	2.00E+00	7.97E-13	1.14E-13		
			HAZARD INDEX =	4.38E-05	TOTAL CANCER RISK =		1.53E-09

TABLE A-30

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation : CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	4.10E-01	7.86E-10	5.00E-03	1.57E-07	2.81E-10	4.30E+00	1.21E-09
Cadmium	5.72E+01	1.10E-07	1.00E-03	1.10E-04	3.92E-08		
Chromium	5.38E+02	1.03E-06	1.00E+00	1.03E-06	3.68E-07		
Cobalt	1.10E+01	2.10E-08	6.00E-02	3.51E-07	7.52E-09		
Lead	1.82E+02	3.49E-07			1.25E-07		
Mercury	5.27E-01	1.01E-09	3.00E-04	3.37E-06	3.61E-10		
Nickel	2.04E+02	3.91E-07	2.00E-02	1.95E-05	1.40E-07		
Silver	5.38E+00	1.03E-08	5.00E-03	2.06E-06	3.69E-09		
Thallium	6.26E+01	1.20E-07	8.00E-05	1.50E-03	4.29E-08		
Vanadium	2.53E+01	4.86E-08	7.00E-03	6.94E-06	1.74E-08		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	1.38E-09			4.93E-10	3.40E-01	1.68E-10
Aldrin	1.61E-01	3.09E-09	3.00E-05	1.03E-04	1.11E-09	1.70E+01	1.88E-08
Aroclor 1254	7.38E+00	1.42E-07	2.00E-05	7.08E-03	5.05E-08		
Dieldrin	6.31E-01	1.21E-08	5.00E-05	2.42E-04	4.32E-09	1.60E+00	6.92E-09
Heptachlor	4.14E-01	7.94E-09	5.00E-04	1.59E-05	2.84E-09	4.50E+00	1.28E-08
alpha-Chlordane	3.92E-01	7.51E-09	6.00E-05	1.25E-04	2.68E-09	1.30E+00	3.49E-09
delta-BHC	9.80E-02	1.88E-09			6.71E-10		
Semivolatile Organics							
1,4-Dichlorobenzene	1.37E+00	2.64E-08			9.41E-09	2.40E-02	2.26E-10
1-Chloronaphthalene	2.60E+00	4.99E-08	3.00E-02	1.66E-06	1.78E-08		
2-Chloronaphthalene	1.36E+00	2.60E-08	8.00E-02	3.26E-07	9.30E-09		
2-Methylnaphthalene	1.43E+00	2.74E-08	3.00E-02	9.13E-07	9.78E-09		
2-Naphthylamine	1.40E-01	2.68E-09			9.59E-10	1.30E+02	1.25E-07
Acenaphthene	1.39E+00	2.66E-08	6.00E-02	4.43E-07	9.49E-09		
Anthracene	2.56E+00	4.90E-08	3.00E-01	1.63E-07	1.75E-08		
Benzidine	2.90E-01	5.56E-09	3.00E-03	1.85E-06	1.99E-09	2.30E+02	4.57E-07
Benzo(a)anthracene	7.93E+00	1.52E-07			5.43E-08	7.30E-01	3.97E-08
Benzo(a)pyrene	6.62E+00	1.27E-07			4.54E-08	7.30E+00	3.31E-07
Benzo(b)fluoranthene	1.41E+01	2.71E-07			9.68E-08	7.30E-01	7.06E-08
Benzo(g,h,i)perylene	3.72E+00	7.14E-08	3.00E-02	2.38E-06	2.55E-08		
Benzo(k)fluoranthene	1.88E+00	3.60E-08			1.29E-08	7.30E-02	9.39E-10
Chrysene	9.10E+00	1.75E-07			6.23E-08	7.30E-03	4.55E-10
Di-n-octyl phthalate	1.69E+00	3.24E-08	2.00E-02	1.62E-06	1.16E-08		
Dibenz(a,h)anthracene	1.25E+00	2.40E-08			8.58E-09	7.30E+00	6.26E-08
Dibenzofuran	1.47E+00	2.82E-08	4.00E-03	7.04E-06	1.01E-08		
Fluoranthene	3.17E+01	6.08E-07	4.00E-02	1.52E-05	2.17E-07		
Fluorene	1.48E+00	2.84E-08	4.00E-02	7.10E-07	1.01E-08		
Indeno(1,2,3-cd)pyrene	3.27E+00	6.27E-08			2.24E-08	7.30E-01	1.64E-08
Naphthalene	1.77E+00	3.39E-08	3.00E-02	1.13E-06	1.21E-08		
Phenanthrene	1.84E+01	3.54E-07	3.00E-02	1.18E-05	1.26E-07		
Pyrene	2.26E+01	4.34E-07	3.00E-02	1.45E-05	1.55E-07		
bis(2-Ethylhexyl)phthalate	6.24E+00	1.20E-07	2.00E-02	5.99E-06	4.28E-08	1.40E-02	5.99E-10
Volatile Organics							
2-Butanone (MEK)	3.68E-02	7.06E-10	6.00E-01	1.18E-09	2.52E-10		
Acetone	8.79E-02	1.69E-09	1.00E-01	1.69E-08	6.02E-10		
Carbon disulfide	1.02E-02	1.95E-10	1.00E-01	1.95E-09	6.95E-11		
Chlorobenzene	1.12E-01	2.15E-09	2.00E-02	1.08E-07	7.69E-10		
Toluene	2.23E-02	4.27E-10	2.00E-01	2.14E-09	1.53E-10		
Xylenes (total)	1.02E-02	1.95E-10	2.00E+00	9.76E-11	6.97E-11		
			HAZARD INDEX =	9.27E-03	TOTAL CANCER RISK =		1.15E-06

TABLE A-31

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	3.58E-01	1.40E-10	5.00E-03	2.81E-08	1.00E-11	4.30E+00	4.31E-11
Cadmium	3.24E+01	1.27E-08	1.00E-03	1.27E-05	9.06E-10		
Chromium	3.60E+02	1.41E-07	1.00E+00	1.41E-07	1.01E-08		
Cobalt	1.01E+01	3.96E-09	6.00E-02	6.60E-08	2.83E-10		
Lead	1.30E+02	5.09E-08			3.63E-09		
Mercury	4.42E-01	1.73E-10	3.00E-04	5.77E-07	1.24E-11		
Nickel	1.46E+02	5.70E-08	2.00E-02	2.85E-06	4.07E-09		
Silver	4.28E+00	1.68E-09	5.00E-03	3.35E-07	1.20E-10		
Thallium	6.26E+01	2.45E-08	8.00E-05	3.06E-04	1.75E-09		
Vanadium	2.24E+01	8.77E-09	7.00E-03	1.25E-06	6.26E-10		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	2.82E-11			2.01E-12	3.40E-01	6.84E-13
Aldrin	1.46E-01	5.72E-11	3.00E-05	1.91E-06	4.09E-12	1.70E+01	6.95E-11
Aroclor 1254	3.41E+00	1.34E-09	2.00E-05	6.68E-05	9.54E-11		
Dieldrin	6.31E-01	2.47E-10	5.00E-05	4.94E-06	1.76E-11	1.60E+00	2.82E-11
Heptachlor	2.74E-01	1.07E-10	5.00E-04	2.14E-07	7.65E-12	4.50E+00	3.44E-11
alpha-Chlordane	3.92E-01	1.53E-10	6.00E-05	2.56E-06	1.10E-11	1.30E+00	1.42E-11
delta-BHC	9.60E-02	3.76E-11			2.68E-12		
Semivolatile Organics							
1,4-Dichlorobenzene	1.08E+00	4.23E-10			3.02E-11	2.40E-02	7.25E-13
1-Chloronaphthalene	2.60E+00	1.02E-09	3.00E-02	3.39E-08	7.27E-11		
2-Chloronaphthalene	1.06E+00	4.14E-10	8.00E-02	5.17E-09	2.95E-11		
2-Methylnaphthalene	1.11E+00	4.33E-10	3.00E-02	1.44E-08	3.09E-11		
2-Naphthylamine	1.40E-01	5.48E-11			3.91E-12	1.30E+02	5.09E-10
Acenaphthene	1.28E+00	5.03E-10	6.00E-02	8.38E-09	3.59E-11		
Anthracene	2.35E+00	9.20E-10	3.00E-01	3.07E-09	6.57E-11		
Benzidine	2.90E-01	1.14E-10	3.00E-03	3.78E-08	8.11E-12	2.30E+02	1.86E-09
Benzo(a)anthracene	4.68E+00	1.83E-09			1.31E-10	7.30E-01	9.55E-11
Benzo(a)pyrene	4.00E+00	1.56E-09			1.12E-10	7.30E+00	8.16E-10
Benzo(b)fluoranthene	6.91E+00	2.70E-09			1.93E-10	7.30E-01	1.41E-10
Benzo(g,h,i)perylene	2.31E+00	9.03E-10	3.00E-02	3.01E-08	6.45E-11		
Benzo(k)fluoranthene	1.55E+00	6.05E-10			4.32E-11	7.30E-02	3.16E-12
Chrysene	4.99E+00	1.95E-09			1.40E-10	7.30E-03	1.02E-12
Di-n-octyl phthalate	1.26E+00	4.95E-10	2.00E-02	2.47E-08	3.53E-11		
Dibenz(a,h)anthracene	9.82E-01	3.84E-10			2.75E-11	7.30E+00	2.00E-10
Dibenzofuran	1.13E+00	4.41E-10	4.00E-03	1.10E-07	3.15E-11		
Fluoranthene	1.30E+01	5.08E-09	4.00E-02	1.27E-07	3.63E-10		
Fluorene	1.42E+00	5.56E-10	4.00E-02	1.39E-08	3.97E-11		
Indeno(1,2,3-cd)pyrene	2.08E+00	8.16E-10			5.83E-11	7.30E-01	4.25E-11
Naphthalene	1.36E+00	5.33E-10	3.00E-02	1.78E-08	3.81E-11		
Phenanthrene	9.49E+00	3.72E-09	3.00E-02	1.24E-07	2.65E-10		
Pyrene	1.02E+01	4.00E-09	3.00E-02	1.33E-07	2.86E-10		
bis(2-Ethylhexyl)phthalate	3.46E+00	1.35E-09	2.00E-02	6.77E-08	9.68E-11	1.40E-02	1.35E-12
Volatile Organics							
2-Butanone (MEK)	3.68E-02	1.44E-11	6.00E-01	2.40E-11	1.03E-12		
Acetone	7.50E-02	2.93E-11	1.00E-01	2.93E-10	2.10E-12		
Carbon disulfide	1.02E-02	3.97E-12	1.00E-01	3.97E-11	2.84E-13		
Chlorobenzene	1.12E-01	4.39E-11	2.00E-02	2.20E-09	3.14E-12		
Toluene	2.23E-02	8.72E-12	2.00E-01	4.36E-11	6.23E-13		
Xylenes (total)	1.02E-02	3.98E-12	2.00E+00	1.99E-12	2.85E-13		
			HAZARD INDEX =	4.01E-04	TOTAL CANCER RISK =		3.87E-09

TABLE A-32

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation : **CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)**
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	4.10E-01	4.01E-09	5.00E-03	8.02E-07	1.43E-09	4.30E+00	6.16E-09
Cadmium	5.72E+01	5.60E-07	1.00E-03	5.60E-04	2.00E-07		
Chromium	5.38E+02	5.26E-06	1.00E+00	5.26E-06	1.88E-06		
Cobalt	1.10E+01	1.07E-07	6.00E-02	1.79E-06	3.84E-08		
Lead	1.82E+02	1.78E-06			6.36E-07		
Mercury	5.27E-01	5.16E-09	3.00E-04	1.72E-05	1.84E-09		
Nickel	2.04E+02	1.99E-06	2.00E-02	9.97E-05	7.12E-07		
Silver	5.38E+00	5.27E-08	5.00E-03	1.05E-05	1.88E-08		
Thallium	6.26E+01	6.13E-07	8.00E-05	7.66E-03	2.19E-07		
Vanadium	2.53E+01	2.48E-07	7.00E-03	3.54E-05	8.85E-08		
PCBs/Pesticides							
4,4'-DDE	7.20E-02	7.05E-10			2.52E-10	3.40E-01	8.55E-11
Aldrin	1.61E-01	1.58E-09	3.00E-05	5.26E-05	5.64E-10	1.70E+01	9.59E-09
Aroclor 1254	7.38E+00	7.22E-08	2.00E-05	3.61E-03	2.58E-08		
Dieldrin	6.31E-01	6.18E-09	5.00E-05	1.24E-04	2.21E-09	1.60E+00	3.53E-09
Heptachlor	4.14E-01	4.05E-09	5.00E-04	8.10E-06	1.45E-09	4.50E+00	6.51E-09
alpha-Chlordane	3.92E-01	3.83E-09	6.00E-05	6.39E-05	1.37E-09	1.30E+00	1.78E-09
delta-BHC	9.80E-02	9.59E-10			3.42E-10		
Semivolatile Organics							
1,4-Dichlorobenzene	1.37E+00	1.34E-08			4.80E-09	2.40E-02	1.15E-10
1-Chloronaphthalene	2.60E+00	2.54E-08	3.00E-02	8.48E-07	9.09E-09		
2-Chloronaphthalene	1.36E+00	1.33E-08	8.00E-02	1.66E-07	4.75E-09		
2-Methylnaphthalene	1.43E+00	1.40E-08	3.00E-02	4.66E-07	4.99E-09		
2-Naphthylamine	1.40E-01	1.37E-09			4.89E-10	1.30E+02	6.36E-08
Acenaphthene	1.39E+00	1.36E-08	6.00E-02	2.26E-07	4.84E-09		
Anthracene	2.56E+00	2.50E-08	3.00E-01	8.34E-08	8.93E-09		
Benzidine	2.90E-01	2.84E-09	3.00E-03	9.46E-07	1.01E-09	2.30E+02	2.33E-07
Benzo(a)anthracene	7.93E+00	7.76E-08			2.77E-08	7.30E-01	2.02E-08
Benzo(a)pyrene	6.62E+00	6.48E-08			2.31E-08	7.30E+00	1.69E-07
Benzo(b)fluoranthene	1.41E+01	1.38E-07			4.94E-08	7.30E-01	3.60E-08
Benzo(g,h,i)perylene	3.72E+00	3.64E-08	3.00E-02	1.21E-06	1.30E-08		
Benzo(k)fluoranthene	1.88E+00	1.84E-08			6.56E-09	7.30E-02	4.79E-10
Chrysene	9.10E+00	8.91E-08			3.18E-08	7.30E-03	2.32E-10
Di-n-octyl phthalate	1.69E+00	1.65E-08	2.00E-02	8.27E-07	5.91E-09		
Dibenz(a,h)anthracene	1.25E+00	1.23E-08			4.38E-09	7.30E+00	3.20E-08
Dibenzofuran	1.47E+00	1.44E-08	4.00E-03	3.59E-06	5.13E-09		
Fluoranthene	3.17E+01	3.10E-07	4.00E-02	7.76E-06	1.11E-07		
Fluorene	1.48E+00	1.45E-08	4.00E-02	3.62E-07	5.17E-09		
Indeno(1,2,3-cd)pyrene	3.27E+00	3.20E-08			1.14E-08	7.30E-01	8.35E-09
Naphthalene	1.77E+00	1.73E-08	3.00E-02	5.77E-07	6.18E-09		
Phenanthrene	1.84E+01	1.81E-07	3.00E-02	6.02E-06	6.45E-08		
Pyrene	2.26E+01	2.21E-07	3.00E-02	7.38E-06	7.91E-08		
bis(2-Ethylhexyl)phthalate	6.24E+00	6.11E-08	2.00E-02	3.05E-06	2.18E-08	1.40E-02	3.05E-10
Volatile Organics							
2-Butanone (MEK)	3.68E-02	3.60E-10	6.00E-01	6.00E-10	1.29E-10		
Acetone	8.79E-02	8.60E-10	1.00E-01	8.60E-09	3.07E-10		
Carbon disulfide	1.02E-02	9.93E-11	1.00E-01	9.93E-10	3.55E-11		
Chlorobenzene	1.12E-01	1.10E-09	2.00E-02	5.49E-08	3.92E-10		
Toluene	2.23E-02	2.18E-10	2.00E-01	1.09E-09	7.79E-11		
Xylenes (total)	1.02E-02	9.96E-11	2.00E+00	4.98E-11	3.56E-11		
			HAZARD INDEX =	1.23E-02	TOTAL CANCER RISK =		5.91E-07

AREA 4
OFF-BASE EAST SOLDIER CREEK

TABLE A-33

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)**
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.025 L/hour
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.0025 L/hour
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.17E-04	8.28E-05	3.45E-08	4.00E-04	8.62E-05	1.66E-05	6.90E-09		
Cadmium	4.33E-04	8.28E-05	3.59E-08	5.00E-04	7.17E-05	1.66E-05	7.17E-09		
Cobalt	3.50E-04	8.28E-05	2.90E-08	6.00E-02	4.83E-07	1.66E-05	5.79E-09		
Nickel	6.35E-03	8.28E-05	5.26E-07	2.00E-02	2.63E-05	1.66E-05	1.05E-07		
Silver	2.00E-04	8.28E-05	1.66E-08	5.00E-03	3.31E-06	1.66E-05	3.31E-09		
Vanadium	1.24E-02	8.28E-05	1.03E-06	7.00E-03	1.47E-04	1.66E-05	2.06E-07		
Pesticides									
4,4'-DDT	5.26E-05	8.28E-05	4.36E-09	5.00E-04	8.71E-06	1.66E-05	8.71E-10	3.40E-01	2.96E-10
Semivolatile Organics									
2,6-Dichlorophenol	2.80E-03	8.28E-05	2.32E-07	3.00E-03	7.73E-05	1.66E-05	4.64E-08		
3/4-Methylphenol	1.20E-03	8.28E-05	9.93E-08	5.00E-02	1.99E-06	1.66E-05	1.99E-08		
Phenol	2.00E-03	8.28E-05	1.66E-07	6.00E-01	2.76E-07	1.66E-05	3.31E-08		
Volatile Organics									
Acetone	5.59E-03	8.28E-05	4.62E-07	1.00E-01	4.62E-06	1.66E-05	9.25E-08		
				HAZARD INDEX =	4.28E-04			TOTAL CANCER RISK =	2.96E-10

TABLE A-34

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)**
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.05 L/hour
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.005 L/hour
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	5.90E-04	3.10E-04	1.83E-07	4.00E-04	4.57E-04	1.33E-04	7.84E-08		
Cadmium	7.03E-04	3.10E-04	2.18E-07	5.00E-04	4.36E-04	1.33E-04	9.34E-08		
Cobalt	6.69E-04	3.10E-04	2.07E-07	6.00E-02	3.46E-06	1.33E-04	8.89E-08		
Nickel	8.70E-03	3.10E-04	2.70E-06	2.00E-02	1.35E-04	1.33E-04	1.16E-06		
Silver	2.00E-04	3.10E-04	6.20E-08	5.00E-03	1.24E-05	1.33E-04	2.66E-08		
Vanadium	1.70E-02	3.10E-04	5.27E-06	7.00E-03	7.53E-04	1.33E-04	2.26E-06		
Pesticides									
4,4'-DDT	5.87E-05	3.10E-04	1.82E-08	5.00E-04	3.64E-05	1.33E-04	7.80E-09	3.40E-01	2.65E-09
Semivolatile Organics									
2,6-Dichlorophenol	2.80E-03	3.10E-04	8.68E-07	3.00E-03	2.89E-04	1.33E-04	3.72E-07		
3/4-Methylphenol	1.20E-03	3.10E-04	3.72E-07	5.00E-02	7.44E-06	1.33E-04	1.59E-07		
Phenol	2.00E-03	3.10E-04	6.20E-07	6.00E-01	1.03E-06	1.33E-04	2.66E-07		
Volatile Organics									
Acetone	7.36E-03	3.10E-04	2.28E-06	1.00E-01	2.28E-05	1.33E-04	9.78E-07		
				HAZARD INDEX =	2.15E-03			TOTAL CANCER RISK =	2.65E-09

TABLE A-35

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : $HIF = \{ [(SAc \times ETc \times EFc \times EDc) / BWc + (SAa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)\} \times CF$

$CDI = CW \times PC \times HIF$

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

HIF = Human Intake Factor

CDI = Chronic Daily Intake

CW = Concentration in Surface Water

PC = Chemical-specific Dermal Permeability Constant

SAc = Child Skin Surface Area Available for Contact = 1,800 cm^2

ETc = Child Exposure Time = 3 hours/day

EFc = Child Exposure Frequency = 17 days per year

EDc = Child Exposure Duration = 5 years

BWc = Child Body Weight = 15.1 kg

SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2

ETa = Adult Exposure Time = 1 hour /day

EFa = Adult Exposure Frequency = 2 days per year

EDa = Adult Exposure Duration = 9 years

BW = Adult Body Weight = 57.1 kg

CF = Conversion Factor (1L/1000cm^2)

AT1 = Days Per Year = 365 days/year

AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)

SF = Slope Factor

RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	4.17E-04	0.001	2.17E-02	9.02E-09	0.0004	2.26E-05	4.33E-03	1.80E-09		
Cadmium	4.33E-04	0.001	2.17E-02	9.38E-09	0.0005	1.88E-05	4.33E-03	1.88E-09		
Cobalt	3.50E-04	0.001	2.17E-02	7.58E-09	0.06	1.26E-07	4.33E-03	1.52E-09		
Nickel	6.35E-03	0.001	2.17E-02	1.38E-07	0.02	6.88E-06	4.33E-03	2.75E-08		
Silver	2.00E-04	0.001	2.17E-02	4.33E-09	0.005	8.66E-07	4.33E-03	8.66E-10		
Vanadium	1.24E-02	0.001	2.17E-02	2.69E-07	0.007	3.84E-05	4.33E-03	5.38E-08		
Pesticides										
4,4'-DDT	5.26E-05	0.43	2.17E-02	4.90E-07	0.0005	9.80E-04	4.33E-03	9.80E-08	0.34	3.33E-08
Semivolatile Organics										
2,6-Dichlorophenol	2.80E-03	0.06	2.17E-02	3.64E-06	0.003	1.21E-03	4.33E-03	7.28E-07		
3/4-Methylphenol	1.20E-03	0.015	2.17E-02	3.90E-07	0.05	7.80E-06	4.33E-03	7.80E-08		
Phenol	2.00E-03	0.0055	2.17E-02	2.38E-07	0.6	3.97E-07	4.33E-03	4.76E-08		
Volatile Organics										
Acetone	5.59E-03		2.17E-02		0.1		4.33E-03			
					HAZARD INDEX =	2.29E-03			TOTAL CANCER RISK =	3.33E-08

Note:

a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-36

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : $HIF = \{ [(SAc \times ETc \times EFc \times EDc) / BWc + (SAa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)\} \times CF$

$CDI = CW \times PC \times HIF$

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

HIF = Human Intake Factor

CDI = Chronic Daily Intake

CW = Concentration in Surface Water

PC = Chemical-specific Dermal Permeability Constant

SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2

ETc = Child Exposure Time = 6 hours/day

EFc = Child Exposure Frequency = 34 days per year

EDc = Child Exposure Duration = 5 years

BWc = Child Body Weight = 15.1 kg

SAa = Adult Skin Surface Area Available for Contact = 8,620 cm^2

ETa = Adult Exposure Time = 2 hour /day

EFa = Adult Exposure Frequency = 4 days per year

EDa = Adult Exposure Duration = 25 years

BW = Adult Body Weight = 57.1 kg

CF = Conversion Factor (1L/1000cm^2)

AT1 = Days Per Year = 365 days/year

AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)

SF = Slope Factor

RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	5.90E-04	1.00E-03	4.29E-02	2.53E-08	4.00E-04	6.32E-05	1.84E-02	1.08E-08		
Cadmium	7.03E-04	1.00E-03	4.29E-02	3.01E-08	5.00E-04	6.03E-05	1.84E-02	1.29E-08		
Cobalt	6.69E-04	1.00E-03	4.29E-02	2.87E-08	6.00E-02	4.78E-07	1.84E-02	1.23E-08		
Nickel	8.70E-03	1.00E-03	4.29E-02	3.73E-07	2.00E-02	1.86E-05	1.84E-02	1.60E-07		
Silver	2.00E-04	1.00E-03	4.29E-02	8.57E-09	5.00E-03	1.71E-06	1.84E-02	3.67E-09		
Vanadium	1.70E-02	1.00E-03	4.29E-02	7.29E-07	7.00E-03	1.04E-04	1.84E-02	3.12E-07		
Pesticides										
4,4'-DDT	5.87E-05	4.30E-01	4.29E-02	1.08E-06	5.00E-04	2.16E-03	1.84E-02	4.64E-07	3.40E-01	1.58E-07
Semivolatile Organics										
2,6-Dichlorophenol	2.80E-03	6.00E-02	4.29E-02	7.20E-06	3.00E-03	2.40E-03	1.84E-02	3.09E-06		
3/4-Methylphenol	1.20E-03	1.50E-02	4.29E-02	7.71E-07	5.00E-02	1.54E-05	1.84E-02	3.31E-07		
Phenol	2.00E-03	5.50E-03	4.29E-02	4.71E-07	6.00E-01	7.86E-07	1.84E-02	2.02E-07		
Volatile Organics										
Acetone	7.36E-03		4.29E-02		1.00E-01		1.84E-02			
					HAZARD INDEX =	4.83E-03			TOTAL CANCER RISK =	1.58E-07

Note:

a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-37

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)**
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100 mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10 mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	3.93E+00	1.11E-07	4.36E-07	4.00E-04	1.09E-03	2.22E-08	8.71E-08		
Beryllium	4.49E-01	1.11E-07	4.98E-08	5.00E-03	9.96E-06	2.22E-08	9.96E-09	4.30E+00	4.28E-08
Cadmium	5.52E+00	1.11E-07	6.11E-07	1.00E-03	6.11E-04	2.22E-08	1.22E-07		
Cobalt	5.41E+00	1.11E-07	5.99E-07	6.00E-02	9.98E-06	2.22E-08	1.20E-07		
Mercury	6.93E-02	1.11E-07	7.68E-09	3.00E-04	2.56E-05	2.22E-08	1.54E-09		
Vanadium	1.86E+01	1.11E-07	2.06E-06	7.00E-03	2.94E-04	2.22E-08	4.12E-07		
PCBs/Pesticides									
Aldrin	4.92E-03	1.11E-07	5.45E-10	3.00E-05	1.82E-05	2.22E-08	1.09E-10	1.70E+01	1.85E-09
Aroclor 1254	1.01E-01	1.11E-07	1.12E-08	2.00E-05	5.60E-04	2.22E-08	2.24E-09		
Dieldrin	3.26E-02	1.11E-07	3.61E-09	5.00E-05	7.22E-05	2.22E-08	7.22E-10	1.60E+01	1.16E-08
Heptachlor	2.29E-02	1.11E-07	2.54E-09	5.00E-04	5.07E-06	2.22E-08	5.07E-10	4.50E+00	2.28E-09
alpha-Chlordane	1.29E-02	1.11E-07	1.43E-09	6.00E-05	2.38E-05	2.22E-08	2.86E-10	1.30E+00	3.72E-10
Semivolatile Organics									
1-Chloronaphthalene	2.70E-01	1.11E-07	2.99E-08	3.00E-02	9.97E-07	2.22E-08	5.98E-09		
3/4-Methylphenol	3.19E-01	1.11E-07	3.53E-08	5.00E-02	7.06E-07	2.22E-08	7.06E-09		
Benzo(a)anthracene	2.79E-01	1.11E-07	3.10E-08			2.22E-08	6.19E-09	7.30E-01	4.52E-09
Benzo(a)pyrene	2.65E-01	1.11E-07	2.94E-08			2.22E-08	5.87E-09	7.30E+00	4.29E-08
Benzo(b)fluoranthene	2.72E-01	1.11E-07	3.01E-08			2.22E-08	6.02E-09	7.30E-01	4.40E-09
Benzo(g,h,i)perylene	2.00E-01	1.11E-07	2.22E-08	3.00E-02	7.39E-07	2.22E-08	4.43E-09		
Benzoic acid	5.60E-02	1.11E-07	6.20E-09	4.00E+00	1.55E-09	2.22E-08	1.24E-09		
Chrysene	2.59E-01	1.11E-07	2.87E-08			2.22E-08	5.74E-09	7.30E-03	4.19E-11
Di-n-octyl phthalate	1.00E-01	1.11E-07	1.11E-08	2.00E-02	5.54E-07	2.22E-08	2.22E-09		
Dimethyl phthalate	1.60E-01	1.11E-07	1.77E-08	1.00E+01	1.77E-09	2.22E-08	3.54E-09		
Fluoranthene	2.95E-01	1.11E-07	3.27E-08	4.00E-02	8.17E-07	2.22E-08	6.53E-09		
Indeno(1,2,3-cd)pyrene	1.80E-01	1.11E-07	1.99E-08			2.22E-08	3.99E-09	7.30E-01	2.91E-09
Phenanthrene	2.98E-01	1.11E-07	3.31E-08	3.00E-02	1.10E-06	2.22E-08	6.61E-09		
Pyrene	3.05E-01	1.11E-07	3.38E-08	3.00E-02	1.13E-06	2.22E-08	6.76E-09		
bis(2-Ethylhexyl)phthalate	4.74E-01	1.11E-07	5.25E-08	2.00E-02	2.62E-06	2.22E-08	1.05E-08	1.40E-02	1.47E-10
Volatile Organics									
2-Butanone (MEK)	2.20E-03	1.11E-07	2.44E-10	6.00E-01	4.06E-10	2.22E-08	4.87E-11		
Acetone	1.67E-02	1.11E-07	1.85E-09	1.00E-01	1.85E-08	2.22E-08	3.71E-10		
Carbon disulfide	3.19E-03	1.11E-07	3.53E-10	1.00E-01	3.53E-09	2.22E-08	7.07E-11		
Chlorobenzene	1.70E-03	1.11E-07	1.88E-10	2.00E-02	9.42E-09	2.22E-08	3.77E-11		
Toluene	3.55E-03	1.11E-07	3.94E-10	2.00E-01	1.97E-09	2.22E-08	7.87E-11		
				HAZARD INDEX =	2.73E-03		TOTAL CANCER RISK =		1.14E-07

TABLE A-38

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.10E+00	2.22E-07	9.09E-07	4.00E-04	2.27E-03	9.50E-08	3.90E-07		
Beryllium	5.44E-01	2.22E-07	1.21E-07	5.00E-03	2.41E-05	9.50E-08	5.16E-08	4.30E+00	2.22E-07
Cadmium	3.08E+01	2.22E-07	6.83E-06	1.00E-03	6.83E-03	9.50E-08	2.93E-06		
Cobalt	6.61E+00	2.22E-07	1.46E-06	6.00E-02	2.44E-05	9.50E-08	6.28E-07		
Mercury	1.13E-01	2.22E-07	2.51E-08	3.00E-04	8.36E-05	9.50E-08	1.07E-08		
Vanadium	2.14E+01	2.22E-07	4.75E-06	7.00E-03	6.78E-04	9.50E-08	2.03E-06		
PCBs/Pesticides									
Aldrin	8.93E-03	2.22E-07	1.98E-09	3.00E-05	6.59E-05	9.50E-08	8.48E-10	1.70E+01	1.44E-08
Aroclor 1254	2.16E-01	2.22E-07	4.79E-08	2.00E-05	2.39E-03	9.50E-08	2.05E-08		
Dieldrin	5.77E-02	2.22E-07	1.28E-08	5.00E-05	2.56E-04	9.50E-08	5.48E-09	1.60E+01	8.77E-08
Heptachlor	9.93E-02	2.22E-07	2.20E-08	5.00E-04	4.40E-05	9.50E-08	9.43E-09	4.50E+00	4.24E-08
alpha-Chlordane	3.00E-02	2.22E-07	6.65E-09	6.00E-05	1.11E-04	9.50E-08	2.85E-09	1.30E+00	3.70E-09
Semivolatile Organics									
1-Chloronaphthalene	2.70E-01	2.22E-07	5.98E-08	3.00E-02	1.99E-06	9.50E-08	2.56E-08		
3/4-Methylphenol	4.00E-01	2.22E-07	8.87E-08	5.00E-02	1.77E-06	9.50E-08	3.80E-08		
Benzo(a)anthracene	3.84E-01	2.22E-07	8.50E-08			9.50E-08	3.64E-08	7.30E-01	2.66E-08
Benzo(a)pyrene	3.98E-01	2.22E-07	8.83E-08			9.50E-08	3.78E-08	7.30E+00	2.76E-07
Benzo(b)fluoranthene	3.64E-01	2.22E-07	8.07E-08			9.50E-08	3.46E-08	7.30E-01	2.53E-08
Benzo(g,h,i)perylene	2.00E-01	2.22E-07	4.43E-08	3.00E-02	1.48E-06	9.50E-08	1.90E-08		
Benzoic acid	5.60E-02	2.22E-07	1.24E-08	4.00E+00	3.10E-09	9.50E-08	5.32E-09		
Chrysene	3.56E-01	2.22E-07	7.90E-08			9.50E-08	3.38E-08	7.30E-03	2.47E-10
Di-n-octyl phthalate	1.00E-01	2.22E-07	2.22E-08	2.00E-02	1.11E-06	9.50E-08	9.50E-09		
Dimethyl phthalate	1.60E-01	2.22E-07	3.55E-08	1.00E+01	3.55E-09	9.50E-08	1.52E-08		
Fluoranthene	4.96E-01	2.22E-07	1.10E-07	4.00E-02	2.75E-06	9.50E-08	4.71E-08		
Indeno(1,2,3-cd)pyrene	1.80E-01	2.22E-07	3.99E-08			9.50E-08	1.71E-08	7.30E-01	1.25E-08
Phenanthrene	3.96E-01	2.22E-07	8.77E-08	3.00E-02	2.92E-06	9.50E-08	3.76E-08		
Pyrene	3.90E-01	2.22E-07	8.64E-08	3.00E-02	2.88E-06	9.50E-08	3.70E-08		
bis(2-Ethylhexyl)phthalate	1.06E+00	2.22E-07	2.36E-07	2.00E-02	1.18E-05	9.50E-08	1.01E-07	1.40E-02	1.41E-09
Volatile Organics									
2-Butanone (MEK)	2.20E-03	2.22E-07	4.88E-10	6.00E-01	8.13E-10	9.50E-08	2.09E-10		
Acetone	2.03E-02	2.22E-07	4.49E-09	1.00E-01	4.49E-08	9.50E-08	1.92E-09		
Carbon disulfide	3.71E-03	2.22E-07	8.22E-10	1.00E-01	8.22E-09	9.50E-08	3.52E-10		
Chlorobenzene	1.70E-03	2.22E-07	3.77E-10	2.00E-02	1.88E-08	9.50E-08	1.61E-10		
Toluene	4.25E-03	2.22E-07	9.43E-10	2.00E-01	4.71E-09	9.50E-08	4.04E-10		
				HAZARD INDEX =	1.28E-02			TOTAL CANCER RISK =	7.13E-07

TABLE A-39

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 0.2
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	3.93E+00	7.33E-09	5.77E-09	4.00E-04	1.44E-05	1.47E-09	1.15E-09		
Beryllium	4.49E-01	7.33E-09	6.59E-10	5.00E-03	1.32E-07	1.47E-09	1.32E-10	4.30E+00	5.67E-10
Cadmium	5.52E+00	7.33E-09	8.09E-09	1.00E-03	8.09E-06	1.47E-09	1.62E-09		
Cobalt	5.41E+00	7.33E-09	7.93E-09	6.00E-02	1.32E-07	1.47E-09	1.59E-09		
Mercury	6.93E-02	7.33E-09	1.02E-10	3.00E-04	3.39E-07	1.47E-09	2.03E-11		
Vanadium	1.86E+01	7.33E-09	2.73E-08	7.00E-03	3.90E-06	1.47E-09	5.45E-09		
PCBs/Pesticides									
Aldrin	4.92E-03	7.33E-08	7.22E-11	3.00E-05	2.41E-06	1.47E-08	1.44E-11	1.70E+01	2.45E-10
Aroclor 1254	1.01E-01	7.33E-08	1.48E-09	2.00E-05	7.42E-05	1.47E-08	2.97E-10		
Dieldrin	3.26E-02	7.33E-08	4.78E-10	5.00E-05	9.56E-06	1.47E-08	9.56E-11	1.60E+01	1.53E-09
Heptachlor	2.29E-02	7.33E-08	3.36E-10	5.00E-04	6.72E-07	1.47E-08	6.72E-11	4.50E+00	3.02E-10
alpha-Chlordane	1.29E-02	7.33E-08	1.89E-10	6.00E-05	3.16E-06	1.47E-08	3.79E-11	1.30E+00	4.92E-11
Semivolatile Organics									
1-Chloronaphthalene	2.70E-01	7.33E-08	3.96E-09	3.00E-02	1.32E-07	1.47E-08	7.92E-10		
3/4-Methylphenol	3.19E-01	7.33E-08	4.67E-09	5.00E-02	9.35E-08	1.47E-08	9.35E-10		
Benzo(a)anthracene	2.79E-01	7.33E-08	4.10E-09			1.47E-08	8.20E-10	7.30E-01	5.98E-10
Benzo(a)pyrene	2.65E-01	7.33E-08	3.89E-09			1.47E-08	7.78E-10	7.30E+00	5.68E-09
Benzo(b)fluoranthene	2.72E-01	7.33E-08	3.99E-09			1.47E-08	7.98E-10	7.30E-01	5.82E-10
Benzo(g,h,i)perylene	2.00E-01	7.33E-08	2.93E-09	3.00E-02	9.78E-08	1.47E-08	5.87E-10		
Benzoic acid	5.60E-02	7.33E-08	8.21E-10	4.00E+00	2.05E-10	1.47E-08	1.64E-10		
Chrysene	2.59E-01	7.33E-08	3.80E-09			1.47E-08	7.61E-10	7.30E-03	5.55E-12
Di-n-octyl phthalate	1.00E-01	7.33E-08	1.47E-09	2.00E-02	7.33E-08	1.47E-08	2.93E-10		
Dimethyl phthalate	1.60E-01	7.33E-08	2.35E-09	1.00E+01	2.35E-10	1.47E-08	4.69E-10		
Fluoranthene	2.95E-01	7.33E-08	4.32E-09	4.00E-02	1.08E-07	1.47E-08	8.65E-10		
Indeno(1,2,3-cd)pyrene	1.80E-01	7.33E-08	2.64E-09			1.47E-08	5.28E-10	7.30E-01	3.85E-10
Phenanthrene	2.98E-01	7.33E-08	4.38E-09	3.00E-02	1.46E-07	1.47E-08	8.75E-10		
Pyrene	3.05E-01	7.33E-08	4.47E-09	3.00E-02	1.49E-07	1.47E-08	8.95E-10		
bis(2-Ethylhexyl)phthalate	4.74E-01	7.33E-08	6.94E-09	2.00E-02	3.47E-07	1.47E-08	1.39E-09	1.40E-02	1.94E-11
Volatile Organics									
2-Butanone (MEK)	2.20E-03	7.33E-08	3.23E-11	6.00E-01	5.38E-11	1.47E-08	6.45E-12		
Acetone	1.67E-02	7.33E-08	2.45E-10	1.00E-01	2.45E-09	1.47E-08	4.91E-11		
Carbon disulfide	3.19E-03	7.33E-08	4.68E-11	1.00E-01	4.68E-10	1.47E-08	9.35E-12		
Chlorobenzene	1.70E-03	7.33E-08	2.49E-11	2.00E-02	1.25E-09	1.47E-08	4.99E-12		
Toluene	3.55E-03	7.33E-08	5.21E-11	2.00E-01	2.61E-10	1.47E-08	1.04E-11		
				HAZARD INDEX =	1.18E-04		TOTAL CANCER RISK =		9.96E-09

TABLE A-40

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 8,600 cm^2
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 1.0
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	4.10E+00	8.06E-09	3.31E-08	4.00E-04	8.27E-05	3.45E-09	1.42E-08		
Beryllium	5.44E-01	8.06E-09	4.38E-09	5.00E-03	8.77E-07	3.45E-09	1.88E-09	4.30E+00	8.08E-09
Cadmium	3.08E+01	8.06E-09	2.48E-07	1.00E-03	2.48E-04	3.45E-09	1.06E-07		
Cobalt	6.61E+00	8.06E-09	5.33E-08	6.00E-02	8.88E-07	3.45E-09	2.28E-08		
Mercury	1.13E-01	8.06E-09	9.12E-10	3.00E-04	3.04E-06	3.45E-09	3.91E-10		
Vanadium	2.14E+01	8.06E-09	1.73E-07	7.00E-03	2.47E-05	3.45E-09	7.40E-08		
PCBs/Pesticides									
Aldrin	8.93E-03	8.06E-08	7.20E-10	3.00E-05	2.40E-05	3.45E-08	3.08E-10	1.70E+01	5.24E-09
Aroclor 1254	2.16E-01	8.06E-08	1.74E-08	2.00E-05	8.71E-04	3.45E-08	7.46E-09		
Dieldrin	5.77E-02	8.06E-08	4.65E-09	5.00E-05	9.31E-05	3.45E-08	1.99E-09	1.60E+01	3.19E-08
Heptachlor	9.93E-02	8.06E-08	8.00E-09	5.00E-04	1.60E-05	3.45E-08	3.43E-09	4.50E+00	1.54E-08
alpha-Chlordane	3.00E-02	8.06E-08	2.42E-09	6.00E-05	4.03E-05	3.45E-08	1.04E-09	1.30E+00	1.35E-09
Semivolatile Organics									
1-Chloronaphthalene	2.70E-01	8.06E-08	2.18E-08	3.00E-02	7.26E-07	3.45E-08	9.33E-09		
3/4-Methylphenol	4.00E-01	8.06E-08	3.23E-08	5.00E-02	6.45E-07	3.45E-08	1.38E-08		
Benzo(a)anthracene	3.84E-01	8.06E-08	3.09E-08			3.45E-08	1.33E-08	7.30E-01	9.68E-09
Benzo(a)pyrene	3.98E-01	8.06E-08	3.21E-08			3.45E-08	1.38E-08	7.30E+00	1.00E-07
Benzo(b)fluoranthene	3.64E-01	8.06E-08	2.94E-08			3.45E-08	1.26E-08	7.30E-01	9.18E-09
Benzo(g,h,i)perylene	2.00E-01	8.06E-08	1.61E-08	3.00E-02	5.37E-07	3.45E-08	6.91E-09		
Benzoic acid	5.60E-02	8.06E-08	4.51E-09	4.00E+00	1.13E-09	3.45E-08	1.93E-09		
Chrysene	3.56E-01	8.06E-08	2.87E-08			3.45E-08	1.23E-08	7.30E-03	8.99E-11
Di-n-octyl phthalate	1.00E-01	8.06E-08	8.06E-09	2.00E-02	4.03E-07	3.45E-08	3.45E-09		
Dimethyl phthalate	1.60E-01	8.06E-08	1.29E-08	1.00E+01	1.29E-09	3.45E-08	5.53E-09		
Fluoranthene	4.96E-01	8.06E-08	4.00E-08	4.00E-02	1.00E-06	3.45E-08	1.71E-08		
Indeno(1,2,3-cd)pyrene	1.80E-01	8.06E-08	1.45E-08			3.45E-08	6.22E-09	7.30E-01	4.54E-09
Phenanthrene	3.96E-01	8.06E-08	3.19E-08	3.00E-02	1.06E-06	3.45E-08	1.37E-08		
Pyrene	3.90E-01	8.06E-08	3.14E-08	3.00E-02	1.05E-06	3.45E-08	1.35E-08		
bis(2-Ethylhexyl)phthalate	1.06E+00	8.06E-08	8.57E-08	2.00E-02	4.29E-06	3.45E-08	3.67E-08	1.40E-02	5.14E-10
Volatile Organics									
2-Butanone (MEK)	2.20E-03	8.06E-08	1.77E-10	6.00E-01	2.96E-10	3.45E-08	7.60E-11		
Acetone	2.03E-02	8.06E-08	1.63E-09	1.00E-01	1.63E-08	3.45E-08	7.00E-10		
Carbon disulfide	3.71E-03	8.06E-08	2.99E-10	1.00E-01	2.99E-09	3.45E-08	1.28E-10		
Chlorobenzene	1.70E-03	8.06E-08	1.37E-10	2.00E-02	6.85E-09	3.45E-08	5.87E-11		
Toluene	4.25E-03	8.06E-08	3.43E-10	2.00E-01	1.71E-09	3.45E-08	1.47E-10		
				HAZARD INDEX =	1.41E-03			TOTAL CANCER RISK =	1.86E-07

APPENDIX B - SUPPORTING TABLES

B1 First Quarter Second Year Sediment Results (0-6 inches)

B2 First Quarter Second Year Sediment Results (6-12 inches)

B3 First Quarter Second Year Sediment Results (greater than 12 inches)

B4 Second Quarter Second Year Sediment Results (0-6 inches)

B5 Second Quarter Second Year Sediment Results (6-12 inches)

B6 Second Quarter Second Year Sediment Results (greater than 12 inches)

B7 Third Quarter Second Year Sediment Results (0-6 inches)

B8 Third Quarter Second Year Sediment Results (6-12 inches)

B9 Third Quarter Second Year Sediment Results (greater than 12 inches)

B10 Fourth Quarter Second Year Sediment Results (0-6 inches)

B11 Fourth Quarter Second Year Sediment Results (6-12 inches)

B12 Fourth Quarter Second Year Sediment Results (greater than 12 inches)

B13 First Quarter Second Year Surface Water Results

B14 Second Quarter Second Year Surface Water Results

B15 Third Quarter Second Year Surface Water Results

B16 Fourth Quarter Second Year Surface Water Results

B17 Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

B18 Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Sediment Samples

B19 Statistical Evaluation of Analytes Tentatively Identified in Surface Water

B20 Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Surface Water

TABLE B-1
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek					
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06
Inorganics (mg/kg)																		
Aluminum	1770	2260	1110	999	1960	3320	2730	11300	2190	2090	5490	10300	13200	18100	21000	4350	1090	2110
Antimony				15.8							5.6							
Arsenic	3.5	2.7	3.8	1.2	0.9	2.2	1.4	5	1.9	1.3	3.7	1.9	2.3	5.2	5.2	1.7	1.9	2.7
Barium	216	1060	783	441	513	401	84.5	533	125	345	1490	819	451	483	347	194	3350	391
Beryllium	0.15					0.41	0.17	0.61	0.16	0.15	0.43	0.6	0.92	1	1.2	0.32		0.29
Cadmium	2	2.5	1.6	1.4	3.8	7.2	15	78.9	5	11	18		1.3	19.3	87.3	3.2	6.2	5.2
Calcium	125000	142000	127000	214000	158000	39900	115000	25600	96000	91600	54700	1170	19300	17100	7530	5270	117000	31800
Chromium	9.1	90.5	145	15.3	51	79.1	152	287	96.5	88.4	318	16.4	20.9	313	912	41.3	35.2	71.8
Cobalt	2.4	8.7	5.8	2.2	2.8	7.3	4.2	10.2	9.9	2.3	8.8	7.8	8.1	10.5	108	3.6	3.2	3.5
Copper	6.6	244	96.7	12.8	49.7	58.4	96.4	311	27.9	7.9	56.1	5.5	19.1	111	654	6.7	383	8.1
Iron	3980	17100	5080	5470	10500	7980	17200	14000	3430	3620	11200	17100	14900	17600	24900	8060	3420	7600
Lead	22.4	39.6	498	33.2	81	67.8	168	158	15.1	26.3	26.8	12.7	28.9	111	369	19.2	53.4	25
Magnesium	5790	5110	8530	8980	4860	2890	4280	4400	1690	4710	24100	1670	8590	5940	6430	1140	3180	3530
Manganese	254	151	232	463	337	284	159	206	270	251	1730	237	654	203	244	466	181	395
Mercury	0.72		0.067	0.16	0.58		0.17	0.29		0.13	0.11			0.12	1.5			
Molybdenum		19.7	9.1			5.1	2.1	10.4	5.3		1.9			8.8	39.4		11.2	4.4
Nickel	8.1	384	338	13.8	9.8	43.2	41.6	89.9	36.3	36.9	124	12.5	21.9	338	3690	23.8	65	26
Potassium	259			290	351		374	1740	513	371	774	1400	2080	2400	2830	583	147	363
Selenium			0.28					1.2	0.34					0.9	7.2			
Silver					3.4	1.8	2.8	9.7	0.56	1	5.9			11.7	112	2.2	1.9	1.7
Sodium											225		345				400	
Thallium		0.12		0.12		0.17							0.24	0.19	0.33	0.15		
Vanadium	8.5	9.7	11.7	9.3	19.9	21.1	12.3	36.8	10.7	7.7	21.6	27.6	24.2	43.6	75.4	17.7	6.2	13.9
Zinc	80.6	98.3	76.7	35.3	90.8	106	233	364	44.9	26.2	57.1	17.6	43.9	465	1920	34.9	42.5	40.1
PCBs & Pesticides (mg/kg)																		
4,4'-DDD								0.26										
Aldrin		0.81	0.25	0.01	0.018	0.023	3.7	0.35	0.0043	0.016	0.0057				0.036			
alpha-Chlordane							16	0.58	0.0052		0.065							
Aroclor 1254		39	11	0.24	0.66	1.5			0.15	0.21					2.8	0.088	4.2	2.2
delta-BHC							3.2											
Dieldrin							25	0.64			0.34							

TABLE B-1
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek					
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06
Heptachlor						0.011	7	0.42	0.0054	0.03	0.044							
Semivolatile Organics (mg/kg)																		
1,2-Dichlorobenzene																0.044		
1-Chloronaphthalene								0.39										
2-Chloronaphthalene								0.31										
2-Methylnaphthalene			0.46													0.042		
4,6-Dinitro-^2-methylphenol														17				
Acenaphthene	0.25		4.2		0.14	0.35	3.6							0.093		0.15		
Anthracene	0.67		9.7		0.33	0.59	11	0.61						0.37	0.33	0.16		
Benzidine															0.35		0.046	
Benzo(a)anthracene	2.8	0.53	15	0.24	1.6	1.7	26	3.1	0.08	0.045			0.054	2.2	1.6	0.52		0.3
Benzo(a)pyrene	2.4	0.42	12	0.23	1.3	1.5	26	3	0.087	0.047			0.069	1.9	2.1	0.48		0.21
Benzo(b)fluoranthene	5.7	1.7	21	0.52	2.2	2.8	49	6.5	0.16	0.094	0.096		0.12		3.7	0.79	0.04	0.4
Benzo(g,h,i)perylene	0.78	0.25	6.5	0.11	0.55		20	1.4	0.057					1.2	1.3	0.18		0.11
Benzo(k)fluoranthene																		0.21
bis(2-Ethylhexyl)phthalate	0.65	1.2	0.73	0.11	0.22	0.6	1.9	7.8	2.8		1.7			0.98	3.7	0.06	0.12	0.26
Butyl benzyl phthalate						0.23								0.068				0.11
Chrysene	2.3	0.8	14	0.3	1.8	1.9	33	4.3	0.15	0.086	0.093		0.077	2.7	2.5	0.63		0.4
Di-n-butyl phthalate													0.059	0.037				
Di-n-octyl phthalate	0.093							0.5	0.44	0.1								
Dibenz(a,h)anthracene			1.3		0.17	0.17									0.29	0.06		
Dibenzofuran	0.093		1.9			0.2	2.5									0.074		
Diethyl phthalate					0.12													
Dimethyl phthalate														0.3				
Fluoranthene	11	1	57	0.86	3	5.3	100	9	0.51	0.28	0.24		0.13	3.3	3.7	1.1		0.7
Fluorene	0.22		3.7		0.096	0.34	5.9	0.33						0.11		0.12		
Indeno(1,2,3-cd)pyrene	0.82	0.22	5.1	0.089	0.51	0.66	14	1.2	0.049					1.1	1.1	0.2		0.12
Naphthalene			2.2			0.35		2.5								0.11		
Phenanthrene	3.4	0.3	45	0.35	1.8	3.7	73	4.8	0.14	0.067			0.049	1.9	2.1	0.84		0.078
Pyrene	6.2	1.1	43	0.7	2.8	3.9	80	6.8	0.23	0.18	0.18		0.12	2.9	2.7	0.91		0.59
Volatile Organics (mg/kg)																		
2-Butanone (MEK)						0.0064		0.019						0.062				

TABLE B-1
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek					
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06
Acetone	0.0068	0.011	0.0063	0.0077		0.029	0.012	0.079	0.0082	0.012	0.016			0.12				
Carbon disulfide		0.0018	0.0041			0.0025				0.002				0.0025				
Chlorobenzene								0.18										
Methylene chloride	0.0031	0.0031	0.0033	0.0043	0.0045	0.005	0.0027	0.0039	0.0023	0.0027		0.0016	0.0034	0.0043	0.0041	0.0042	0.0031	0.0032
Siloxane												0.013						
Tetrachloroethene															0.089			
Toluene		0.0019					0.0064	0.0023					0.0014	0.015	0.0061	0.0021		
Trichloroethene															0.013			
Xylenes (total)								0.0022								0.0015		

TABLE B-2
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek							West Soldier Creek			
	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04
Inorganics (mg/kg)											
Aluminum	2600	3970	11200	1550	5090	5520	10400	15600	6790	21200	7110
Antimony							5.6				
Arsenic	2.7	2.1	4.5	1.9	1.6	5.1	2.8	2.2	0.88	8.7	2.5
Barium	416	207	408	180	260	807	379	404	125	610	316
Beryllium	0.18	0.3	0.59		0.34	0.48	0.59	1	0.54	1.4	0.45
Cadmium	4.6	16.4	97.6	4	11.7	34.9		0.56	1	306	12.8
Calcium	65500	107000	9120	66200	4730	29100	1310	22100	4280	8970	29400
Chromium	83.2	196	221	68.3	106	303	15.4	20.4	74.5	5140	146
Cobalt	4.8	5.4	10	6.1	4.1	11.2	5.9	9.4	4.5	105	15.6
Copper	41.9	41.2	155	64.9	8	100	4.7	21.3	12.4	1220	56
Iron	5280	7290	13400	3920	9030	27900	14700	16800	11800	24100	10600
Lead	184	130	94.7	13.7	20.6	82.3	13.2	27.3	19.6	616	87.7
Magnesium	3810	10900	2910	2030	1350	9740	1670	13100	3320	6960	2710
Manganese	176	182	155	186	126	1130	209	875	168	246	367
Mercury			0.16			0.2				1.1	
Molybdenum	3		2.6	4.3	3.6	5.9			1.7	136	7.1
Nickel	25.9	50.2	86.4	19.6	23	123	12.8	22.8	26.2	8790	180
Potassium	418	671	1530	376	970	758	1430	2720	1210	2820	941
Selenium			1	0.53						17.7	2
Silver		7	5.5	0.47	0.97	5.2			0.42	245	7.2
Sodium		234			196		207	392			
Thallium								0.22		0.26	
Vanadium	11.7	16.2	31.1	13.7	15.7	28.6	25.9	23.8	22.8	112	27
Zinc	88.1	111	174	83.4	21.6	113	17.3	39.2	40.7	2570	332
Pesticides and PCBs (mg/kg)											
Aldrin	0.022	2.5	0.055	0.0036	0.0012	0.039					
alpha-Chlordane		15	0.1	0.0035		0.029					
Aroclor 1254	0.84			0.098	0.061	0.69				19	0.38

TABLE B-2
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek							West Soldier Creek			
	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04
Dieldrin		18	0.47								
gamma-Chlordane			0.038								
Heptachlor	0.015	4.6	0.2	0.0028	0.012	0.061					
Semivolatile Organics (mg/kg)											
1-Chloronaphthalene			0.42			0.27					
2-Chloronaphthalene			0.6								
Acenaphthene	0.16	2	0.58								
Anthracene	0.41	11	0.63								0.058
Benzo(a)anthracene	1.3	21	1.9			0.53					0.35
Benzo(a)pyrene	1.1	19	1.8			0.44			0.046		0.38
Benzo(b)fluoranthene		33	2.4	0.055		0.79		0.041		0.18	
Benzo(g,h,i)perylene	0.47	11	1.2			0.2					0.2
Benzo(k)fluoranthene	2.1		1								0.8
bis(2-Ethylhexyl)phthalate	1	1.4	5.5	0.85	0.44	1.5			0.075	2	0.48
Chrysene	1.4	21	2.8	0.059		0.6				0.13	0.45
Di-n-octyl phthalate				0.056							
Dibenz(a,h)anthracene		2.1									
Dibenzofuran	0.11	1.6	0.21								
Fluoranthene	4.9	85	5.1	0.16	0.11	1.4		0.059	0.05	0.1	0.67
Fluorene	0.18	3.6	0.44								
Indeno(1,2,3-cd)pyrene	0.42	8.2	1.2			0.18					0.19
Naphthalene	0.091		1.1								
Phenanthrene	2.7	58	4			0.85					0.37
Pyrene	3.9	58	4.8	0.12		1.2		0.051		0.15	0.54
Volatile Organics (mg/kg)											
1,1,1-Trichloroethane		0.029									
1,1-Dichloroethane		0.0025									
2-Butanone (MEK)	0.011		0.099			0.0022					
Acetone	0.053	0.0084	0.054		0.027		0.017	0.015			0.0032

TABLE B-2
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek							West Soldier Creek			
	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04
Carbon disulfide	0.0029		0.0019	0.0014	0.0076	0.0015					
Carbon tetrachloride		0.0036									
Chlorobenzene			0.0039	0.0014							0.0023
Methylene chloride	0.0068	0.004	0.0032	0.0027	0.0035	0.0016	0.0016	0.0041		0.0055	0.0035
Tetrachloroethene										0.087	
Toluene	0.002	0.003			0.0013			0.0014	0.0021		0.0085
Trichloroethene										0.016	0.011
Xylenes (total)		0.0024									

TABLE B-3
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches (bgs)

	East Soldier Creek				West Soldier Creek		
	QE07 (3-4 feet)	QE09 (1-1.5 feet)	QE10 (1-2 feet)	TR01 (3-5 feet)	QW01 (1-2 feet)	QW03 (1-2 feet)	QW04 (2-3 feet)
Inorganics (mg/kg)							
Aluminum	5550	2500	5040	8100	20500	4020	4580
Antimony	0	0	0	6	0	0	0
Arsenic	1.6	3.3	1.4	4.2	0.79	1.6	3.4
Barium	201	603	299	663	77.4	149	361
Beryllium	0.39	0.18	0.29	0.43	1.6	0.37	0.26
Cadmium	30.2	14.8	0	0	0	7.3	66.4
Calcium	27600	87900	702	1130	17900	8220	7340
Chromium	239	342	9.2	12.8	21.4	105	1110
Cobalt	5.6	5.9	3.1	5.5	14.3	7.9	17.9
Copper	51.7	141	4.1	4.5	42.4	34.9	56.1
Iron	10500	5830	9350	12700	21800	9870	7400
Lead	50.8	36.2	12.4	12.7	17.9	23.1	112
Magnesium	3330	2170	951	1290	18700	2750	1320
Manganese	200	728	163	151	902	328	960
Mercury	0	0.076	0	0	0	0.067	0
Molybdenum	0	4.5	0	0	0	3.7	56.3
Nickel	57.6	53.2	7.4	8.6	36.8	292	290
Potassium	807	485	918	1280	4370	760	579
Selenium	0	1	0	0	0	0.49	0.36
Silver	1.4	3.1	0	0	0	13.9	38.3
Sodium	169	0	176	229	937	0	0
Thallium	0	0	0	0	0.25	0.13	0.15
Vanadium	15.8	19.5	16.2	21	24	18.8	15.6
Zinc	123	156	11.3	14.8	45.8	99.1	247
PCBs & Pesticides (mg/kg)							
Aldrin	0	0.0017	0	0	0	0	0.013
alpha-Chlordane	4.5	0	0	0	0	0	0
Aroclor 1254	0	0.16	0	0	0	2.2	0.42
Dieldrin	5.3	0	0	0	0	0	0
gamma-Chlordane	0	0.0027	0	0	0	0	0
Heptachlor	1.6	0.008	0	0	0	0	0
Semivolatile Organics (mgkg)							
1-Naphthylamine	0	0	0	0	0	0	0.56
2-Chloronaphthalene	0.25	0	0	0	0	0	0
2-Methylnaphthalene	0	0	0	0	0	0	0.6
Acenaphthene	0.081	0	0	0	0	0	0
Acenaphthylene	0	0	0	0	0	0	0.31
Anthracene	0.25	0	0	0	0	0	0.53
Benzo(a)anthracene	1.4	0	0	0	0	0.1	1.9
Benzo(a)pyrene	1.2	0	0	0	0	0.15	1.9
Benzo(b)fluoranthene	2.5	0.19	0	0	0	0	3.1

TABLE B-3
FIRST QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches (bgs)

	East Soldier Creek				West Soldier Creek		
	QE07 (3-4 feet)	QE09 (1-1.5 feet)	QE10 (1-2 feet)	TR01 (3-5 feet)	QW01 (1-2 feet)	QW03 (1-2 feet)	QW04 (2-3 feet)
Benzo(g,h,i)perylene	0.49	0	0	0	0	0.074	1.2
Benzo(k)fluoranthene	0	0	0	0	0	0.31	0
bis(2-Ethylhexyl)phthalate	1.1	15	0	0	0	1.1	22
Butyl benzyl phthalate	0.06	0	0	0	0	0	0
Chrysene	1.5	0.2	0	0	0	0.17	2.8
Di-n-octyl phthalate	0	3.8	0	0	0	0	0
Dibenz(a,h)anthracene	0.12	0	0	0	0	0	0
Dibenzofuran	0.061	0	0	0	0	0	0.31
Fluoranthene	3	1.4	0	0	0	0.21	2
Fluorene	0.11	0	0	0	0	0	0
Indeno(1,2,3-cd)pyrene	0.46	0	0	0	0	0.065	1.1
Naphthalene	0.19	0	0	0	0	0	0.51
Phenanthrene	1.8	0	0	0	0	0.1	2
Pyrene	2.2	0.24	0	0	0	0.24	3.2
Volatile Organics (mg/kg)							
1,1,1-Trichloroethane	0.026	0	0	0	0	0	0
2-Butanone (MEK)	0	0.12	0	0	0	0	0.013
Acetone	0.013	0.082	0.016	0.014	0.0047	0.0025	0.06
Carbon disulfide	0	0.0052	0	0	0	0	0.0094
Carbon tetrachloride	0.0031	0	0	0	0	0	0
Chlorobenzene	0	0.073	0	0	0	0	0.0043
Methylene chloride	0.0036	0.0036	0.0026	0.002	0.0027	0.0024	0.0034
Tetrachloroethene	0	0	0	0	0	0.0042	0
Toluene	0	0.0023	0	0	0	0.0045	0.0043
Trichloroethene	0	0	0	0	0	0	0.0075
Xylenes (total)	0	0.0018	0	0	0	0	0

TABLE B-4
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek											West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Inorganics (mg/kg)																		
Aluminum	5930	1740	1500	6530	797	6390	7400	4440	3080	2770	17000	13900	11700	15300	3310	3010	989	6130
Arsenic	1	10.5	7.7	1.2	1.1	4.3	0.97	2.4	1.8	2.2	4.8	1.9	2.5	4.8	1.3	2.1	1.8	3.9
Barium	633	1070	2440	497	197	524	275	245	371	1200	750	312	521	366	135	533	914	185
Beryllium	0.31			0.39		0.46	0.48	0.37		0.27	1.2	0.89	0.75	1.1				0.38
Cadmium		3.6	19.9		1.8	14.4	79.4	14.7	50.7	8	7	1.6	4.8	85.1	4.1	9.8	16.6	
Calcium	16900	118000	46500	1620	231000	23700	11700	12600	35700	23500	4590	12300	10800	15700	2560	107000	17900	28500
Chromium	22.3	274	2920	18.7	29.2	206	308	105	1190	96.4	66.2	24.9	53.4	1790	56.3	95.6	139	13.6
Cobalt	4.9	13.1	11.7	5.2	1.4	9.4	35.9	4.5	7.7	4.9	12.2	9.8	9.3	51.8	5.5	7.4	3.5	7.2
Copper	13.3	551	537	9	18.4	349	94	220	44.8	8.6	21.7	21.1	26.1	242	6.3	13.6	5.3	7.6
Iron	10000	10100	8250	14200	4770	11700	10700	6810	8560	9640	26700	16300	15700	19500	4970	13800	3680	9800
Lead	21.1	167	291	6.8	8.6	119	115	39.6	47.8	12.7	25.4	24.4	70.7	217	15.1	21.3	9.3	12.8
Magnesium	2450	5330	6930	1670	4770	3870	2810	2070	3250	12400	3450	8060	4590	5860	1320	9220	7500	1410
Manganese	580	121	147	154	210	260	148	91.2	394	857	371	727	346	253	255	604	332	398
Mercury	0.27	0.57	4.7	0.059	3	0.55	0.18	0.46	0.17	0.12	0.26			0.11				
Molybdenum		135	37.6			8.1	7	7.2	3.7				6.8	25.4		4.1		
Nickel	26	444	202	11.2	6.9	69	114	34.9	269	30.8	29.2	25.2	56.8	3600	26.5	36.6	32.2	6.8
Potassium	655	287	225	910		911	971	628	400	422	2780	2370	1440	1970	448	502	166	732
Selenium		3.1	6.2			0.43		0.24		0.26				2.8				
Silver		2.5	3.7			2.6	8.5	2	9.1	1.7			1.7	131	2.2	15.5	1.5	
Vanadium	11.7	70.3	105	19.9	11.5	32.8	22.4	19.6	16.4	13	44.2	22.5	30.2	121	10.3	16.6	11.9	23.4
Zinc	36.6	248	339	16.1	34.9	216	153	174	68.4	22.9	58.6	46.2	110	973	32.3	234	1670	29.4
PCBs & Pesticides (mg/kg)																		
4,4'-DDE											0.89							
alpha-Chlordane							0.48											
Aroclor 1254	0.058	8.4	15	0.028	0.7	0.52		1.6	0.31	0.17			0.2	10	0.19	6	0.57	
Dieldrin											0.89							
Heptachlor						0.012	0.6	0.056	0.0091									
Semivolatile Organics (mg/kg)																		
1,2-Dichlorobenzene			3															
1,4-Dichlorobenzene			2.4						0.25									

TABLE B-4
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek											West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
1-Chloronaphthalene							1.5											
2-Methylnaphthalene			4		0.048													
3-Methylcholanthrene			1.3															
3/4-Methylphenol										0.44	0.1							
Acenaphthene	0.088	0.37	17		0.32	0.22	0.33	0.45										
Anthracene	0.21	0.68	36		0.53	0.5	0.95	1.4										
Benzo(a)anthracene	0.64	2.6	59		1.1	2.2	2.1	4.6	0.39				0.072	0.61	0.13			
Benzo(a)pyrene	0.67	3	45		0.91	1.9	2.1	5	0.34	0.045			0.091	0.88	0.2			
Benzo(b)fluoranthene	1.5	4.9	83		1.7	3.7	4	9.6	0.74	0.085	0.14		0.18	1.9	0.35	0.05		0.051
Benzo(g,h,i)perylene	0.35	1.4	19		0.43	1.2	1.1	3.2	0.23				0.077	0.75	0.16			
Benzoic acid										0.056								
Benzyl alcohol																0.079		
bis(2-Ethylhexyl)phthalate	0.6	4.2	4.4		0.26	6.9	9.2	3	11	0.26	0.18			1.2	0.16	0.19	0.27	0.097
Chrysene	0.98	3.3	57		1.2	2.7	2.7	5.7	0.53	0.058			0.096	0.91	0.19			
Di-n-octyl phthalate						0.37	1.4											
Dibenz(a,h)anthracene	0.097	0.42	6		0.14	0.35	0.33	0.77										
Dibenzofuran	0.048		11		0.15													
Dimethyl phthalate										0.086								
Fluoranthene	2	7.3	120		2.7	5.7	6.5	14	5.3	0.14	0.17		0.19	1.5	0.37	0.061	0.061	0.055
Fluorene	0.11	0.34	23		0.31	0.32	0.47	0.7										
Indeno(1,2,3-cd)pyrene	0.31	1.4	20		0.43	1.1	1.1	2.9					0.064	0.65	0.14			
Naphthalene			15		0.06		0.41											
Phenanthrene	1.2	3.4	110		2.2	2.8	4	8.1	0.4				0.1	0.86	0.24			
Pyrene	1.8	6.2	110		2.5	5.7	5.7	10	1	0.1	0.15		0.2	1.7	0.34	0.092		0.048
Volatile Organics (mg/kg)																		
2-Butanone (MEK)						0.013		0.015			0.025							
Acetone	0.013	0.028	0.064	0.01	0.0086	0.046	0.082	0.063	0.2	0.029	0.15		0.019	0.029	0.016	0.013	0.0066	0.024
Carbon disulfide		0.0044																
Chlorobenzene						0.1			0.24									
Methylene chloride					0.0014			0.0019	0.021	0.0015	0.0045	0.0016	0.0022	0.0037	0.0026	0.002	0.0022	0.0017
Tetrachloroethene														0.011				

TABLE B-4
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek											West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Toluene									0.063	0.0021	0.012							
Trichloroethene														0.0026	0.0038			
Xylenes (total)						0.0026												

TABLE B-5
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek					West Soldier Creek				
	QE06	QE07	QE08	QE09	QE11	QW01	QW02	QW03	QW04	QW07
Inorganics (mg/kg)										
Aluminum	6640	7260	9380	1340	5860	5240	8050	9490	6210	5460
Arsenic	2.4	2.7	3.2	1.1	2.2	0.36	2.3	2.8	1.6	1.3
Barium	464	321	620	176	519	99.4	387	250	219	133
Beryllium	0.49	0.48	0.72		0.64	0.34	0.63	0.48	0.33	0.39
Cadmium	36.7	120	103	14	1.5		1.1	39.6	12.6	
Calcium	11600	34000	9070	54700	1420	14400	15300	17100	8610	5340
Chromium	368	485	977	156	44	14.8	26.8	803	123	11
Cobalt	8.1	80.4	10.2	4.2	8.2	5.5	7.5	35.4	14.2	3
Copper	108	172	63.9	24.8	4.5	7.8	11	181	37.7	3.5
Iron	10200	10300	15500	3770	11600	12300	14900	12800	8460	7750
Lead	121	187	104		6.5	8.2	21.4	135	41.9	5.7
Magnesium	3030	3660	3460	1150	1830	9590	6340	4500	2460	994
Manganese	264	202	466	163	119	653	582	216	308	169
Mercury	0.45	0.5	0.44	0.24	0.097			0.44		
Molybdenum	5.3	10	4.3	3				28	3.5	
Nickel	84.5	211	186	34.4	22.1	11.4	17.8	1790	115	6.2
Potassium	951	802	1230	234	940	1090	1070	1380	902	683
Selenium	0.25	0.64						1.3		
Silver	4.7	13.7	9.7	2.7				80	8	
Vanadium	24.5	25.9	39	7.2	19.8	21.8	31.9	48.7	21.1	14.9
Zinc	140	260	118	37.2	18.9	17.5	42.7	557	211	14.1
PCBs & Pesticides (mg/kg)										
alpha-Chlordane		0.25								
Aroclor 1254	0.79		0.76	0.24	0.14			86	0.38	
Heptachlor	0.057	0.39	0.1	0.019						
Semivolatile Organics (mg/kg)										
1-Chloronaphthalene		2.6	0.56							
2-Chloronaphthalene			0.31							

TABLE B-5
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek					West Soldier Creek				
	QE06	QE07	QE08	QE09	QE11	QW01	QW02	QW03	QW04	QW07
3/4-Methylphenol									0.06	
Acenaphthene		0.5								
Anthracene	0.36	2.4						0.13		
Benzo(a)anthracene	1.3	6.2	0.38	0.42				0.7	0.12	
Benzo(a)pyrene	1.5	4.7	0.37	0.41				0.93	0.21	
Benzo(b)fluoranthene	2.6	8.3	0.6	0.87			0.077	1.7	0.39	
Benzo(g,h,i)perylene	0.71	2						0.9	0.18	
Benzo(k)fluoranthene			0.25							
Benzoic acid								0.069		
bis(2-Ethylhexyl)phthalate	3.5	24	5	3.8	2.5			1.4	0.27	
Chrysene	1.8	5.9	0.5	0.7				1.1	0.19	
Di-n-octyl phthalate		8.9								
Dibenz(a,h)anthracene		0.57								
Dibenzofuran		0.36								
Dimethyl phthalate	0.28									
Fluoranthene	4.1	14	3.1	2.7			0.081	1.7	0.33	
Fluorene		0.82								
Indeno(1,2,3-cd)pyrene	0.68	1.9						0.83	0.16	
Naphthalene		0.69								
Phenanthrene	2.2	7.1	0.76	1.6			0.046	1.2	0.19	
Pyrene	3.6	14	0.9	1.3			0.082	2.4	0.34	
Volatile Organics (mg/kg)										
2-Butanone (MEK)		0.0079								
Acetone	0.07	0.034		0.058	0.014	0.0062	0.0087	0.039	0.017	0.015
Chlorobenzene	0.22		2.5	0.088						
Methylene chloride	0.0039	0.0037			0.0023	0.0016	0.0017	0.0043	0.0035	
Tetrachloroethene								0.0073		
Toluene				0.15	0.013					
Trichloroethene								0.0024		

TABLE B-6
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek		West Soldier Creek	
	QE06 (2.5-3 feet)	QE09 (2.5-3 feet)	QW04 (2.5-3 feet)	QW07 (2-2.5 feet)
Inorganics (mg/kg)				
Aluminum	6520	1400	4500	5260
Arsenic	4	1.2	1.5	1.9
Barium	550	225	157	127
Beryllium	0.41		0.31	0.44
Cadmium	19.4	18.9	9.3	
Calcium	23900	40300	3500	3380
Chromium	225	493	76.8	13.3
Cobalt	8.3	2.7	9.2	3.4
Copper	303	15.3	28.1	2.9
Iron	11700	4710	6380	8760
Lead	95.4	32.2	22.9	8.1
Magnesium	4000	1350	1740	1410
Manganese	247	317	266	164
Mercury	0.48	0.23		
Molybdenum	13.2		3.3	
Nickel	68.3	83.6	87.8	6
Potassium	919	195	610	718
Selenium	0.58		0.61	
Silver	4.1	6.7	5.2	
Vanadium	35.5	9.7	17.6	14.9
Zinc	237	31.3	138	12.2
PCBs & Pesticides (mg/kg)				
Aroclor 1254	0.59	0.16	0.31	
Heptachlor	0.15	0.021		
Semivolatile Organics (mg/kg)				
1,4-Dichlorobenzene	0.14			
1-Chloronaphthalene	0.37			
2-Chloronaphthalene		0.073		
3/4-Methylphenol		0.11		
Acenaphthene	0.16			
Anthracene	0.34			
Benzo(a)anthracene	1.7	0.08	0.12	
Benzo(a)pyrene	1.8	0.084	0.37	
Benzo(b)fluoranthene	3.2	0.19	0.54	
Benzo(g,h,i)perylene	1.1	0.048	0.36	
bis(2-Ethylhexyl)phthalate	4.4	1.3	0.83	
Chrysene	2.2	0.11	0.23	
Di-n-butyl phthalate	0.12			
Di-n-octyl phthalate	0.14	0.09	0.12	
Dibenz(a,h)anthracene	0.25		0.087	
Fluoranthene	3.8	0.89	0.25	

TABLE B-6
SECOND QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek		West Soldier Creek	
	QE06	**QE09**	**QW04**	**QW07**
Fluorene	0.19			
Indeno(1,2,3-cd)pyrene	0.94	0.042	0.31	
Naphthalene	0.2			
Phenanthrene	2	0.093	0.16	
Pyrene	4.4	0.24	0.32	
Volatile Organics (mg/kg)				
2-Butanone (MEK)	0.021			
Acetone	0.069	0.12	0.0065	0.024
Chlorobenzene	0.18	0.57		
Methylene chloride	0.0021		0.0027	0.0021
Toluene		0.71		
Trichloroethene			0.0028	
Xylenes (total)	0.0017			
	0.18	0.71	0.0065	0.024

TABLE B-7
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Inorganics (mg/kg)																			
Aluminum	1620	2220	1700	13700	2080	11400	11200	16700	763	9050	4980	8350	14600	14700	13300	11000	946	2740	10700
Antimony						6.5	6.1						5.9		7.9			5.8	
Arsenic	1.9	6.2	5	1.2	1.6	4.6	1.9	5.2	0.61	1.4	2.4	2.7	1.8	1.4	1.9	4	1.9	1.8	6.4
Barium	785	720	670	1330	675	740	819	698	97.2	273	448	527	246	445	221	524	1110	1240	554
Beryllium	0.2	0.19	0.13	0.8		0.69	0.67	1		0.6	0.5	0.54	0.87	0.8	0.65	0.52		0.33	0.79
Cadmium	2.6	7.9	2.9		2.5	27.4	390	33.3	9.9		1.4			7.2	9.2	190	7.4	2.5	
Calcium	92100	74400	68900	9390	140000	20900	5780	34400	7400	1510	4120	1130	14100	33000	30100	12300	84400	42100	3980
Chromium	18.1	232	451	26.1	48	412	1230	261	54.4	15.3	23.9	13.4	20.2	112	118	2230	67.4	84.6	18.9
Cobalt	2.4	33.9	11.5	7.5	4.4	11.3	13.5	12.5	1.4	5.1	4.3	6	7.1	8.7	26	109	3.4	8.2	6.5
Copper	15	304	241	13.3	46.3	251	86	467	8	10.2	4.7	3.7	16.4	32.3	85.7	92.5	6.7	11.9	11.6
Iron	3060	9090	6880	16900	14600	14600	13500	20200	1880	11600	13700	14300	15200	15100	13900	15000	2480	7430	20100
Lead	27.7	261	1050	12.3	47.9	230	212	106	12.8	11.4	8.4	6.1	17.4	60.3	60.9	434	117	18.7	11.5
Magnesium	6790	5300	4070	3210	17300	5010	2890	6090	552	1580	2910	1270	5590	4810	4970	3390	5440	5700	2170
Manganese	141	389	185	236	243	302	463	271	102	177	247	183	480	225	198	4140	224	1780	313
Mercury	0.26	0.9	0.43		0.082	0.5	0.31	0.46						0.48	0.23	0.076			
Molybdenum		32.6	12.8	8.3		8.4	4.1	14		2.6				5.6	3.9	30.1			
Nickel	12.4	518	321	15.6	19.5	90.2	778	84.6	9.1	12.2	14.7	9.8	18.8	164	239	424	47.1	32.8	14.1
Potassium	168	330	274	1850	475	1720	1740	2530	108	1190	761	1170	2280	2140	2400	1420		531	953
Selenium		0.33	0.44			0.93		0.32							0.41	0.46	0.48		
Silver		5.8	2.9			6.8	22.8	6						3.2	12.6	102	4.1		
Sodium							270												
Thallium		54.9	62.6																
Vanadium	7.8	23.2	17.5	29.8	15.5	35.8	19.8	46.3	3.8	23.7	24.9	22.4	24.7	31.5	30.1	17.6	5.5	15.8	33.3
Zinc	77.4	219	131	25.9	361	245	254	425	21.3	17.3	12.4	14	43.3	147	442	366	53	42.3	23
PCBs & Pesticides (mg/kg)																			
4,4'-DDE									0.072										
alpha-Chlordane									0.014		0.12								
Aroclor 1254	0.13	20	8.1	0.047	0.42	1		1.1						0.2	6.1	3.1	2.5	1.8	
Dieldrin							0.89		0.027		0.2								
Heptachlor						0.03	0.31	0.097	0.057		0.25								
Semivolatile Organics (mg/kg)																			
1,2,4-Trichlorobenzene																0.14			

TABLE B-7
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
1,2-Dichlorobenzene																1.6			
1,3-Dichlorobenzene																0.15			
1,4-Dichlorobenzene																0.25			
1-Chloronaphthalene							0.26												
2,4-Dimethylphenol																0.18			
2-Methylnaphthalene		0.46					0.11												
Acenaphthene		1.9	0.42				0.18	0.99					0.21	0.081		0.37			
Anthracene	0.23	3.3	0.84			0.41	0.22	3.6					0.33	0.15	0.085	0.58			
Benzo(a)anthracene	0.71	8.6	3.5		0.18	2.2	1	11	0.09				1	0.87	0.53	3.4		0.086	
Benzo(a)pyrene	0.6	7.3	3		0.17	2.1	1	10	0.083				0.84	0.96	0.66	3.6		0.075	
Benzo(b)fluoranthene	1	12	5.9		0.36	4.2	2	20	0.14				1.5	1.9	1.3	7	0.067	0.12	0.045
Benzo(g,h,i)perylene	0.34	3.9	1.8		0.092	1.2	0.56	5.4	0.056				0.57	0.64	0.59	2.8		0.059	
Benzo(k)fluoranthene	0.41																		
Benzoic acid					0.05														
bis(2-Ethylhexyl)phthalate	0.56	3.9	3.9	0.067	0.27	5.2	2.1	6.5	0.62	0.086	0.44	0.059	0.066	0.47	0.86	1.4	0.18	0.51	0.067
Chrysene	0.86	8.6	3.8		0.24	2.6	1.4	12	0.12				1	1	0.74	4.1		0.098	
Di-n-butyl phthalate														0.054					
Dibenz(a,h)anthracene	0.087	0.97	0.46			0.29	0.13	1.1					0.13	0.15	0.12	0.59			
Dibenzofuran		1.2	0.23				0.12						0.075	0.072		0.25			
Fluoranthene	1.8	21	5.8	0.1	0.48	4.8	3.3	35	0.28		0.046		2.3	1.8	1.1	7.6	0.059	0.21	0.063
Fluorene	0.099	1.7	0.36				0.19	1.6					0.16	0.075		0.32			
Indeno(1,2,3-cd)pyrene	0.33	3.6	1.7		0.087	1	0.51	4.7	0.043				0.5	0.55	0.51	2.4		0.047	
N-Nitrosodiphenylamine									0.047										
Naphthalene		2.1	0.2				2.2						0.1	0.11		0.32			
Phenanthrene	1.1	18	4		0.2	2.3	2.3	18	0.082				1.7	1.3	0.57	5.7		0.056	
Pyrene	1.6	18	7.9	0.082	0.52	5.5	2.8	27	0.21				1.9	2.2	1.4	8.4	0.069	0.17	
Volatile Organics (mg/kg)																			
1,1,1-Trichloroethane			0.0026																
1,1-Dichloroethane			0.0017																
2-Butanone (MEK)		0.016				0.043		0.25											
Acetone		0.046	0.026	0.012		0.059	0.017	0.74	0.015	0.014	0.016	0.017		0.012					0.0077
Carbon disulfide		0.0015	0.0032	0.0017															
Chlorobenzene						0.013		0.095											

TABLE B-7
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Ethylbenzene								0.018											
Methylene chloride							0.025				0.0016	0.0017	0.0012	0.0028	0.0029	0.003	0.0028	0.0021	0.0023
Tetrachloroethene		0.002													0.0021				
Toluene								0.76											

TABLE B-8
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek								West Soldier Creek			
	QE02	QE03	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW03	QW04	QW07
Inorganics (mg/kg)												
Aluminum	3570	2620	8770	10300	15400	1010	6660	4050	4240	3050	12300	9810
Arsenic	4.6	3.2	2.6	1.2	5.1	0.65	1.8	2.6	0.82	1.1	2.6	6.1
Barium	989	913	529	552	587	84	290	742	104	91.4	487	1270
Beryllium	0.24	0.17	0.55	0.59	0.78		0.52	0.28			0.59	0.75
Cadmium	4.4	3.9	21.8	158	141	17.5		1.2	0.65	6	10.1	
Calcium	69600	94300	14000	2190	17700	9500	1240	15800	9430	3520	10600	2200
Chromium	355	241	291	675	1460	70.5	9.3	18	20.1	43.4	134	18.3
Cobalt	12.2	11.3	8.9	8.7	20.1	2.5	7.1	3.5	3.1	4.1	12.2	7.2
Copper	158	217	124	125	198	9.5	6	3.5	4.9	17.9	18.2	9.3
Iron	8700	8410	11700	12300	17800	5360	10200	9450	7370	4060	14800	17300
Lead	170	120	139	81.6	137	14.6	7.8	8.3	12.7	36.7	44.9	10.5
Magnesium	5130	15000	4120	2360	4090	1250	1250	3430	1830	1340	3590	2090
Manganese	352	267	470	273	639	158	226	282	81.9	63.5	792	853
Mercury	0.67	0.63	0.42	0.2	0.64	0.11			0.056	0.14		
Molybdenum	21	11.9	4.1		9.9					3.5	7.7	
Nickel	220	149	74	431	419	13.7	8.9	11.6	24.8	65.7	43.8	15.5
Potassium	532	382	1330	1610	2450	138	929	635	793	553	1910	846
Selenium	0.54	0.37	0.33	0.26	0.37	0.2				0.25	0.44	
Silver	2		5.2	11.6	19.1						4	
Sodium			296									
Thallium	51.4											
Vanadium	18.4	18.9	27.2	17.4	31.7	9.3	17.9	20.7	13	9.8	24.9	31.1
Zinc	151	130	199	97.3	209	21.8	12.7	12.1	28.1	117	63.4	21.6
PCBs & Pesticides (mg/kg)												
4,4'-DDE						0.063						
alpha-Chlordane				0.098								
Aroclor 1254	9.5	7.4	0.48		1.8				0.072	51	0.14	
Dieldrin				0.28		0.022						

TABLE B-8
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek								West Soldier Creek			
	QE02	QE03	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW03	QW04	QW07
Heptachlor			0.033	0.14	0.19	0.026						
Semivolatile Organics (mg/kg)												
1,2,4-Trichlorobenzene											0.051	
1,2-Dichlorobenzene											0.67	
1,3-Dichlorobenzene					1.8						0.071	
1,4-Dichlorobenzene					4.1						0.13	
1-Chloronaphthalene				0.47								
2-Chloronaphthalene					2.1							
2-Methylnaphthalene	1.6	0.17		0.13	10						0.045	
3-Methylcholanthrene	1											
Acenaphthene	15	0.59		0.26							0.16	
Anthracene	29	1	0.24	0.26							0.22	
Benzo(a)anthracene	46	6.8	1.1	1.3	1.3	0.13			0.097	0.23	1.1	
Benzo(a)pyrene	35	5.6	1	1.4	1.1	0.12			0.096	0.31	1	
Benzo(b)fluoranthene	43	11	2	2.8	2.2	0.22			0.18	0.65	1.8	
Benzo(g,h,i)perylene	16	3.3	0.63	0.75		0.058			0.075	0.4	0.66	
Benzo(k)fluoranthene	23											
bis(2-Ethylhexyl)phthalate	5.2	6.6	3.5	2.3	22	0.38	0.076	0.054	0.12	0.93	0.14	0.051
Chrysene	42	6.6	1.3	1.8	1.8	0.15			0.11	0.34	1.2	
Di-n-octyl phthalate			0.21									
Dibenz(a,h)anthracene	4.1	0.78		0.19							0.16	
Dibenzofuran	8	0.28		0.21							0.11	
Dimethyl phthalate							0.16					
Fluoranthene	120	11	2.9	4.4	16	0.38		0.043	0.21	0.7	2.3	
Fluorene	16	0.47		0.25							0.15	
Indeno(1,2,3-cd)pyrene	15	3	0.52	0.73		0.051			0.063	0.35	0.6	
Naphthalene	4	0.32		3.5	4.1						0.15	
Phenanthrene	110	5.6	1.7	3.1	2.5	0.15			0.12	0.38	2	
Pyrene	88	14	2.7	3.7	3.5	0.28			0.17	0.62	2.3	

TABLE B-8
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek								West Soldier Creek			
	QE02	QE03	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW03	QW04	QW07
Volatile Organics (mg/kg)												
2-Butanone (MEK)			0.019			0.013						
Acetone	0.045	0.026	0.062	0.018		0.026	0.014	0.018	0.0038			0.0064
Carbon disulfide	0.0016	0.0027										
Chlorobenzene			0.013		25							
Ethylbenzene					0.42							
Methylene chloride			0.0014	0.024					0.0014	0.0023	0.0024	
Tetrachloroethene										0.012		
Toluene			0.0031									
Trichloroethene										0.0037		
Xylenes (total)					0.77							

TABLE B-9
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek					West Soldier Creek	
	QE06 (3-3.5 feet)	QE07 (3-3.5 feet)	QE09 (3-4 feet)	QE10 (3-3.5 feet)	QE11 (1-2 feet)	QW04 (2-2.5 feet)	QW07 (2-2.5 feet)
Inorganics (mg/kg)							
Aluminum	7800	6750	6290	6440	4700	12600	9320
Arsenic	2.4	0.77	2.1	1.6	4.2	2.1	9.6
Barium	559	414	391	348	343	524	1140
Beryllium	0.5	0.37	0.47	0.57	0.39	0.67	0.9
Cadmium	19	9	11.2		5.5	11.3	
Calcium	9860	934	2630	1400	1290	13900	2560
Chromium	243	46.6	97.4	11.5	118	147	21.2
Cobalt	7.8	4.9	5.2	7.3	6.4	15.2	13.2
Copper	105	7.7	7.4	7.4	4.4	20.6	11.4
Iron	11800	10900	10300	10700	12700	15700	26100
Lead	142	9.5	12.4	10.9	14.2	52.8	22.9
Magnesium	3080	1930	1290	1400	1390	4120	2640
Manganese	322	443	221	486	334	890	1170
Mercury	0.16						
Molybdenum	2.4					4.3	
Nickel	55.2	48.1	13.5	9.9	22.5	49.9	17.7
Potassium	1060	1150	973	975	705	2540	853
Selenium	0.29						
Silver	3.1	0.9			1.5	3.6	
Sodium		237					
Vanadium	25.6	14.9	18.8	20.6	20.9	25.4	43.9
Zinc	131	19.2	24.9	15.2	15.3	60.8	26.9
PCBs & Pesticides (mg/kg)							
4,4'-DDE			0.013				
alpha-Chlordane			0.0016				
Aroclor 1254	0.3					0.1	
Dieldrin			0.0062				

TABLE B-9
THIRD QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek					West Soldier Creek	
	QE06 (3-3.5 feet)	QE07 (3-3.5 feet)	QE09 (3-4 feet)	QE10 (3-3.5 feet)	QE11 (1-2 feet)	QW04 (2-2.5 feet)	QW07 (2-2.5 feet)
Heptachlor		0.016					
Semivolatile Organics (mg/kg)							
1,2,4-Trichlorobenzene						0.086	
1,2-Dichlorobenzene						1.7	
1,3-Dichlorobenzene						0.15	
1,4-Dichlorobenzene						0.3	
Anthracene	0.093						
Benzo(a)anthracene	0.56					0.26	
Benzo(a)pyrene	0.56					0.33	
Benzo(b)fluoranthene	1.1					0.57	
Benzo(g,h,i)perylene	0.39					0.32	
bis(2-Ethylhexyl)phthalate	0.89	0.053	0.21	0.057	0.071	0.078	
Chrysene	0.61					0.34	
Di-n-butyl phthalate	0.17						
Dibenz(a,h)anthracene						0.065	
Fluoranthene	1.3		0.04			0.54	
Indeno(1,2,3-cd)pyrene	0.31					0.25	
Phenanthrene	0.81					0.22	
Pyrene	1.5					0.45	
Volatile Organics (mg/kg)							
2-Butanone (MEK)	0.019						
Acetone	0.065	0.0044	0.026	0.0088	0.023	0.0032	
Chlorobenzene	0.018		0.0086		0.0016	0.0023	
Methylene chloride	0.0015				0.0015	0.0025	0.0021

TABLE B-10
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek											West Soldier Creek							
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Inorganics (mg/kg)																			
Aluminum	5350	4380	3430	7400	3160	3080	1050	2610	755	8810	8760	10300	23400	15200	13800	16200	2810	5580	8570
Antimony																		17.3	
Arsenic	4.9	13.2	9.5	2.3	0.95	3.6	0.45	1.4	0.55	1.9	2.3	2.4	2.6	4.1	2.7	6.6	4.4	1.5	3.8
Barium	1010	1840	668	817	400	377	363	289	71	271	316	490	537	261	869	707	665	1370	193
Beryllium	0.41	0.44		0.53	0.48	0.53	0.3	0.48		0.49	0.56	0.65	1.5	0.91	1.1	1.1			0.59
Cadmium	6.6	11.6	6.5		1.8	8.8	242	10.8	4.7		0.66			29.1	17.9	70.7		23.4	
Calcium	66600	34100	65700	1080	9960	21100	79200	54700	11500	1410	3240	1260	18300	26700	10600	25300	70100	13900	9720
Chromium	103	1350	1550	16.6	66.6	120	569	134	50.6	13.6	19.6	15.5	34.7	472	324	1870	23.4	115	18.7
Cobalt	7.1	90.1	6.3	7.6	4	6	4.3	5.8	1.7	3.7	4.2	5.7	13.6	20.9	26.3	77.3	3.4	40.8	6.7
Copper	19.4	1050	210	6.3	31	268	38.8	128	8.7	4.7	6.2	4.5	23.4	98.2	109	133	10.3	17000	12.3
Iron	9580	11800	8470	11600	5060	6320	2860	4500	2040	8760	10900	14600	27500	15500	26700	20500	8730	12000	10200
Lead	144	1210	151	10.4	104	74	235	43.9	6.6	6.8	6.7	7.5	25.4	116	66.6	396		640	15
Magnesium	2950	4410	5280	1400	1940	2420	3740	3950	2570	1330	2310	1490	6120	5370	5730	5010	4020	2580	1590
Manganese	416	321	151	423	142	150	177	221	63.9	94.5	353	195	1320	196	278	1250	429	1840	324
Mercury	0.15	3.8	0.24		0.16	0.28	0.13	0.14	0.71		0.016		0.24	0.25	0.2	0.1			
Molybdenum	3.9	62.1	32.3	3.5	6	14.1	2.9	7.2	3					15.6	6	14.3		5.5	
Nickel	11.8	1420	38.1	10.2	13.5	49.9	285	39.3	14.6	11.2	11.4	11	33.5	1110	554	659	9.8	95.4	12
Potassium	715	527	537	930	411	381		330	114	1180	1060	1310	3010	2280	2280	2000	552	323	914
Selenium		0.68	7.2			1.7		0.46						1.5	2.6	0.93			
Silver		8.4				1.2	38.4	3.2	0.68					30.9	27	42.7		6.7	
Thallium	49.8													61.6		51.8			
Vanadium	16.3	42.6	56.6	19.8	14.2	25.5	11	17.3	5.9	16.1	17.3	22	43.1	38.4	47.4	57	14.6	23.3	21.8
Zinc	164	545	188	14.8	66.5	223	172	126	15.1	14.2	15.9	15.4	82.9	344	345	465	16.3	759	47.1
PCBs & Pesticides (mg/kg)																			
Aroclor 1254		18	1.1			0.96								6.1	61	1.4	0.38	0.57	
Aroclor 1260	0.48																		
Semivolatile Organics (mg/kg)																			
1,2-Dichlorobenzene		3.6																	
1,3-Dichlorobenzene		0.52																	
1,4-Dichlorobenzene		1.2																	
1-Chloronaphthalene									0.35										
2-Chloronaphthalene									0.28										

TABLE B-10
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(0-6 inches bgs)

	East Soldier Creek											West Soldier Creek							
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
2-Methylnaphthalene		0.52	0.61				0.047												
4-Nitrophenol														0.23					
Acenaphthene	0.59	2.2	3.1		0.071	0.49	0.22							0.11					
Acenaphthylene		0.36																	
Anthracene	0.97	3.5	5		0.094	0.93	0.48							0.13		0.28			
Benzidine		0.29																	
Benzo(a)anthracene	3.3	16	13		0.53	3.9	0.88	1						0.74	0.48	1.9			
Benzo(a)pyrene	3	14	11		0.59	3.3	0.72	1						1	0.78	2.2			
Benzo(b)fluoranthene	5.6	27	14		1.2	6.9	1.4	2						1.4	0.82	2.6			0.097
Benzo(g,h,i)perylene	1.9	10	6.8		0.22	1.3	0.2							0.74	0.84	2.3			
Benzo(k)fluoranthene			7.4						0.091					0.91	0.85	2.1			
bis(2-Ethylhexyl)phthalate	0.37	2.4	1.1		0.3	4.5	0.69	2.8	0.31		0.074			0.74	2	0.67	0.087	0.18	0.13
Butyl benzyl phthalate														0.071					
Chrysene	4.1	18	15		0.81	5.3	1	1.5						1.2	0.72	2.7			0.08
Di-n-butyl phthalate	0.51												0.51	0.075					
Di-n-octyl phthalate														0.084					
Dibenz(a,h)anthracene					0.075		0.073							0.29	0.32	0.77			
Dibenzofuran	0.32	1.1	1.6				0.16							0.076					
Fluoranthene	10	30	30	0.056	1.3	8.5	2.5	3.3	0.11				0.076	2.8	1.3	6.2		0.047	0.11
Fluorene	0.59	1.7	2.7		0.057	0.45	0.26							0.1					
Indeno(1,2,3-cd)pyrene	1.7	8.9	6.1		0.24	1.2	0.25							0.75	0.74	1.9			
Naphthalene	0.56	1.5	2.7				0.23							0.074					
Pentachlorophenol			0.49											0.096					
Phenanthrene	7.2	24	28		0.79	5.4	2.1	1.9						1.5	0.67	3.6			
Pyrene	7.2	28	23	0.052	0.88	6.6	1.8	2.1					0.063	2	0.95	4.4			0.099
Volatile Organics (mg/kg)																			
2-Butanone (MEK)						0.019		0.056	0.019					0.0099					
Acetone	0.012	0.064		0.008	0.008	0.046		0.19	0.13	0.012	0.011	0.008	0.0027	0.03	0.005	0.003	0.0046	0.0025	0.0063
Carbon disulfide		0.004				0.003		0.003		0.002				0.0056					
Chlorobenzene						0.002		0.003			0.001								
Chloromethane						0.003													
Methylene chloride			0.007	0.008	0.002	0.005	0.003	0.003	0.002										0.0024
Toluene								0.015	0.006					0.0071					

TABLE B-11
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek						West Soldier Creek			
	QE03	QE06	QE08	QE09	QE10	QE11	QW01	QW03	QW04	QW07
Inorganics (mg/kg)										
Aluminum	2300	3110	3430	547	6590	10600	10100	13000	9680	13500
Arsenic	7.3	2.8	2	0.44	2.2	2.4	2.1	4.1	2.9	3.6
Barium	783	353	261	94.5	324	819	280	2010	266	424
Beryllium		0.44	0.61		0.5	0.65	0.55	0.97	0.57	0.95
Cadmium	8.4	10.1	29.8	4.3		3.2		2.4	8.8	
Calcium	76800	16900	16800	9250	1360	7090	4220	9780	4100	2660
Chromium	1850	130	140	44.6	10.3	44.1	20.9	59.5	36.6	22.4
Cobalt	7.8	5.1	7.4	1.8	4.2	5.5	5.7	13.7	6.2	15.1
Copper	292	230	46.7	8.3	4.5	8.9	7.2	38.5	19.3	5.4
Iron	7390	5400	7220	1680	8250	12600	13800	31800	17300	20600
Lead	224	76.3	26.3	8.7		8.8	7.4	25.6	28.7	19.4
Magnesium	5220	2500	3870	1400	1120	3680	2300	9150	1830	1910
Manganese	202	141	165	93.3	93.4	487	509	528	2940	1200
Mercury	0.67	0.25	0.11	0.022		0.013		0.026		
Molybdenum	27.7	9.4		3.5					15.1	
Nickel	801	39.1	36.4	11.6	8.4	19.4	13.4	79.7	16	13.3
Potassium	451	391	523		915	1260	1250	2400	1080	1060
Selenium	5.5	0.57								
Silver	1.3	1.4	2.3			1.3		2	0.66	
Thallium								52.5		
Vanadium	56.8	23.3	16.5	4.5	14.7	21.8	26.8	42.2	24.2	32.9
Zinc	227	213	58.5	17.8	12.2	22.7	31.5	81.6	55.9	19.1
PCBs & Pesticides (mg/kg)										
Aroclor 1254	2.7	1.1		6.8				8.2		
Semivolatile Organics (mg/kg)										
4-Nitrophenol	0.57									
Acenaphthene	0.71		0.61							
Anthracene	1.4	0.3	2.6							

TABLE B-11
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(6-12 inches bgs)

	East Soldier Creek						West Soldier Creek			
	QE03	QE06	QE08	QE09	QE10	QE11	QW01	QW03	QW04	QW07
Benzo(a)anthracene	6.3	1.6	5.6	0.063				0.23	0.089	
Benzo(a)pyrene	6.2	1.5	4.1	0.066				0.37	0.098	
Benzo(b)fluoranthene	9.3	3.3	7.3	0.13				0.44	0.12	
Benzo(g,h,i)perylene	3.6	0.59	1.2					0.34	0.11	
Benzo(k)fluoranthene								0.32	0.093	
bis(2-Ethylhexyl)phthalate	1.2	5	8.9	0.26		0.19		1.3	0.063	
Chrysene	7.2	2.2	6.5	0.084				0.34	0.12	
Di-n-octyl phthalate			0.63							
Dibenz(a,h)anthracene	0.84							0.14	0.059	
Fluoranthene	14	3.9	13	0.18		0.053		0.54	0.24	
Fluorene	0.58		0.62							
Indeno(1,2,3-cd)pyrene	3.4	0.58	1.3					0.32	0.082	
Naphthalene	0.52									
Phenanthrene	8.1	2	9.1	0.067				0.3	0.15	
Pyrene	11	2.7	8.4	0.13				0.47	0.19	
Volatile Organics (mg/kg)										
2-Butanone (MEK)			0.0087	0.071						
Acetone	0.0047	0.021	0.021	0.079	0.021	0.018		0.0048	0.0017	0.0013
Carbon disulfide				0.0064						
Chlorobenzene		0.0026	0.013			0.0017				
Ethylbenzene	0.0013									
Methylene chloride		0.0032	0.0017	0.0021		0.0013				
Tetrachloroethene	0.033									
Toluene									0.0014	

TABLE B-12
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek			West Soldier Creek	
	QE06 (4-4.5 feet)	QE09 (1.5-2 feet)	QE10 (2.5-3 feet)	QW04 (1.5-2 feet)	QW07 (1-1.5 feet)
Inorganics (mg/kg)					
Aluminum	3600	1500	5680	10900	16500
Arsenic	1.8	0.91	1.7	2.5	3.4
Barium	408	181	395	284	5560
Beryllium	0.58	0.39	0.43	0.64	1.4
Cadmium	37.2	33.5		5.8	
Calcium	8480	15000	2040	4300	2570
Chromium	498	291	10.2	49.2	59
Cobalt	5.1	6.9	3.4	6.4	7.4
Copper	79.2	37	4.6	14.8	6.6
Iron	5890	4340	7930	13700	23900
Lead	174	33	6.9	23.1	6
Magnesium	3160	1110	1060	2360	3360
Manganese	266	313	170	516	827
Mercury	0.43	0.12			
Molybdenum	3.7	3.9		4	
Nickel	97.4	72.3	7.7	22.5	22.3
Potassium	445	199	910	1250	1460
Silver	3.4	4.9		0.85	
Vanadium	23.9	13.5	13.5	23.5	38.4
Zinc	162	64.1	15.5	47.7	26.8
Semivolatile Organics (mg/kg)					
1,4-Dichlorobenzene	0.32				
2-Chloronaphthalene	0.28	0.071			
2-Naphthylamine		0.14			
Anthracene		0.052			
Benzo(a)anthracene	0.74	0.1		0.056	
Benzo(a)pyrene	0.83	0.087		0.053	

TABLE B-12
FOURTH QUARTER SECOND YEAR SEDIMENT DETECTIONS
(greater than 12 inches bgs)

	East Soldier Creek			West Soldier Creek	
	QE06 (4-4.5 feet)	QE09 (1.5-2 feet)	QE10 (2.5-3 feet)	QW04 (1.5-2 feet)	QW07 (1-1.5 feet)
Benzo(b)fluoranthene	1.4	0.14		0.061	
Benzo(g,h,i)perylene	0.37	0.042		0.041	
Benzo(k)fluoranthene	0.71	0.079		0.053	
bis(2-Ethylhexyl)phthalate	2.9	3.4			
Chrysene	1.3	0.13		0.076	
Di-n-octyl phthalate		0.35			
Fluoranthene	2.9	1.8		0.15	
Fluorene		0.066			
Indeno(1,2,3-cd)pyrene	0.34				
Phenanthrene	1.5	0.06		0.11	
Phenol		0.044			
Pyrene	1.9	0.27		0.12	
Volatile Organics (mg/kg)					
2-Butanone (MEK)	0.017	0.049			
Acetone	0.042	0.1	0.025	0.0046	0.0026
Acrylonitrile				0.0012	
Carbon disulfide	0.0022	0.027			
Chlorobenzene	0.22	0.021			
Methylene chloride	0.0031	0.0045			
Toluene		0.013			

TABLE B-13
FIRST QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	East Soldier Creek											West Soldier	
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW05	QW06
Inorganics (mg/L)													
Aluminum					0.028			0.025			0.033		0.053
Antimony													0.046
Barium	0.44	0.41	0.54	0.5	0.44	0.46	0.41	0.47	0.45	0.33	0.32	0.43	0.48
Calcium	46.9	59.2	103	77.9	64.4	60	43.9	63.9	61.3	60	59.4	54.5	60
Chromium			0.014	0.01									
Copper	0.011	0.27	0.16	0.085	0.11	0.042	0.085	0.048	0.032	0.013	0.013		0.0031
Iron								0.034	0.053	0.098	0.12		0.04
Magnesium	21.2	26.6	47.2	35.5	29	27.3	20.2	29	28.2	28.6	28.2	22.6	25.1
Manganese	0.01	0.01	0.005	0.005	0.006	0.005		0.02	0.024	0.075	0.086	0.0043	0.012
Molybdenum		0.16	0.5	0.29	0.17	0.12		0.17	0.17	0.1	0.11		
Nickel											0.011		0.01
Potassium	1.1	2.4	5.4	3.7	2.4	2.7	1.3	3	2.2	3.4	3.4	1.2	0.83
Sodium	12.4	18	29.2	22.2	18.9	17.2	10.9	24.2	26.1	179	161	17.5	19.2
Vanadium	0.012	0.012	0.026	0.021	0.02	0.016	0.011	0.014	0.011	0.007	0.008	0.016	0.015
Zinc	0.031	0.035	0.023	0.022	0.026	0.023	0.055	0.019	0.016	0.009	0.009	0.0072	0.0094
Arsenic			0.002	0.001								0.0013	0.001
Lead	0.001	0.003	0.001		0.001	0.001	0.001						0.0028
Selenium										0.003	0.003		
Volatile Organics (mg/L)													
2-Butanone (MEK)	0.003	0.004	0.004	0.005	0.003	0.001	0.004						
Acetone	0.008	0.026	0.012	0.01	0.005	0.007	0.006			0.01			
Bromoform		0.001	0.004	0.002					0.001				
Dichlorodifluoromethane		0.002											
Methylene chloride	0.003	0.003	0.003	0.003	0.003	0.003				0.15	0.12	0.0019	0.0013
Semivolatile Organics (mg/L)													
1,2-Dichlorobenzene			0.002										
3/4-Methylphenol											0.001		
Benzoic acid		0.002	0.001										
Butyl benzyl phthalate	0.003			0.001	0.002	0.003							
Diethyl phthalate		0.001											
Phenol											0.002		

TABLE B-14
SECOND QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	EAST SOLDIER CREEK											WEST SOLDIER CREEK					
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW03	QW04	QW05	QW06	QW07
Total Metals - Methods 6010/6020/7060/7470 (mg/L)																	
Aluminum	0.064	0.037	0.025	0.029	0.025	0.053	0.019	0.058	0.11	0.099	0.032	0.2	0.016	0.033	0.15	0.38	0.081
Antimony	0.0009	0.0002	0.0003	0.0005	0.0005	0.0005	0.0003	0.0008	0.0005	0.0005	0.0005			0.0004	0.0003	0.0005	0.0003
Arsenic	0.0016	0.0029	0.0031	0.0013	0.0014	0.0013				0.0012					0.0011	0.0011	0.0033
Barium	0.36	0.34	0.34	0.37	0.37	0.33	0.17	0.075	0.075	0.13	0.26	0.084	0.11	0.14	0.2	0.18	0.14
Cadmium	0.0002	0.0005	0.001	0.0005	0.0005	0.0007	0.0005	0.0004	0.0005	0.0004	0.0004	0.0002	0.0002	0.001	0.0007	0.0006	
Calcium	40.9	53.3	67.9	50.6	52.6	49.8	28.5	17.4	16.6	29.6	50.6	19.3	34.4	38.6	56.3	41.3	42.5
Chromium	0.0042	0.007	0.0097	0.0064	0.0057	0.0049	0.0028	0.0045	0.0025	0.0081	0.0064				0.0059	0.0028	0.0009
Cobalt	0.0002	0.0003	0.0003	0.0002		0.0003				0.0006	0.0007	0.0008	0.0012	0.0004	0.0003	0.0004	0.0005
Copper	0.0039	0.049	0.043	0.012	0.013	0.011	0.024	0.0064	0.008	0.0055	0.0069	0.022	0.0071	0.0069	0.011	0.014	0.016
Iron	0.13	0.32	0.27	0.084	0.1	0.16	0.035	0.11	0.17	0.25	0.21	1.5	0.47	0.35	0.53	0.92	0.24
Lead	0.0024	0.0007	0.0009	0.0035	0.0006	0.0013	0.0008	0.0011	0.0015	0.0011	0.0008	0.002	0.0006	0.0009	0.0015	0.0018	0.0006
Magnesium	19	25.3	32.5	24.2	24.6	21.9	10.9	4.5	4.3	12.3	24.4	2.7	5.4	5.4	19.2	11.5	9.8
Manganese	0.017	0.013	0.013	0.01	0.011	0.036	0.004	0.0078	0.01	0.036	0.07	0.12	0.03	0.022	0.013	0.017	0.052
Nickel	0.0029	0.0053	0.0057	0.0038	0.0038	0.0043	0.0025	0.0021	0.0024	0.0061	0.0077	0.013	0.032	0.024	0.0081	0.01	0.0051
Potassium	1.8	2.6	3.6	2.4	2.6	2.8	0.92	1.7	1.7	3	5.4	0.96	1.4	1.7	5.6	4.3	9.6
Selenium							0.001	0.001	0.0006	0.0009	0.0028	0.0008		0.0007	0.0015	0.0015	0.0015
Sodium	13.2	20.6	31.8	21.9	33	25.5	6.3	7.8	4.7	90.7	200		2.6	4.2	27.4	18.7	8
Vanadium	0.011	0.015	0.019	0.014	0.014	0.011	0.0048	0.0027	0.0028	0.003	0.0068	0.0008	0.0004	0.0013	0.0063	0.005	0.0024
Zinc	0.026	0.027	0.022	0.023	0.026	0.031	0.032	0.034	0.035	0.024	0.019	0.021	0.016	0.018	0.076	0.047	0.017
Dissolved Metals - Methods 6010/6020 (mg/L)																	
Aluminum	0.016	0.015	0.013	0.012	0.012	0.0075	0.007	0.029	0.035	0.017	0.0058	0.01			0.014	0.025	0.025
Antimony	0.0006	0.0001	0.0002	0.0006	0.0005	0.0006	0.0002	0.0004	0.0004	0.0006	0.0006			0.0003	0.0003	0.0004	0.0004
Barium	0.35	0.34	0.35	0.37	0.36	0.32	0.2	0.084	0.083	0.14	0.31	0.11	0.15	0.16	0.25	0.19	0.16
Cadmium	0.0001	0.0005	0.0008	0.0004	0.0005	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003		0.0001	0.0007	0.0007	0.0005	
Calcium	38.5	48.7	64.4	48.2	50.9	46.9	27.7	16	15.8	27.2	52.3	18.7	34.3	39	57.4	45.6	46.1
Chromium	0.02	0.018	0.021	0.022	0.021	0.018	0.012	0.0059	0.0048	0.012	0.018	0.0021	0.0081	0.0081	0.014	0.013	0.0057
Cobalt		0.0002	0.0002			0.0003				0.0005	0.0007	0.0003	0.0012	0.0005	0.0003	0.0003	0.0005
Copper	0.0024	0.029	0.02	0.0074	0.0086	0.0066	0.023	0.0048	0.0048	0.0031	0.0043	0.0084	0.0033	0.0042	0.0088	0.0096	0.016
Iron		0.053	0.08	0.023	0.045	0.041		0.022	0.023	0.025	0.053	0.23	0.096	0.031	0.034	0.069	0.038
Lead				0.0005													
Magnesium	17.5	22.7	30.3	22.4	23.5	19.7	10.3	4	4	10.9	26.5	2.6	5.7	5.7	20.2	13	11
Manganese	0.012	0.011	0.011	0.0093	0.01	0.038	0.0039	0.0063	0.0072	0.037	0.081	0.056	0.029	0.025	0.0086	0.0087	0.042
Nickel	0.0026	0.0051	0.0057	0.0035	0.0038	0.0039	0.0024	0.0016	0.0018	0.0055	0.0081	0.0056	0.039	0.027	0.009	0.01	0.0053
Potassium	1.9	2.5	3.6	2.2	2.4	2.7	0.98	1.8	1.5	2.8	5.6		1.2	1.5	5.6	4.1	10
Sodium	13.7	19.6	30.6	22.2	35.2	25.5	8	6.5	5.6	81.4	207		3.5	5.1	28.8	20.4	8.8
Vanadium	0.015	0.018	0.022	0.018	0.018	0.014	0.0079	0.0043	0.0038	0.0055	0.012	0.0011	0.0023	0.0028	0.011	0.0073	0.0046

TABLE B-14
SECOND QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	EAST SOLDIER CREEK											WEST SOLDIER CREEK					
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW03	QW04	QW05	QW06	QW07
Zinc	0.024	0.023	0.021	0.025	0.027	0.031	0.032	0.03	0.028	0.024	0.02	0.017	0.019	0.017	0.079	0.033	0.019
PCBs and Chlorinated Pesticides - Method 8080 (ug/L)																	
4,4'-DDT										0.11							
Semivolatile Organics - Method 8270A (mg/L)																	
4-Nitrophenol						0.001		0.0013									
Aniline		0.004	0.0018														
Benzidine								0.0011	0.0012								
Benzoic acid																	0.0012
Dimethyl phthalate														0.001			
Fluoranthene							0.0016		0.0011								
Phenol								0.002	0.0015								
Volatile Organics - Method 8260 (mg/L)																	
Acetone	0.0043			0.003						0.0029		0.0044					
Carbon disulfide													0.0026				0.004
Methylene chloride	0.0023			0.0012	0.0019												
trans-1,2-Dichloroethene														0.033			
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1 (mg/L)																	
Alkalinity, Bicarb. as CaCO3 at pH 4.5	181	166	167	181	182	168	109	55.3	51.9	124	219	68.5	108	109	212	151	128
Alkalinity, Total as CaCO3 at pH 4.5	181	166	167	181	182	168	112	55.3	51.9	124	219	68.5	108	109	212	151	128
Chemical Oxygen Demand (Regular)										42.2	40.7						66.3
Chloride	19.4	18.8	32.5	7.6	34.2	26.8	4.3	6.8	3.2	94	254	0.77	1.7	3	12.1	8	9.3
Hardness as CaCO3	170	222	291	218	226	200	109	60.3	58.3	125	224	60	102	114	212	156	150
Sulfate	58.8	83.5	155	10.4	66	62	5.9	9.9	10.4	66.6	85.4	0.84	3.8	11.9	19	16	26.9
Total Dissolved Solids	220	326	461	310	358	316	121	105	92	379	789	71	126	149	327	259	243
Total Organic Carbon	2.8	4.8	4.7	3.2	2.8	5.2	3.5	5.4	4.8	9.9	10	9.1	4.7	6.5	6.4	7.7	26
Total Suspended Solids	10	3.2	2.4			4.4		2	5.2	14	9.6	54.8		2.4	7.2	6	7.6

TABLE B-15
THIRD QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	East Soldier Creek											West Soldier Creek				
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW04	QW05	QW06	QW07
Dissolved Metals - Methods 6010/6020																
Aluminum	0.0021	0.0074	0.0079	0.0057	0.0057	0.016		0.0068			0.0066				0.018	0.015
Antimony			0.0001		0.0001	0.0003	0.0002	0.0003	0.0003	0.0003	0.0004					0.0006
Barium	0.43	0.48	0.49	0.48	0.47	0.39	0.36	0.43	0.39	0.35	0.33	0.25	0.2	0.28	0.21	0.19
Cadmium		0.0009	0.0009	0.0007	0.0006	0.0002	0.0019	0.0007	0.0005	0.0003	0.0003		0.001	0.0003	0.0004	
Calcium	44.5	101	95.4	73.3	72.8	54.6	38.5	61.9	56.2	52.1	50.1	47.6	45.5	57.6	41.6	36
Chromium	0.0053	0.014	0.016	0.018	0.017	0.012	0.0098	0.014	0.011	0.012	0.011	0.0073	0.014	0.02	0.012	0.0048
Cobalt	0.0002	0.0004		0.0003	0.0003		0.0016	0.0004	0.0003	0.0002	0.0003	0.0009	0.0007			0.0006
Copper	0.0012	0.098	0.11	0.059	0.06	0.018	0.038	0.017	0.014	0.011	0.0092		0.017	0.011	0.012	0.0096
Iron		0.026	0.026			0.037	0.03	0.034	0.044	0.025	0.081	0.27	0.075			0.03
Lead			0.0008	0.0004	0.0005	0.0004	0.011	0.0015	0.0004	0.0003	0.0004					
Magnesium	21.9	48.8	46	36.1	35.5	27	17.8	29.9	26.2	23.7	22.8	6.6	5.4	22.9	13.5	6
Manganese	0.0026	0.0063	0.0076	0.0047	0.0053	0.021	0.054	0.019	0.015	0.033	0.098	0.23	0.044	0.0013	0.0036	0.11
Molybdenum		0.44	0.41	0.28	0.27	0.13	0.0003	0.19	0.16	0.13	0.11	0.0074	0.061	0.0043	0.0061	0.01
Nickel	0.0021	0.0049	0.0048	0.0041	0.004	0.0033	0.0039	0.0043	0.0039	0.0038	0.0042	0.04	0.03	0.0044	0.0054	0.0043
Potassium	1.6	5.3	4.9	3.7	3.6	2	2.4	3.1	3.2	2.9	3.1	2.3	3.7	4.1	5.9	5.2
Selenium	0.0022	0.024	0.023	0.021	0.018	0.01		0.017	0.016	0.015	0.012					
Silver											0.0002					
Sodium	15.1	70.3	113	31.6	37.9	42.2	13.5	41.9	39.4	36.9	37.2	6.7	5.6	39.4	26.6	6.2
Vanadium	0.013	0.027	0.026	0.021	0.02	0.016	0.008	0.015	0.014	0.012	0.011	0.0006	0.0035	0.011	0.0062	0.0015
Zinc	0.0028	0.0081		0.0054			0.058	0.01	0.0055	0.0052		0.011	0.019	0.031	0.022	0.0085
Semivolatile Organics - Method 8270A																
Benzoic acid							0.0012								0.0012	0.0011
Total Metals - Methods 6010/6020/7060/7470																
Aluminum	0.011	0.025	0.037	0.02	0.021	0.033	0.04	0.049	0.054	0.055	0.05	0.15	0.18	0.017	0.025	0.083
Antimony		0.0001			0.0002	0.0002	0.0003	0.0003	0.0003	0.0004	0.0004					
Arsenic	0.0017	0.0033	0.0021	0.0018	0.0016	0.001		0.0017	0.0015				0.0013			0.003
Barium	0.42	0.49	0.48	0.43	0.46	0.45	0.37	0.43	0.36	0.31	0.34	0.25	0.2	0.28	0.21	0.19
Beryllium						0.0001	0.0007									
Cadmium		0.0009	0.0008	0.0006	0.0007	0.0003	0.0025	0.0009	0.0006	0.0004	0.0005		0.0034	0.0005	0.0005	0.0003
Calcium	44.7	103	96.2	75.9	75.4	59.3	40.3	63.9	56.2	51.1	49.7	48.5	45.5	58	42.4	35.9
Chromium	0.0062	0.015	0.015	0.01	0.011	0.0084	0.0037	0.0062	0.0056	0.0043	0.0041	0.0073	0.014	0.02	0.012	
Cobalt	0.0001			0.0002	0.0002		0.0017	0.0004	0.0002			0.0009	0.001			0.0006
Copper	0.0013	0.12	0.14	0.07	0.072	0.032	0.049	0.032	0.025	0.02	0.018		0.024	0.011	0.012	0.0097
Iron		0.027	0.03	0.088	0.095	0.12	0.16	0.18	0.27	0.14	0.33	1.7	0.37		0.041	0.17

TABLE B-15
THIRD QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	East Soldier Creek											West Soldier Creek				
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW02	QW04	QW05	QW06	QW07
Lead	0.0002	0.0041	0.012	0.0019	0.002	0.0024	0.016	0.0033	0.0028	0.002	0.0016	0.0017	0.0025			
Magnesium	21.6	49.8	46.5	37	36.4	29.2	18.7	30.6	26	23.2	22.3	6.7	5.4	23.3	13.7	6
Manganese	0.0035	0.008	0.01	0.0053	0.0063	0.0089	0.063	0.02	0.021	0.038	0.11	0.23	0.11	0.0022	0.0047	0.2
Molybdenum	0.0011	0.56	0.53	0.31	0.33	0.15		0.23	0.19	0.14	0.12	0.0076	0.069	0.0054	0.0074	0.012
Nickel	0.0015	0.0042	0.0042	0.0031	0.0034	0.0031	0.0044	0.0044	0.0034	0.0034	0.004	0.049	0.03	0.0044	0.0054	0.0043
Potassium	1.6	5.5	5	3.9	3.7	2.6	2.7	3.2	3	2.9	2.9	2.7	3.7	4.4	6.2	5.3
Selenium		0.021	0.018	0.014	0.016	0.0073		0.014	0.012	0.0097	0.0092					
Sodium	14.8	71.7	114	30.8	37.9	50	12.8	42.7	38.5	36.2	36.2	6.7	5.6	41.2	26.8	4.7
Vanadium	0.013	0.026	0.026	0.02	0.021	0.017	0.0083	0.016	0.013	0.011	0.011	0.0014	0.0041	0.011	0.0064	0.0019
Zinc	0.02	0.032	0.04	0.028	0.033	0.034	0.1	0.03	0.03	0.027	0.024	0.029	0.038	0.051	0.04	0.013
Volatile Organics - Method 8260																
Acetone		0.0034				0.0065	0.012	0.0094				0.0055	0.0084			0.0038
Bromodichloromethane																
Bromoform	0.0019															
Carbon disulfide			0.0025													
Chloroform							0.001									
Methylene chloride	0.0018	0.0014	0.0014	0.0023	0.0023	0.0023	0.0021	0.0012								
Tetrachloroethene													0.0015			
Toluene												0.0036				
Trichloroethene													0.013			
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1																
Alkalinity, Bicarb. as CaCO3 at pH 4.5	196	161	160	178	174	185	175	174	168	160	162	141	122	234	156	106
Alkalinity, Carb. as CaCO3 at pH 8.3														7.7		
Alkalinity, Total as CaCO3 at pH 4.5	196	161	160	178	174	186	175	174	168	160	162	141	122	242	156	106
Chemical Oxygen Demand (Regular)							27.6					58.3	48.9			50.8
Chloride	8.1	99	162	28.8	39.8	63	7.1	51.3	47.5	44.5	45.2	6	4.2	15.3	9.2	2.6
Hardness as CaCO3	190	436	422	328	337	259	173	276	240	213	211	145	140	239	159	112
Sulfate	5.2	297	275	169	168	84.8	4.6	109	84.5	68.2	62	5	11.8	21.5	16	11.2
Total Dissolved Solids	233	790	842	504	520	436	226	446	381	336	341	198	196	373	271	175
Total Organic Carbon		4	3.9	2.4	2.4	1.5	8.1	3.3	3.7	4	4.5	16.6	18.3	3.7	5.8	18
Total Suspended Solids					2.4	2	2.4	3.6	6.8	2.8	5.2	18	13.2			3.6

TABLE B-16
FOURTH QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	East Soldier Creek											West Soldier Creek			
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW04	QW05	QW06	QW07
Dissolved Metals - Methods 6010/6020 (mg/L)															
Aluminum		0.013		0.016	0.013	0.023			0.028	0.013	0.033	0.0061	0.0055	0.0054	0.021
Antimony		0.00012				0.00016	0.0002	0.0002	0.00022	0.0003	0.0003	0.00021	0.00042	0.0005	0.00024
Barium	0.45	0.52	0.64	0.52	0.55	0.51	0.35	0.47	0.47	0.45	0.46	0.27	0.26	0.31	0.1
Cadmium							0.0037	0.00011	0.0002	0.00064	0.00081		0.00034	0.0003	
Calcium	46.6	73.2	94.7	59.9	73.9	67.5	32.6	61.2	62.9	57.5	57.8	59.4	61.2	61	19.6
Chromium	0.0019	0.029	0.042	0.013	0.024	0.016	0.0015	0.014	0.018	0.017	0.016		0.0025	0.003	
Cobalt		0.00021	0.00031	0.00011	0.00016	0.00028		0.00025	0.00025	0.00023	0.00022	0.00051	0.00025	0.00024	
Copper	0.002	0.27	0.15	0.038	0.11	0.061	0.016	0.034	0.039	0.028	0.027		0.0062	0.0054	0.0034
Iron						0.086		0.075	0.064	0.074	0.091	0.09			
Lead		0.00038	0.00052		0.00033	0.00042		0.00075	0.00082	0.00084	0.00082				
Magnesium	22.5	34.4	45.2	28.8	35.7	30.4	16.3	28.3	29	26.5	26.5	6.1	25.6	24.5	1.7
Manganese	0.0028	0.0093	0.017	0.0063	0.0049	0.069	0.0047	0.041	0.033	0.055	0.086	0.19	0.0021	0.0022	0.03
Molybdenum	0.001	0.0023	0.0025	0.0016	0.0021	0.045	0.0003	0.005		0.0058	0.006	0.012	0.0093	0.0096	0.00096
Nickel	0.004	0.0075	0.0098	0.0054	0.0074	0.0095	0.0046	0.0075	0.0074	0.0078	0.0087	0.017	0.0093	0.009	0.0027
Potassium	1.3	2.6	3.4	1.9	2.5	2.5	1.1	2.4	2.4	2.3	2.3		2.6	2.9	2.3
Selenium		0.0036	0.0041	0.0025	0.0033	0.0026		0.003	0.0035	0.0036	0.0037		0.0042	0.0045	
Sodium	15.2	24.9	32.9	20.2	25.5	23	10.9	21.6	22.9	21.1	20.8		60.8	60.4	2.5
Vanadium	0.016	0.02	0.024	0.018	0.021	0.017	0.0089	0.016	0.018	0.017	0.017	0.0028	0.013	0.013	0.0043
Zinc	0.0066	0.024	0.021	0.013	0.017	0.0053	0.0024	0.0075	0.0088	0.0042	0.0092	0.0089		0.0025	
Total Metals - Methods 6010/6020/7060/7470 (mg/L)															
Aluminum	0.054	0.039	0.022	0.021	0.031	0.039	0.037	0.028	0.081	0.05	0.061	0.019	0.041	0.023	0.21
Antimony		0.00014	0.00014		0.00012		0.0002	0.00031	0.00024	0.00029	0.00032	0.00027	0.00044	0.00051	0.00018
Arsenic		0.0027	0.0029								0.002	0.0024			0.0025
Barium	0.46	0.55	0.65	0.48	0.59	0.53	0.35	0.46	0.47	0.47	0.48	0.26	0.26	0.32	0.099
Beryllium											0.000087			0.00014	
Cadmium	0.00011	0.0002	0.00017	0.00012	0.00026	0.0003	0.0053	0.00049	0.0013	0.0011	0.0016	0.00012	0.00076	0.00063	
Calcium	46.3	73.4	91.1	57.3	72.4	64.4	31.6	60.1	63	60.4	59.3	62.1	66	66.8	19.3
Chromium	0.0088	0.018	0.02	0.0097	0.016	0.01	0.0049	0.0097	0.014	0.012	0.014		0.0048	0.0043	
Cobalt	0.00013	0.00034	0.00037	0.00017	0.00026	0.0005	0.00019	0.00033	0.00042	0.00037	0.00036	0.00046	0.00038	0.00035	0.00054
Copper	0.00083	0.36	0.23	0.044	0.14	0.074	0.025	0.04	0.063	0.043	0.043	0.0029	0.0076	0.0058	0.0044
Iron		0.14	0.072	0.072		0.19	0.091	0.26	0.22	0.21	0.26	0.098			1.1
Lead		0.0001													
Magnesium	23.4	35.2	44.7	28.8	34.4	28.4	16.2	28.1	29.1	27.8	27.7	6.4	28	27.4	1.8
Manganese	0.0035	0.016	0.018	0.0063	0.0056	0.069	0.0078	0.039	0.042	0.06	0.091	0.09	0.004	0.0041	0.087
Molybdenum	0.0012	0.0029	0.0028	0.0016	0.0024	0.0098	0.00049	0.0053	0.0051	0.0065	0.0064	0.013	0.0099	0.011	
Nickel	0.0028	0.0074	0.0089	0.0036	0.0066	0.011	0.0034	0.0053	0.0065	0.0066	0.0079	0.015	0.0071	0.0097	0.00074
Potassium	1.5	3	3.6	2	2.5	3	0.96	2.5	2.5	2.4	2.6		3	3.6	2.7
Selenium		0.0032	0.0042		0.0029	0.0021		0.0022	0.0023	0.0033	0.0024		0.0039	0.0035	
Sodium	16.1	25.8	32.9	20.4	24.9	23.1	10.1	22.1	22.2	22.1	23.1	2.1	66.5	68	
Vanadium	0.014	0.021	0.023	0.016	0.021	0.016	0.0082	0.015	0.016	0.015	0.015	0.0011	0.01	0.0092	0.003

TABLE B-16
FOURTH QUARTER SECOND YEAR
SURFACE WATER SAMPLING DETECTIONS

	East Soldier Creek											West Soldier Creek			
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW04	QW05	QW06	QW07
Zinc	0.0044	0.026	0.021	0.0093	0.013	0.012	0.015	0.0081	0.016	0.0089	0.0083		0.0072	0.0042	0.013
PCBs and Pesticides - Method 8080 (ug/L)															
alpha-Chlordane					0.11										
Heptachlor					0.041										
Heptachlor epoxide			0.072	0.027	0.059	0.054		0.077							
Semivolatile Organics - Method 8270 (mg/L)															
1,2-Dichlorobenzene									0.001						
2,4,6-Trichlorophenol									0.00096						
2,6-Dichlorophenol										0.0028	0.002				
2-Chlorophenol									0.0014						
Benzoic acid					0.0015										0.001
bis(2-Ethylhexyl)phthalate									0.0013						
Di-n-butyl phthalate		0.0014	0.0011												
Dibenzofuran									0.0011						
Dimethyl phthalate						0.0013									
Fluoranthene									0.0015						
Naphthalene									0.0014						
Phenol		0.0014													
Volatile Organics - Method 8260 (mg/L)															
2-Butanone (MEK)		0.0027	0.0026												
2-Hexanone			0.0054												
Acetone	0.0044	0.023	0.024	0.0059	0.014	0.0078		0.0085	0.011	0.0059	0.0062	0.0043	0.0047	0.0027	0.0045
Bromoform	0.0026			0.0014											
Chloroform															
Dibromochloromethan	0.0011														
Methylene chloride	0.011	0.012	0.011		0.0011	0.0083	0.0011	0.0086	0.0011	0.0012	0.0012				
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/410.4/415.1 (mg/L)															
Alkalinity, Bicarb. as	219	150	165	203	188	199	150	188	187	178	181	171	278	283	52.7
Alkalinity, Total as Ca	219	150	165	203	188	199	150	188	187	178	181	171	278	283	52.7
Chemical Oxygen Demand (Regula		17.5	27.4		30	12.9		8.6	11.3			21.6			24.9
Chloride	7.7	18.1	21.4	11	17.1	13.2	6.8	14	15.1	15.1	15.3	0.62	25.2	24.3	1.1
Hardness as CaCO3	199	304	388	244	302	270	140	252	264	261	261	175	263	271	53
Sulfate	6.4	217	277	75.1	164	101	5.1	95	109	104	103	0.74	34.8	36	4.7
Total Dissolved Solids	249	512	610	332	460	382	175	361	391	371	379	211	492	502	99
Total Organic Carbon	0.93	7.5	9.3	2.7	10.1	4.8	1.8	4.4	5.2	5.3	5.1	9.4	3.4	2.7	9.6
Total Suspended Solids			2		8.8	3.2	10.8	8.4	44.8	4	6.8	11.2	3.2		43.2

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Semivolatile Organics (mg/kg)			
(R)-(-)-(z)-14-methyl-8-hexadecen-1-ol	1	1	1
.alpha.-D-Galactopyranose, 1,2,3,4,6-pentakis-O-!	1	2.6	2.6
.delta.-Selinene	1	0.18	0.18
1,1'-Bicyclohexyl, 2-ethyl-, cis-	1	2.2	2.2
1,1'-Bicyclohexyl,2-methyl-,trans-	1	5.4	5.4
1,1'-Bipehnyl, 2,3',5,5'-tetrachloro-	1	0.21	0.21
1,1'-Biphenyl, 2,2',3,3',4,4'-hexachloro-	1	0.36	0.36
1,1'-Biphenyl, 2,2',3,4,5'-pentachloro-	1	0.17	0.17
1,1'-Biphenyl, 2,2',3,4-tetrachloro-	1	2	2
1,1'-Biphenyl, 2,2',4,4',6-pentachloro-	2	0.54	0.82
1,1'-Biphenyl, 2,2',4,5',6-pentachloro-	2	0.97	3.7
1,1'-Biphenyl, 2,2',4,5,5'-pentachloro-	8	0.25	5.3
1,1'-Biphenyl, 2,3',4',5-tetrachloro-	3	0.31	1.8
1,1'-Biphenyl, 2,3',4,4',5,5'-hexachloro-	1	1.3	1.3
1,1'-Biphenyl, 2,3',4,5',6-pentachloro-	1	1.5	1.5
1,1'-Biphenyl, 2,3',4,5,5'-pentachloro-	2	3.5	6.3
1,1'-Biphenyl, 2,3,3',4',6-pentachloro-	1	0.37	0.37
1,1'-Biphenyl, 2,3,3',4'-tetrachloro-	1	2.4	2.4
1,1'-Biphenyl, 2,3,3',4,6-pentachloro-	3	0.66	2.4
1,1'-Biphenyl, 2,3,4',5,6-Pentachloro-	1	4.5	4.5
1,1'-Biphenyl, 2,3,4,5-tetrachloro-	1	0.79	0.79
1,1'-Biphenyl, 3,3',4,4',5,5'-hexachloro-	1	0.43	0.43
1,1'-Biphenyl, pentachloro-	2	0.24	1.9
1,1'-Biphenyl, tetrachloro-	1	0.36	0.36
1,1'-Biphenyl,2,2',4,4',6,6'-hexachloro-	3	0.6	3.4
1,1,4-Trimethylcyclohexane	1	1.9	1.9
1,1-Biphenyl, 2,2',3,4,5,5'-hexachloro-	3	0.66	4.1
1,1-Dimesityl-3-methyl-1-buten-2-ol	1	2.6	2.6
1,2-Benzenedicarboxylic acid,ditridecyl ester	1	16	16
1,3,6-Octatriene, 3,7-dimethyl-, (E)-	1	0.23	0.23
1,3,7,7-Tetramethyl-2,11-dioxa-3,5-bicyclo(4.4.1!	1	1.7	1.7
1,4-Naphthoquinone, 6-ethyl-2,5-dihydroxy-	1	0.26	0.26
1,5-Heptadiene, 3,3,5-trimethyl-	1	0.39	0.39
1,6-Dimethyldibenzothiophene	1	3.5	3.5
1,7-Dimethyldibenzothiophene	2	1.2	2
1-Adamantyl bromomethyl ketone	2	0.26	0.35
1-Butanol, 2-ethyl-	1	1.6	1.6
1-Chlorohexadecane	1	1.5	1.5
1-Decene, 4-methyl-	1	2.8	2.8
1-Docosanethiol	1	0.45	0.45
1-Dotriacontanol	1	0.72	0.72
1-Eicosanol	3	0.36	1
1-Hentetracontanol	1	4.5	4.5
1-Methyl-2,6-diphenyl-4,4-tetramethylene-1,4-dih!	1	0.45	0.45
1-Nonadecene	2	0.34	0.64
1-Nonene	1	2.9	2.9
1-Octadecanol	1	1.2	1.2

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
1-Tetradecanamine, N,N-dimethyl-	1	4	4
1-Tetradecene	1	0.42	0.42
10-Demethylsqualene	1	0.33	0.33
10H-Phenothiaphosphine, 7-chloro-2-fluor-10-hydr!	9	0.18	1.5
11-Dodecen-1-ol, 2,4,6-trimethyl-,(R,R,R)-	1	0.4	0.4
11H-Benzo[a]fluorene	2	0.4	5.7
11H-Benzo[b]fluorene	4	1.7	7.4
16-Octadecenal	1	0.4	0.4
17-Pentatriacontene	1	0.32	0.32
1H-1,2,4-Triazole, 1-butyl-	1	0.4	0.4
1H-3a,7-Methanoazulene, 2,3,6,7,8,8a-hexahydro-1	1	0.69	0.69
1H-Cycloprop[e]azulene, 1a,2,3,4,4a,-5,6,7b-oct!	3	0.62	1.7
1H-Cyclopropa[a]naphthalene,1a,2,3,3a,4,5,6,7b-o!	1	0.24	0.24
1H-Indene, 1-(1,5-dimethyl-2-hexenyl)octahydro-7!	1	2.3	2.3
1H-Indene, 5-butyl-6-hexyloctahydro-	3	1.7	2.3
2(1H)-Naphthalenone, 4a,5,6,7,8,8a -hexahydro-7.!	1	3.7	3.7
2(1H)-Naphthalenone, octahydro-1,4a-dimethyl-, (!	1	7.2	7.2
2(1H)-Pyridinone, 1-propyl-	1	43	43
2,2',4,4',5,5'-hexachlorobiphenyl	1	0.34	0.34
2,2',4,4',5,6'-hexachlorobiphenyl	1	1.2	1.2
2,3',4,4',5-pentachlorobiphenyl	2	0.87	2.1
2,3,3',4,4'-pentachlorobiphenyl	4	0.45	4.9
2,4-Dimethylaniline	1	2.3	2.3
2,5-Nonadien-4-one, 9-(3-furanyl)-2,6-dimethyl-!	1	3.8	3.8
2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-	1	0.17	0.17
2-Decene, 8-methyl-, (Z)-	1	0.29	0.29
2-Docosene	7	0.15	21
2-Dodecen-1-yl(-)succinic anhydride	19	0.2	8.2
2-Methoxyresorcinol	1	2.4	2.4
2-Methyl-1-undecanol	1	5.1	5.1
2-Methyl-2,3,4,5,6,7-hexhydro-1H-2-benzazonine	1	0.52	0.52
2-Methylchrysene	2	2.9	5.7
2-Pentanone, 4-hydroxy-4-methyl-	20	6.4	30
2-Pentene, 3-ethyl-4,4-dimethyl-	1	0.85	0.85
2-Propenoic acid, 3-[2,3-dihydro-3-[(4-methoxyph!	1	4.8	4.8
28-Nor-17.alpha.(H)-hopane	9	2	41
28-Nor-17.beta.(H)-hopane	13	2.8	52
2H-1,2,3-Triazole-4-carboxaldehyde,2-(2-fluoroph!	1	1	1
2H-1-Benzopyran-6-ol, 3,4-dihyro-2,5,7,8-tetramet	1	5.6	5.6
2H-Pyran, 2-[(1-butyl-2-propynyl)oxy]tetrahydro-	1	0.18	0.18
3,4-Dihydrocyclopenta(cd)pyrene (acepyrene)	1	3.7	3.7
3,4-Heptadien-2-one, 3,5-dicyclopentyl-6-methyl	1	4.1	4.1
3,5-Heptanedione, 2,6-dimethyl-	1	0.7	0.7
3-(3-Carboxy-4-hydroxyphenyl)-D-alanine	1	0.4	0.4
3-(3-Pyridyl)propenoic acid	2	0.26	0.97
3-Buten-2-one, 4-(dimethylamino)-4-(1-piperidin!	1	3.1	3.1
3-Phenylindole	1	0.28	0.28
4,7-Methano-1H-indene, octahydro-	1	0.32	0.32

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
4-Methyl-3,5-bis(2-methyl-2-propenyl)-2(5H)-fura!	1	2	2
4H-Cyclopenta[def]phenanthrene	17	0.26	14
5,5,9,9-Tetramethylcyclonon-2(cis)-en-1,4-dione	1	2.2	2.2
5-Octen-4-one, 7-methyl-	1	5	5
5.alpha.-Androstan-3.beta.-ol,4,4-dimethyl-	1	1.5	1.5
5.alpha.-Ergostan-15-one	1	4.3	4.3
5.alpha.-Stigmast-3-one-	1	0.62	0.62
6,10,14-Hexadecatrien-1-ol, 3,7,11,15-tetramethy!	1	0.25	0.25
6-Dodecanone	2	4.5	14
6-Octen-1-ol, 3,7-dimethyl-,formate	1	0.74	0.74
6H,8H-Benzo[10,11]chryseno[1,12-cd]pyran-6,8-di	2	3.6	5.3
6H-Purin-6-one, 2-(dimethylamino)-1,7-dihydro-	1	0.29	0.29
7-Amino-2,3-dihydro-5-phenyl-1H-1,4-benzidazepi	1	1.2	1.2
7-Tetradecene, (E)-	1	2.8	2.8
7-Tridecanone	1	1.1	1.1
7H-Benz[de]anthracen-7-one	2	0.17	0.68
9,10-Anthracenedione	14	0.2	3.1
9H-Fluoren-9-one	1	0.44	0.44
9H-Fluorene, 9-(phenylmethylene)-	1	1.6	1.6
9H-Fluorene, 9-ethylidene-	1	1.7	1.7
A'-Neogammacer-22(29)-en-3-one	1	1.7	1.7
Acetamide, N-(3-methylphenyl)-	1	0.94	0.94
Acetamide, N-methyl-N-(4-methylphenyl)-	2	0.23	6.5
Aciphyllene	2	0.33	0.37
Adamantane, 1,3-dimethyl-	2	0.24	0.26
Adenine	1	1.5	1.5
Allopregnane	1	1.5	1.5
Alnulin	1	0.6	0.6
Androst-4-ene-3,17-dione, 15-hydroxy-, (15.alph!	1	5	5
Androstane, (5.beta.)-	1	1	1
Anthracene, 2-methyl-	2	0.2	5.4
Anthracene, 9-butyltetradecahydro-	2	4.9	18
Anthracene, 9-dodecyltetradecahydro-	4	0.96	7
Anthracene, 9-methyl-	3	0.67	4.5
Aromatic Hydrocarbon	65	0.16	15
Azulene, 1,2,3,5,6,7,8,8A-octahydro-1,4-dimethy!	1	3.9	3.9
Baccharane	3	0.63	58
Bacchotricuneatin c	1	0.25	0.25
Benz[j]aceanthrylene, 3-methyl-	1	5.2	5.2
Benzaldehyde, 3-methyl-,oxime	1	0.95	0.95
Benzaldehyde, 4-methyl-, oxime	1	6.2	6.2
Benzenamine, 3,4,5-trichloro-	1	0.29	0.29
Benzenamine, 3,5-dimethyl-	2	0.36	1.5
Benzene, (1-ethoxyethyl)-	2	0.18	1.8
Benzene, 1-nitro-4-(phenylthio)-	1	1.3	1.3
Benzene, hexaethyl-	1	0.61	0.61
Benzenesulfonamide, 4-methyl-	1	0.28	0.28
Benzo(b)fluoranthene	3	0.39	0.69

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Benzo(e)pyrene	16	0.42	20
Benzo(j)fluoranthene	1	6.5	6.5
Benzo[b]chrysene	1	10	10
Benzo[b]naptho[2,1-d]thiophene	1	1.2	1.2
Benzo[ghi]fluoranthene	2	2.2	3.9
Benzo[j]fluoranthene	2	0.43	0.77
Benzothiazole	3	0.28	1.5
Bicyclo[2.2.1]heptane, 1,3,3-trimethyl-	1	3.4	3.4
Bicyclo[3.2.1]octan-2-one, 1-(1-propenyl)-	1	0.21	0.21
Boric acid (H3BO3), trihexyl ester	1	4.4	4.4
Butanoic acid	1	0.26	0.26
Butanoic acid, 2-methyl-, methyl ester	1	0.41	0.41
Caprolactam	2	0.49	0.82
Carbazole	9	0.19	7.8
Carboxylic acid	4	0.18	6.8
Chlorinated Compound	8	0.28	1.3
Chlorinated compound	1	0.42	0.42
Chloroethane	1	0.17	0.17
Cholest-23-ene, (5.beta.)-	1	0.6	0.6
Cholest-7-en-3-ol, 14-methyl-,(3.beta.)-	1	5.6	5.6
Cholestan-3-one, 4,4-dimethyl-,(5.alpha.)-	1	0.43	0.43
Cholestane	2	2.5	4.2
Cholestane, 3-ethoxy-,(3.beta.,5.alpha.)-	2	1	1.5
Cholestane, 4,5-epoxy-, (4.alpha.,5.alpha.)-	2	0.56	1
Cholestanol	6	0.53	2.9
Cholesterol	5	0.33	2
Chromone, 3,5-dibromo-6-hydroxy-2-methyl-	7	0.44	2.9
Costunolide-dihydroketolacetone	1	6.2	6.2
Cyclic Hydrocarbon	32	0.2	15
Cyclohexane, (1-methylethyl)-	1	2.5	2.5
Cyclohexane, (1-octylnonyl)-	1	0.4	0.4
Cyclohexane, (2-methylpropyl)-	1	4.9	4.9
Cyclohexane, (4-methylpentyl)-	2	2.8	6.7
Cyclohexane, 1,1,3,5-tetramethyl-,cis-	1	0.38	0.38
Cyclohexane, 1,1,3,5-tetramethyl-,trans-	1	2.8	2.8
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.alph!	1	0.33	0.33
Cyclohexane, 1,3,5-trimethyl-2-octadecyl-	1	4.3	4.3
Cyclohexane, 1,4-dimethyl-	1	2.3	2.3
Cyclohexane, 1-(cyclohexylmethyl)-3-methyl-, tra!	2	0.82	1.6
Cyclohexane, 1-(cyclohexylmethyl)-ethyl-,trans-	1	2.8	2.8
Cyclohexane, 1-ethyl-2-propyl-	2	3.2	6.5
Cyclohexane, 2-butyl-1,1,3-trimethyl-	1	0.19	0.19
Cyclohexane, decyl-	1	2.8	2.8
Cyclohexane, pentyl-	2	1.8	2.9
Cyclohexanone, 2-(2-butynyl)-	1	0.19	0.19
Cyclohexanone, 2-isopropyl-2,5-dimethyl-	1	2	2
Cyclooctanecarboxylic acid, 4,5-dimethyl-	1	2.2	2.2
Cyclopentadecane	1	5.7	5.7

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Cyclopentane, 1,1'-ethylidenebis-	1	0.18	0.18
Cyclopentane, 1-butyl-2-propyl-	1	1.2	1.2
Cyclopentane, 1-methyl-3-(1-methylethyl)-	1	13	13
Cyclopentanecarboxylic acid, 2-amino-, trans-	1	0.67	0.67
Cyclopentanone, 2,4,4-trimethyl-	1	3.1	3.1
Cyclopropa[5,6]stigmast-22-en-3-one, 3',6-dihyd!	1	2.4	2.4
Cyclopropane, 1,2-dimethyl-1-pentyl-	1	1.2	1.2
Cyclotetradecane	1	5.4	5.4
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methylet!	6	0.98	18
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methyleth	1	0.24	0.24
D-Friedoolean-14-ene, 3-methoxy-,(3.beta.)-	11	0.17	2.9
D-Glycero-L-gulo-Octitol, 2,6:5,7-dianhydro-8-de!	1	0.35	0.35
D-Norandrostan-16-ol,(5.alpha.,16.beta.)-	1	0.96	0.96
D:A-Friedooleanan-3-one	1	0.48	0.48
Decane, 2,6,7-trimethyl-	1	0.17	0.17
Decane, 2-methyl-	1	1.9	1.9
Decane, 3,3,6-trimethyl-	1	2.4	2.4
Decane, 3,8-dimethyl-	2	0.44	4.7
Decane, 5-propyl-	2	2.4	3.6
Desoxyanisoin	1	3.8	3.8
Dibenz(a,c)anthracene	2	2.1	12
Dibenz(a,e)pyrene	2	4.4	4.8
Dibenz[a,j]anthracene	1	2.4	2.4
Dibenzo[def,mno]chrysene	4	2.7	10
Dibenzothiophene	4	0.54	4.6
Diethylphosphinothioic azide	1	1.1	1.1
Diphenylamine	1	0.25	0.25
Docosane	6	0.44	32
Docosane, 11-decyl-	1	1.8	1.8
Docosane, 7-hexyl-	3	2.7	10
Dodecane	1	2	2
Dodecane, 2,6,10-trimethyl-	1	0.21	0.21
Dodecane, 2,7,10-trimethyl-	1	3.2	3.2
Dodecane, 2-methyl-8-propyl-	1	1.2	1.2
Dodecane, 4,6-dimethyl-	2	1.2	4.7
Dodecanedioic acid, 6-hydroxy-	1	0.84	0.84
Dotriacontane	1	3.2	3.2
Eicosane	6	0.2	10
Eicosane, 10-methyl-	2	0.78	2.1
Eicosane, 2-methyl-	1	0.72	0.72
Ergost-22-en-3-ol, (3.beta.,5.alpha.,22E,24R)-	1	0.92	0.92
Ergost-25-ene-3,5,6-triol,(3.beta.,5.-alpha.,6.!	2	0.67	5.5
Ergost-5-en-3-ol, (3.beta.)-	5	0.27	4.1
Ergost-7-en-3-ol, (3,.beta.)-	1	0.2	0.2
Ergosta-5,22-dien-3-ol, (3.beta.,22E)-	1	0.53	0.53
Ethanamine, 1-(2,4-cyclopentadien-1-ylidene)-N,N!	2	1.2	1.6
Ethanoic acid, S-methyl ester	2	0.35	1.2
Ethanol, 2-(tetradecyloxy)-	1	2.4	2.4

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Ethanol, 2-methoxyphenyl-	1	0.37	0.37
Ferrocene, (3-oxo-1-butenyl)-	1	1.5	1.5
Fumariline	1	14	14
Furan, 2,3-dihydro-4-(1-methylethyl)-	1	0.29	0.29
Glaucic acid	1	0.21	0.21
Glycine, N-(2-methoxybenzoyl)-,methyl ester	1	0.27	0.27
Heneicosane	2	3.5	7.4
Heptachloronaphthalene isomer	1	2.2	2.2
Heptadecane	2	0.24	0.31
Heptadecane, 2,6,10,14-tetramethyl-	1	4.1	4.1
Heptadecane, 2,6,10,15-tetramethyl-	1	1.7	1.7
Heptadecane, 3-methyl-	1	4.1	4.1
Heptadecane, 9-octyl-	1	2.1	2.1
Heptane, 3-ethyl-2-methyl-	1	0.33	0.33
Heptane, 4-ethyl-	1	2.3	2.3
Heptanenitrile	1	1.4	1.4
Heptanoic acid, 3-nitrophenyl ester	1	0.54	0.54
Hexachlorobiphenyl isomer	6	0.29	3.1
Hexachlorobiphenyls	1	0.29	0.29
Hexachloronaphthalene isomer	4	1.1	1.9
Hexacosane	4	0.55	10
Hexadecane	4	2.1	7
Hexadecane, 2,6,10,14-tetramethyl-	13	1	7.1
Hexadecane, 2,6,11,15-tetramethyl-	1	3	3
Hexadecane, 3-methyl-	1	0.66	0.66
Hexadecanoic acid	3	0.26	1.2
Hexanedioic acid, bis(2-ethylhexyl)ester	3	0.38	2.5
Hexanedioic acid, dioctyl ester	1	0.41	0.41
Hexatriacontane	4	0.28	2.2
Hop-22(29)-en-3.beta.-ol	3	0.23	1.4
Hyoscyamine	1	3.7	3.7
Isocopalane	1	2.7	2.7
Isophthalic acid, 2,4-dimethoxy-6-methyl-, 3-meth!	1	0.26	0.26
Ketone	6	0.23	0.63
Ketone, 2,2-dimethylcyclohexyl methyl	1	11	11
Ledol	1	24	24
Longifolenaldehyde	1	0.47	0.47
Naphthalene, 1,2,3,4-tetrachloro-	4	0.46	1.7
Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-di!	3	0.24	2.5
Naphthalene, 1,3,5,7-tetrachloro-	2	0.56	0.66
Naphthalene, 1,3,7-trichloro-	5	0.48	4.1
Naphthalene, 1,4,6,7-tetrachloro-	6	0.24	0.73
Naphthalene, 1,4-dichloro-	1	0.57	0.57
Naphthalene, 1,5-dichloro-	2	0.025	1.1
Naphthalene, 2,3,6-trichloro-	3	0.22	2.1
Naphthalene, 2,3-dichloro-	3	0.3	2.2
Naphthalene, 2-(1-methylethyl)-	1	0.28	0.28
Naphthalene, 2-(phenylmethyl)-	1	2.6	2.6

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Naphthalene, 2-phenyl-	2	0.48	3.3
Naphthalene, decahydro-, trans-	2	0.3	4.7
Naphthalene, decahydro-1,6-dimethyl-	1	0.26	0.26
Naphthalene, decahydro-2-methyl-	10	0.32	5.8
Naphthalene, decahydro-4a-methyl-1-methylene-7-(	1	0.27	0.27
Nitrogen Compound	4	0.51	16
Nitrogen compound	6	0.26	9.6
Nonacosane	5	0.43	8.8
Nonadecane	1	3.6	3.6
Nonadecane, 9-methyl-	3	0.19	7.6
Nonahexacontanoic acid	1	0.21	0.21
Nonane, 2-bromo-5-ethyl-	1	1.7	1.7
Nonane, 3-methyl-	1	2.8	2.8
Nonane, 3-methyl-5-propyl-	1	0.3	0.3
Nonanedioic acid, bis(2-ethylhexyl) ester	2	5.1	5.8
None Detected	0		
Octadecanal	1	0.56	0.56
Octadecane	7	0.23	60
Octadecane, 2,6-dimethyl-	1	1.2	1.2
Octadecane, 2-methyl-	1	2.6	2.6
Octadecanoic acid, butyl ester	2	0.26	0.42
Octane, 2,3,7-trimethyl-	2	1.3	5.2
Octane, 2,6-dimethyl-	1	2.7	2.7
Octanethioic acid, S-hexyl ester	1	0.25	0.25
Octyl phenol isomer	2	6.9	12
Olean-12-ene	1	5.7	5.7
Olean-12-ene, 3-methoxy-, (3.beta.)-	1	0.95	0.95
Oleic Acid	1	3.6	3.6
Oxygenated Hydrocarbon	119	0.17	37
P-Terphenyl, 2,4,4",6-tetrachloro-	2	0.3	0.65
Pentachlorobiphenyl isomer	8	0.28	2.5
Pentachloronaphthalene isomer	2	1.1	1.3
Pentacosane	2	0.59	5
Pentadecane	4	0.44	5.5
Pentadecane, 2,6,10,14-tetramethyl-	5	1.3	10
Pentadecane, 4-methyl-	1	2.9	2.9
Perylene	18	0.46	18
Phenanthrene, 2,5-dimethyl-	1	3.4	3.4
Phenanthrene, 2-methyl-	1	4.5	4.5
Phenanthrene, 3-methyl-	2	0.3	0.75
Phenanthrene, 4-methyl-	3	0.58	5.8
Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	1	1.8	1.8
Phenol, 2-(1,1-dimethylethyl)-	1	1.4	1.4
Phenol, 2-(1,1-dimethylethyl)-4-methyl-	3	0.29	4.5
Phenol, 2-methyl-4-(1,1',3,3'-tetramethylbutyl)-	2	1.9	2.5
Phenol, 4-(1,1,3,3-tetramethylbutyl)-	20	0.23	6.4
Phenol, 4-(1,1-dimethylethyl)-2-methyl-	1	0.21	0.21
Phenol, 4-(1,1-dimethylpropyl)-	2	0.66	0.68

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Phenol, 4-(2,2,3,3-tetramethylbutyl)-	20	0.19	5.2
Phenol, 4-(2,2,4-trimethylpentyl)-	4	0.39	16
Phenol, 4-nonyl-	7	0.27	6.8
Phenol, dodecyl-	1	0.3	0.3
Phenol, nonyl-	38	0.18	8.3
Phosphine sulfide, triphenyl-	2	0.25	0.4
Phosphoric acid, 2-ethylhexyl diphenyl ester	8	0.32	14
Phosphoric acid, tris(methylphenyl)ester	2	2.1	2.4
Phthalate	29	0.18	22
Polycyclic Hydrocarbon	2	1	4.2
Polynuclear Aromatic Hydrocarbon	84	0.16	28
Pregn-4-ene-3,20-dione, (10.alpha.)-	1	1.4	1.4
Propanoic acid, 2-methyl-,4-methylphenyl ester	1	0.65	0.65
Purin-8-ol, 6-amino-8,9-dihydro-	1	0.5	0.5
Purine-6(1H)-thione, 3,7-dimethylseleno-	1	1.3	1.3
Pyrazole, 3-(p-chlorophenyl)-5-methyl-	1	1.5	1.5
Pyrene, 1-methyl-	1	0.31	0.31
Pyrene, 2-methyl-	3	0.47	1.5
Pyridine, 2,4,6-trimethyl-	1	5.4	5.4
Pyridine, 4-(dimethylamino)-,^methyl iodide	1	0.74	0.74
Pyridine, 4-methyl-, 1-oxide	1	1.2	1.2
Saturated Hydrocarbon	27	0.18	6.8
Saturated Hydrocarbon: <C10	1	1	1
Saturated Hydrocarbon: >C20	91	0.17	34
Saturated Hydrocarbon: C10-C20	112	0.15	680
Silane, methyltriphenoxy-	1	0.46	0.46
Siloxane	32	0.17	14
Stannane, bromodibutyl(1-methylethyl)-	2	0.21	0.52
Stannane, bromotributyl-	2	0.2	1.1
Stannane, chlorotris(2-methylpropyl)-	2	0.16	0.96
Stannane, tributylchloro-	2	1.8	3.5
Stigmast-4-en-3-one	1	2.4	2.4
Stigmast-5-en-3-ol-, (3.beta.,24S)-	18	0.18	7.3
Stigmastane	2	3.5	12
Sulfur, mol. (S8)	10	0.19	7.2
TID Compound 2	0		
TID Compound 3	0		
TID Compound 4	0		
TID Compound 5	0		
TID Compound 6	0		
TID Compound 7	0		
TID Compound 8	0		
TID Compound 9	0		
TID Compound 10	0		
TID Compound 11	0		
TID Compound 12	0		
TID Compound 13	0		
TID Compound 14	0		

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
TID Compound 15	0		
TID Compound 16	0		
TID Compound 17	0		
TID Compound 18	0		
TID Compound 19	0		
TID Compound 20	0		
TID Compound 21	0		
TID Compound 22	0		
TID Compound 23	1	1.5	1.5
TID Compound 24	0		
TID Compound 25	0		
TID Compound 26	0		
TID Compound 27	0		
TID Compound 28	0		
TID Compound 29	0		
TID Compound 30	0		
Tetracosane	2	9.3	27
Tetracosane, 2,6,10,15,19,23-hexamethyl-	3	0.3	3.3
Tetradecane	4	0.21	9.7
Tetradecane, 2-methyl-	1	1.2	1.2
Tetratriacontane	1	14	14
Trachelanthamidine	1	1.1	1.1
Tricyclo[3.3.1.13,7]decane-2,6-dione, 4-bromo-	1	1.8	1.8
Tricyclo[3.3.1.13,7]decanone, 4-iodo-,(1.alpha.,!	1	1.3	1.3
Tricyclo[4.3.1.13,8]undecane, 3-chloro-	1	1.2	1.2
Tridecane	3	0.19	9
Tridecane 7-cyclohexyl-, 7-cyclohexyl-	2	0.41	3.5
Tridecane, 2-methyl-	1	3.4	3.4
Tridecane, 6-methyl-	3	1.1	3.6
Tridecane, 7-methyl-	2	5	8.4
Undecane, 2 3-dimethyl-	1	0.67	0.67
Undecane, 2,10-dimethyl-	2	0.19	2.3
Undecane, 2,5-dimethyl-	1	0.35	0.35
Undecane, 2,6-dimethyl-	4	1.5	4.1
Undecane, 3,5-dimethyl-	1	3.3	3.3
Undecane, 3,6-dimethyl-	3	0.26	2.3
Undecane, 3,8-dimethyl-	1	0.68	0.68
Undecane, 3-methyl-	1	0.32	0.32
Undecane, 5-methyl-	1	1.4	1.4
Undecane, 6-methyl-	1	3.9	3.9
Unknown	6	0.18	16
Unsaturated Hydrocarbon	41	0.17	9
Vitamin E	6	0.77	7.5
Xanthopterin	1	4.1	4.1
Zinc, bis[2-(1,1-dimethylethyl)-3,3-dimethylcycl!	1	2.3	2.3
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih!	45	0.18	3.9
a'-Neogammacer-22(29)-en-3-ol,(3.beta.,21.beta.)-	1	0.34	0.34
cis-1-Ethinyl-2-methyl-1-cyclohexanol	1	1.7	1.7

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
cis-Tetrahydroionol	1	4.4	4.4
d-Homoandrostane, (5.alpha.,13.alpha.)-	17	0.21	3.1
n-Amylcyclohexane	1	14	14
n-Nonylcyclohexane	1	1.7	1.7
n-Octacosane	1	3.2	3.2
Volatile Organics (mg/kg)			
.alpha.-Pinene	1	0.0075	0.0075
.beta.-Pinene	1	0.012	0.012
1,2,4-Trimethylbenzene	1	2.4	2.4
1,2-Dichlorobenzene	4	0.0081	2
1,3-Dichlorobenzene	1	0.012	0.012
1,4-Dichlorobenzene	3	0.0091	0.068
1-Ethyl-3-methylcyclohexane (c,t)	4	0.0078	0.26
1-Hexanol, 2-ethyl-	4	0.0098	0.17
1-Hexene, 3-methyl-	1	0.025	0.025
1-Nonene, 4,6,8-trimethyl-	1	0.084	0.084
1-Octanol, 2-butyl-	2	0.014	0.063
1-Tridecanol	1	0.058	0.058
2(1H)-Naphthalenone, octahydro-8a -methyl-, cis-	1	0.059	0.059
2,2,6,6-Tetramethylheptane	1	0.026	0.026
2-Octene, 2,6-dimethyl-	2	0.014	0.22
3-Dodecene, (Z)-	1	0.17	0.17
4,7-Methano-1H-inden-1-ol,octahydro-	1	0.047	0.047
4,7-Methano-1H-indene, octahydro-	2	0.013	0.032
4-Decanone	1	0.31	0.31
4-Decene, 6-methyl-, (E)-	4	0.0089	0.13
4-Hepten-3-one, 4-methyl-	1	0.17	0.17
4-Octen-3-one	1	0.031	0.031
4-Octene, 2,6-dimethyl-, [S-(E)]-	1	0.0056	0.0056
5-Dodecene, (Z)-	1	0.061	0.061
8-Octadecenal	1	0.02	0.02
Benserazide	1	0.016	0.016
Benzene, (1,1-dimethylpropyl)-	2	0.011	0.055
Benzene, (2-methyl-1-propenyl)-	1	0.24	0.24
Benzene, 1,2,4,5-tetramethyl-	1	2.6	2.6
Benzene, 1-ethyl-3-(1-methylethyl)-	1	0.11	0.11
Benzene, 1-methyl-3-(1-methylethyl)-	2	0.0082	2.7
Benzene, 2,4-dimethyl-1-(1-methylethyl)-	1	0.069	0.069
Benzene, 2-ethenyl-1,3-dimethyl-	1	0.033	0.033
Benzene, 2-ethyl-1,3-dimethyl-	1	0.21	0.21
Benzene, 2-ethyl-1,4-dimethyl-	1	0.0065	0.0065
Benzene, 4-ethyl-1,2-dimethyl-	2	0.021	0.15
Benzene, ethyl-1,2,4-trimethyl-	1	0.007	0.007
Bicyclo[2.2.1]heptan-2-one,1,7,7-trimethyl-, (1R!	2	0.012	0.019
Bicyclo[2.2.1]heptane, 2-methyl-, exo-	1	0.0065	0.0065
Bicyclo[4.1.0.]heptane, 3,7,7-trimethyl-	1	0.017	0.017
Bicyclo[4.1.0]heptan-3-one, 4,7,7-trimethyl-,[1R!	2	0.007	0.033
Bicyclo[4.1.0]heptan-3-one,4,7,7-trimethyl-, [1R!	1	0.024	0.024

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Butanal	1	0.014	0.014
Butanoic acid, 3-methyl-	1	0.0093	0.0093
Cyclic Hydrocarbon	32	0.0037	0.33
Cyclododecane	3	0.011	0.021
Cycloheptane, methyl-	6	0.0076	0.17
Cycloheptanone, 2-methyl-	1	0.01	0.01
Cyclohexane, (2,2-dimethylcyclopentyl)-	1	0.011	0.011
Cyclohexane, (2-methylpropyl)-	2	0.013	0.21
Cyclohexane, 1,1,2,3-tetramethyl-	4	0.0042	5.5
Cyclohexane, 1,1,3,5-tetramethyl-,cis-	1	0.0079	0.0079
Cyclohexane, 1,1,3-trimethyl-	6	0.0069	1.8
Cyclohexane, 1,1-dimethyl-	2	0.023	0.7
Cyclohexane, 1,1-dimethyl-2-propyl-	2	0.028	0.049
Cyclohexane, 1,2,3-trimethyl-	1	0.011	0.011
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.beta!	5	0.0094	0.056
Cyclohexane, 1,2,4-trimethyl-	2	0.018	0.26
Cyclohexane, 1,2,4-trimethyl-,(1.alpha.,2.beta.,!	3	0.015	0.028
Cyclohexane, 1,2-diethyl-3-methyl-	1	3.1	3.1
Cyclohexane, 1,2-dimethyl-, cis-	3	0.0016	0.0056
Cyclohexane, 1,2-dimethyl-, trans-	1	0.0015	0.0015
Cyclohexane, 1,3,5-trimethyl-2-octadecyl-	1	0.011	0.011
Cyclohexane, 1,3-dimethyl-, trans-	3	0.088	0.38
Cyclohexane, 1,4-dimethyl-	2	0.013	0.036
Cyclohexane, 1,4-dimethyl-, cis-	3	0.016	2.5
Cyclohexane, 1,4-dimethyl-, trans-	1	3	3
Cyclohexane, 1-(cyclohexylmethyl)-3-methyl-, tra!	1	0.058	0.058
Cyclohexane, 1-ethyl-2,3-dimethyl-	2	0.014	0.033
Cyclohexane, 1-ethyl-2-methyl-	1	0.036	0.036
Cyclohexane, 1-ethyl-4-methyl-, cis-	1	0.028	0.028
Cyclohexane, 1-ethyl-4-methyl-,trans-	4	0.0094	1.1
Cyclohexane, 1-methyl-2-propyl-	6	0.0079	0.046
Cyclohexane, 1-methyl-4-(1-methylethyl)-	1	0.019	0.019
Cyclohexane, 2,4-diethyl-1-methyl-	2	0.088	0.17
Cyclohexane, 2-butyl-1,1,3-trimethyl-	2	0.0082	0.096
Cyclohexane, butyl-	4	0.013	2.1
Cyclohexane, ethyl-	1	0.014	0.014
Cyclohexane, methyl-	8	0.011	10
Cyclohexane, pentyl-	2	0.049	0.062
Cyclohexane, propyl-	1	2.5	2.5
Cyclohexanol, 2,6-dimethyl-	1	0.0061	0.0061
Cyclohexanone, 2,3-dimethyl-	1	0.05	0.05
Cyclohexanone, 3-methyl-2-(1-methylethyl)-, cis-!	1	3.7	3.7
Cyclohexanone, 5-methyl-2-(1-methylethylidene)-	1	0.041	0.041
Cyclohexene, 1-pentyl-	1	0.064	0.064
Cyclooctane, butyl-	1	0.022	0.022
Cyclopentane, 1,1,3-trimethyl-	1	0.019	0.019
Cyclopentane, 1-ethyl-3-methyl-, trans-	1	0.042	0.042
Cyclopentane, 1-methyl-2-propyl-	1	0.0089	0.0089

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Cyclopentane, 1-methyl-3-(1-methylethyl)-	1	1	1
Cyclopentane, pentyl-	1	0.0079	0.0079
Cyclopropane, 1-(2-methylbutyl)-1-methylpropyl)-	1	0.71	0.71
Cyclopropane, 1-butyl-1-methyl-2-propyl-	2	0.042	0.1
Cylohexane, 1,3,5-trimethyl-	1	0.0076	0.0076
Decanal	1	0.0065	0.0065
Decane	1	0.051	0.051
Decane, 2,3,5-trimethyl-	1	0.48	0.48
Decane, 2,6,7-trimethyl-	2	0.068	0.088
Decane, 3-ethyl-3-methyl-	1	0.014	0.014
Decane, 3-methyl-	5	0.01	0.095
Decane, 4-methyl-	16	0.0063	1.7
Decane, 5-propyl-	1	0.019	0.019
Dodecane	3	0.04	0.5
Dodecane, 2,6,10-trimethyl-	1	0.035	0.035
Dodecane, 3-methyl-	2	0.032	0.084
Dodecane, 4,6-dimethyl-	1	0.0067	0.0067
Dodecane, 6-methyl-	1	0.0088	0.0088
Eicosane	1	0.013	0.013
Eucalyptol	1	0.018	0.018
Heptane, 2,2-dimethyl-	1	0.0084	0.0084
Heptane, 2-methyl-	1	8.8	8.8
Heptane, 3-ethyl-2-methyl-	8	0.016	0.084
Heptane, 3-methyl-	1	4.4	4.4
Heptane, 4-propyl-	1	0.046	0.046
Hexane	2	0.0037	2.5
Hexane, 2,2,3-trimethyl	1	0.16	0.16
Hexane, 2,2,5,5-tetramethyl-	2	0.011	0.021
Hexane, 2,3,4-trimethyl-	1	2.1	2.1
Hexanoic acid	2	0.008	0.013
N-Nitroso-n-methylurea	1	0.0068	0.0068
Naphthalene	2	0.015	0.079
Naphthalene, decahydro-	4	0.023	2.1
Naphthalene, decahydro-, cis-	1	0.01	0.01
Naphthalene, decahydro-, trans-	16	0.0063	3.7
Naphthalene, decahydro-2-methyl-	9	0.0081	2.4
Nonanal	1	0.0067	0.0067
Nonane, 3,7-dimethyl-	4	0.018	0.49
Nonane, 3-methyl-	9	0.0071	1.3
Nonane, 3-methyl-5-propyl-	2	0.019	0.059
Nonane, 5-methyl-5-propyl-	2	0.039	0.17
None Detected	1	0.36	0.36
Octadecane, 1-(ethenyloxy)-	1	0.19	0.19
Octadecane, 2,6-dimethyl-	1	0.011	0.011
Octane, 1,1'-oxybis-	2	0.015	0.033
Octane, 2,2,6-trimethyl-	1	1.5	1.5
Octane, 2,2-dimethyl-	1	0.057	0.057
Octane, 2,3,7-trimethyl-	1	0.13	0.13

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Octane, 2,3-dimethyl-	1	0.0099	0.0099
Octane, 2,4,6-trimethyl-	1	0.22	0.22
Octane, 2,6-dimethyl-	2	0.007	0.029
Octane, 3,6-dimethyl-	8	0.011	0.28
Octane, 4-ethyl-	1	0.078	0.078
Octane, 5-ethyl-2-methyl-	1	0.039	0.039
Octane, 6-ethyl-2-methyl-	3	0.0087	0.017
Oxirane, [(dodecyloxy)methyl]-	1	0.38	0.38
Oxygenated Hydrocarbon	7	0.00074	0.38
Pulegone	1	0.063	0.063
Saturated Hydrocarbon	6	0.011	0.18
Saturated Hydrocarbon: <C10	1	0.01	0.01
Saturated Hydrocarbon: C10-C20	6	0.0065	0.21
Siloxane	33	0.0062	3.4
Spiro[5.5]undecane	1	2	2
TID Compound 2	0		
TID Compound 3	0		
TID Compound 4	0		
TID Compound 5	0		
TID Compound 6	0		
TID Compound 7	0		
TID Compound 8	0		
TID Compound 9	0		
TID Compound 10	0		
TID Compound 11	0		
TID Compound 12	0		
TID Compound 13	0		
TID Compound 14	0		
TID Compound 15	0		
TID Compound 16	0		
TID Compound 17	0		
TID Compound 18	0		
TID Compound 19	0		
TID Compound 20	0		
Tetradecane	1	0.0083	0.0083
Tetradecane, 2,5-dimethyl-	1	0.17	0.17
Tridecane	1	0.02	0.02
Tridecane, 7-methyl-	7	0.015	0.37
Undecane	1	0.05	0.05
Undecane, 2,5-dimethyl-	1	0.045	0.045
Undecane, 2,6-dimethyl-	7	0.068	0.76
Undecane, 2,9-dimethyl-	1	0.062	0.062
Undecane, 3,6-dimethyl-	2	0.0094	0.19
Undecane, 3-methyl-	1	0.012	0.012
Undecane, 4,4-dimethyl-	1	0.076	0.076
Undecane, 4,7-dimethyl-	2	0.029	1.3
Undecane, 4-methyl-	1	0.084	0.084
Undecane, 6,6-dimethyl-	1	0.0072	0.0072

TABLE B-17
Statistical Evaluation of Analytes Tentatively Identified in Sediment Samples

Compound Name	Frequency of Detection	Minimum Result	Maximum Result
Unknown	11	0.00031	0.18
Unsaturated Hydrocarbon	12	0.0013	0.078
Urea	2	0.0088	0.042
cis-1,2-Dichloroethene	4	0.0094	0.026
cis-1-Ethyl-3-methyl-cyclohexane	2	0.027	0.035
n-Amylcyclohexane	2	0.021	3.2
p-Isopropyltoluene (p-Cymene)	1	0.031	0.031

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Semivolatile Organics (mg/kg)						
(R)-(-)-(z)-14-methyl-8-hexadecen-1-ol	SC-QW02-SD-701 (0.00,0.50)	1	1	1	1	33
.alpha.-D-Galactopyranose, 1,2,3,4,6-pentakis-O-!	SC-QE11-SD-801 (0.00,0.50)	1	2.6	2.6	Jz	23.9
.delta.-Selinene	SC-QE09-SD-703 (3.00,4.00)	1	0.18	0.18	1	16.7
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih!	SC-QE08-SD-701 (0.00,0.50)	45	3.9	0.18	1z	57.7
1,1'-Bicyclohexyl, 2-ethyl-, cis-	SC-QE03-SD-802 (0.50,1.00)	1	2.2	2.2	J	22.9
1,1'-Bicyclohexyl,2-methyl-,trans-	SC-QE03-SD-802 (0.50,1.00)	1	5.4	5.4	J	22.9
1,1'-Bipehnyl, 2,3',5,5'-tetrachloro-	SC-QW05-SD-601 (0.00,5.00)	1	0.21	0.21	2	20.1
1,1'-Biphenyl, 2,2',3,3',4,4'-hexachloro-	SC-QW05-SD-701 (0.00,0.50)	1	0.36	0.36	2	17.3
1,1'-Biphenyl, 2,2',3,4,5'-pentachloro-	SC-QW05-SD-701 (0.00,0.50)	1	0.17	0.17	2	17.3
1,1'-Biphenyl, 2,2',3,4-tetrachloro-	SC-QW03-SD-602 (0.50,1.00)	1	2	2	2	50.1
1,1'-Biphenyl, 2,2',4,4',6-pentachloro-	SC-QW05-SD-701 (0.00,0.50)	2	0.82	0.54	2	17.3
1,1'-Biphenyl, 2,2',4,5',6-pentachloro-	SC-QE02-SD-801 (0.00,0.50)	2	3.7	0.97	J	42.7
1,1'-Biphenyl, 2,2',4,5,5'-pentachloro-	SC-QW03-SD-801 (0.00,0.50)	8	5.3	0.25	J	26.1
1,1'-Biphenyl, 2,3',4',5-tetrachloro-	SC-QW03-SD-601 (0.00,0.50)	3	1.8	0.31	2	54.2
1,1'-Biphenyl, 2,3',4,4',5,5'-hexachloro-	SC-QE02-SD-801 (0.00,0.50)	1	1.3	1.3	J	42.7
1,1'-Biphenyl, 2,3',4,5',6-pentachloro-	SC-QW03-SD-802 (0.50,1.00)	1	1.5	1.5	J	23.9
1,1'-Biphenyl, 2,3',4,5,5'-pentachloro-	SC-QW03-SD-801 (0.00,0.50)	2	6.3	3.5	J	26.1
1,1'-Biphenyl, 2,3,3',4',6-pentachloro-	SC-QW05-SD-601 (0.00,5.00)	1	0.37	0.37		20.1
1,1'-Biphenyl, 2,3,3',4'-tetrachloro-	SC-QW03-SD-702 (0.50,1.00)	1	2.4	2.4	2	23.5
1,1'-Biphenyl, 2,3,3',4,6-pentachloro-	SC-QW03-SD-602 (0.50,1.00)	3	2.4	0.66	2	50.1
1,1'-Biphenyl, 2,3,4',5,6-Pentachloro-	SC-QW03-SD-702 (0.50,1.00)	1	4.5	4.5	2	23.5
1,1'-Biphenyl, 2,3,4,5-tetrachloro-	SC-QW03-SD-602 (0.50,1.00)	1	0.79	0.79	2	50.1
1,1'-Biphenyl, 3,3',4,4',5,5'-hexachloro-	SC-QW05-SD-701 (0.00,0.50)	1	0.43	0.43	2	17.3
1,1'-Biphenyl, pentachloro-	SC-QW03-SD-601 (0.00,0.50)	2	1.9	0.24	2	54.2
1,1'-Biphenyl, tetrachloro-	SC-QW03-SD-701 (0.00,0.50)	1	0.36	0.36	1	34.1
1,1'-Biphenyl,2,2',4,4',6,6'-hexachloro-	SC-QW03-SD-801 (0.00,0.50)	3	3.4	0.6	J	26.1
1,1,4-Trimethylcyclohexane	SC-QE06-SD-803 (4.00,4.50)	1	1.9	1.9	J	27.6
1,1-Biphenyl, 2,2',3,4,5,5'-hexachloro-	SC-QW03-SD-602 (0.50,1.00)	3	4.1	0.66	1	50.1
1,1-Dimesityl-3-methyl-1-buten-2-ol	SC-QE06-SD-801 (0.00,0.50)	1	2.6	2.6	J	41.6
1,2-Benzenedicarboxylic acid,ditridecyl ester	SC-QW04-SD-603 (2.50,3.00)	1	16	16	2	34
1,3,6-Octatriene, 3,7-dimethyl-, (E)-	SC-QW01-SD-801 (0.00,0.50)	1	0.23	0.23	J	34.8
1,3,7,7-Tetramethyl-2,11-dioxa-3,5-bicyclo(4.4.1!	SC-QE06-SD-803 (4.00,4.50)	1	1.7	1.7	Jz	27.6
1,4-Naphthoquinone, 6-ethyl-2,5-dihydroxy-	SC-QW07-SD-701 (0.00,0.50)	1	0.26	0.26	2	20.8
1,5-Heptadiene, 3,3,5-trimethyl-	SC-QW04-SD-802 (0.50,1.00)	1	0.39	0.39	J	20.7
1,6-Dimethyldibenzothiophene	SC-QE08-SD-602 (0.50,1.00)	1	3.5	3.5	2	38
1,7-Dimethyldibenzothiophene	SC-QE06-SD-803 (4.00,4.50)	2	2	1.2	J	27.6
1-Adamantyl bromomethyl ketone	SC-QE09-SD-702 (0.50,1.00)	2	0.35	0.26	1	13.6
1-Butanol, 2-ethyl-	SC-QE06-SD-801 (0.00,0.50)	1	1.6	1.6	J	41.6
1-Chlorohexadecane	SC-QE06-SD-803 (4.00,4.50)	1	1.5	1.5	J	27.6
1-Decene, 4-methyl-	SC-QE06-SD-801 (0.00,0.50)	1	2.8	2.8	J	41.6
1-Docosanethiol	SC-QW02-SD-702 (0.50,1.00)	1	0.45	0.45	1	22.8
1-Dotriacontanol	SC-QW02-SD-601 (0.00,0.50)	1	0.72	0.72	2	28.4
1-Eicosanol	SC-QW02-SD-601 (0.00,0.50)	3	1	0.36	2	28.4
1-Hentetracontanol	SC-QE06-SD-801 (0.00,0.50)	1	4.5	4.5	J	41.6
1-Methyl-2,6-diphenyl-4,4-tetramethylene-1,4-dih!	SC-QE09-SD-701 (0.00,0.50)	1	0.45	0.45	2z	13.8
1-Nonadecene	SC-QW02-SD-602 (0.50,1.00)	2	0.64	0.34	2	26.5
1-Nonene	SC-QE03-SD-802 (0.50,1.00)	1	2.9	2.9	J	22.9
1-Octadecanol	SC-QE09-SD-803 (1.50,2.01)	1	1.2	1.2	J	16.7
1-Tetradecanamine, N,N-dimethyl-	SC-QE02-SD-601 (0.00,0.50)	1	4	4	1	40.4
1-Tetradecene	SC-TR01-SD-601 (0.00,0.50)	1	0.42	0.42	2	64.8
10-Demethylsqualene	SC-QE07-SD-801 (0.00,0.50)	1	0.33	0.33	J	11.1
10H-Phenothiaphosphine, 7-chloro-2-fluor-10-hydr	SC-QE07-SD-801 (0.00,0.50)	9	1.5	0.18	Jz	11.1
11-Dodecen-1-ol, 2,4,6-trimethyl-,(R,R,R)-	SC-QW04-SD-802 (0.50,1.00)	1	0.4	0.4	J	20.7
11H-Benzo[a]fluorene	SC-QE02-SD-702 (0.50,1.00)	2	5.7	0.4	2	17.7
11H-Benzo[b]fluorene	SC-QE03-SD-601 (0.00,0.50)	4	7.4	1.7	2	61
16-Octadecenal	SC-QW02-SD-602 (0.50,1.00)	1	0.4	0.4	2	26.5

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
17-Pentatriacontene	SC-QW01-SD-701 (0.00,0.50)	1	0.32	0.32	J	12.4
1H-1,2,4-Triazole, 1-butyl-	SC-QE09-SD-801 (0.00,0.50)	1	0.4	0.4	J	18.8
1H-3a,7-Methanoazulene, 2,3,6,7,8,8a-hexahydro-1	SC-QW04-SD-802 (0.50,1.00)	1	0.69	0.69	Jz	20.7
1H-Cycloprop[e]azulene, 1a,2,3,4,4a,-5,6,7b-oct!	SC-QW07-SD-802 (0.50,1.00)	3	1.7	0.62	JBz	18
1H-Cyclopropa[a]naphthalene,1a,2,3,3a,4,5,6,7b-o!	SC-QE10-SD-802 (0.50,1.00)	1	0.24	0.24	Jz	25
1H-Indene, 1-(1,5-dimethyl-2-hexenyl)octahydro-7	SC-QW04-SD-801 (0.00,0.50)	1	2.3	2.3	Jz	38.4
1H-Indene, 5-butyl-6-hexyloctahydro-	SC-QW04-SD-801 (0.00,0.50)	3	2.3	1.7	J	38.4
2(1H)-Naphthalenone, 4a,5,6,7,8,8a -hexahydro-7.!	SC-QE01-SD-801 (0.00,0.50)	1	3.7	3.7	Jz	38
2(1H)-Naphthalenone, octahydro-1,4a-dimethyl-, (!	SC-QE06-SD-802 (0.50,1.00)	1	7.2	7.2	Jz	31.8
2(1H)-Pyridinone, 1-propyl-	SC-QE02-SD-801 (0.00,0.50)	1	43	43	J	42.7
2,2',4,4',5,5'-hexachlorobiphenyl	SC-QW05-SD-601 (0.00,5.00)	1	0.34	0.34	2	20.1
2,2',4,4',5,6'-hexachlorobiphenyl	SC-QW03-SD-802 (0.50,1.00)	1	1.2	1.2	J	23.9
2,3',4,4',5-pentachlorobiphenyl	SC-QW03-SD-802 (0.50,1.00)	2	2.1	0.87	J	23.9
2,3,3',4,4'-pentachlorobiphenyl	SC-QW03-SD-702 (0.50,1.00)	4	4.9	0.45	2	23.5
2,4-Dimethylaniline	SC-QE09-SD-701 (0.00,0.50)	1	2.3	2.3	1	13.8
2,5-Nonadien-4-one, 9-(3-furanyl)-2,6-dimethyl-!	SC-QE03-SD-802 (0.50,1.00)	1	3.8	3.8	Jz	22.9
2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-	SC-QW07-SD-602 (0.50,1.00)	1	0.17	0.17	1	16.7
2-Decene, 8-methyl-, (Z)-	SC-QE05-SD-801 (0.00,0.50)	1	0.29	0.29	J	20.3
2-Docosene	SC-QE08-SD-702 (0.50,1.00)	7	21	0.15	2	38.9
2-Dodecen-1-yl(-)succinic anhydride	SC-QE08-SD-701 (0.00,0.50)	19	8.2	0.2	2	57.7
2-Methoxyresorcinol	SC-QE03-SD-802 (0.50,1.00)	1	2.4	2.4	J	22.9
2-Methyl-1-undecanol	SC-QE09-SD-601 (0.00,0.50)	1	5.1	5.1	1	32.1
2-Methyl-2,3,4,5,6,7-hexhydro-1H-2-benzazonine	SC-QW07-SD-701 (0.00,0.50)	1	0.52	0.52	1	20.8
2-Methylchrysene	SC-QE02-SD-601 (0.00,0.50)	2	5.7	2.9	2	40.4
2-Pentanone, 4-hydroxy-4-methyl-	SC-QW04-SD-801 (0.00,0.50)	20	30	6.4	ABJ	38.4
2-Pentene, 3-ethyl-4,4-dimethyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.85	0.85	J	16.7
2-Propenoic acid, 3-[2,3-dihydro-3-[(4-methoxyph!	SC-QE06-SD-802 (0.50,1.00)	1	4.8	4.8	Jz	31.8
28-Nor-17.alpha.(H)-hopane	SC-QE08-SD-802 (0.50,1.00)	9	41	2	J	27.5
28-Nor-17.beta.(H)-hopane	SC-QE03-SD-601 (0.00,0.50)	13	52	2.8	2	61
2H-1,2,3-Triazole-4-carboxaldehyde,2-(2-fluoroph!	SC-QE05-SD-801 (0.00,0.50)	1	1	1	Jz	20.3
2H-1-Benzopyran-6-ol, 3,4-dihyro-2,5,7,8-tetramet	SC-QE08-SD-701 (0.00,0.50)	1	5.6	5.6	2	57.7
2H-Pyran, 2-[(1-butyl-2-propynyl)oxy]tetrahydro-	SC-QW06-SD-801 (0.00,0.50)	1	0.18	0.18	J	18
3,4-Dihydrocyclopenta(cd)pyrene (acepyrene)	SC-QE02-SD-702 (0.50,1.00)	1	3.7	3.7	2	17.7
3,4-Heptadien-2-one, 3,5-dicyclopentyl-6-methyl	SC-QE03-SD-802 (0.50,1.00)	1	4.1	4.1	J	22.9
3,5-Heptanedione, 2,6-dimethyl-	SC-QE09-SD-802 (0.50,1.00)	1	0.7	0.7	J	15.2
3-(3-Carboxy-4-hydroxyphenyl)-D-alanine	SC-QE09-SD-801 (0.00,0.50)	1	0.4	0.4	J	18.8
3-(3-Pyridyl)propenoic acid	SC-QE09-SD-701 (0.00,0.50)	2	0.97	0.26	1	13.8
3-Buten-2-one, 4-(dimethylamino)-4-(1-piperidin!	SC-QE03-SD-802 (0.50,1.00)	1	3.1	3.1	Jz	22.9
3-Phenylindole	SC-QE09-SD-1201 (0.00,0.50)	1	0.28	0.28	1	13.3
4,7-Methano-1H-indene, octahydro-	SC-QW06-SD-701 (0.00,0.50)	1	0.32	0.32	2	19.7
4-Methyl-3,5-bis(2-methyl-2-propenyl)-2(5H)-fura!	SC-QE06-SD-803 (4.00,4.50)	1	2	2	Jz	27.6
4H-Cyclopenta[def]phenanthrene	SC-QE02-SD-702 (0.50,1.00)	17	14	0.26	2	17.7
5,5,9,9-Tetramethylcyclonon-2(cis)-en-1,4-dione	SC-QE08-SD-801 (0.00,0.50)	1	2.2	2.2	J	33.3
5-Octen-4-one, 7-methyl-	SC-QE08-SD-802 (0.50,1.00)	1	5	5	J	27.5
5.alpha.-Androstan-3.beta.-ol,4,4-dimethyl-	SC-QE06-SD-702 (0.50,1.00)	1	1.5	1.5	2	22.7
5.alpha.-Ergostan-15-one	SC-QE03-SD-801 (0.00,0.50)	1	4.3	4.3	J	25.1
5.alpha.-Stigmast-3-one-	SC-QE09-SD-802 (0.50,1.00)	1	0.62	0.62	J	15.2
6,10,14-Hexadecatrien-1-ol, 3,7,11,15-tetramethy!	SC-QW02-SD-601 (0.00,0.50)	1	0.25	0.25	1z	28.4
6-Dodecanone	SC-QE08-SD-801 (0.00,0.50)	2	14	4.5	J	33.3
6-Octen-1-ol, 3,7-dimethyl-,formate	SC-QW04-SD-602 (0.50,1.00)	1	0.74	0.74	1	38.8
6H,8H-Benzo[10,11]chryseno[1,12-cd]pyran-6,8-di	SC-QE06-SD-803 (4.00,4.50)	2	5.3	3.6	Jz	27.6
6H-Purin-6-one, 2-(dimethylamino)-1,7-dihydro-	SC-QE09-SD-1201 (0.00,0.50)	1	0.29	0.29	1	13.3
7-Amino-2,3-dihydro-5-phenyl-1H-1,4-benzidazepi	SC-QE09-SD-803 (1.50,2.01)	1	1.2	1.2	Jz	16.7
7-Tetradecene, (E)-	SC-QE03-SD-802 (0.50,1.00)	1	2.8	2.8	J	22.9
7-Tridecanone	SC-QE09-SD-803 (1.50,2.01)	1	1.1	1.1	J	16.7
7H-Benz[de]anthracen-7-one	SC-QE02-SD-701 (0.00,0.50)	2	0.68	0.17	2	21.2
9,10-Anthracenedione	SC-QW04-SD-701 (0.00,0.50)	14	3.1	0.2	2	35.5

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
9H-Fluoren-9-one	SC-QW04-SD-701 (0.00,0.50)	1	0.44	0.44	2	35.5
9H-Fluorene, 9-(phenylmethylene)-	SC-QE02-SD-801 (0.00,0.50)	1	1.6	1.6	J	42.7
9H-Fluorene, 9-ethylidene-	SC-QE06-SD-602 (0.50,1.00)	1	1.7	1.7	2	25.5
a'-Neogammacer-22(29)-en-3-ol,(3.beta.,21.beta.)-	SC-QE11-SD-802 (0.50,1.00)	1	0.34	0.34	J	20
A'-Neogammacer-22(29)-en-3-one	SC-QE01-SD-801 (0.00,0.50)	1	1.7	1.7	J	38
Acetamide, N-(3-methylphenyl)-	SC-QE09-SD-1201 (0.00,0.50)	1	0.94	0.94	2	13.3
Acetamide, N-methyl-N-(4-methylphenyl)-	SC-QE09-SD-803 (1.50,2.01)	2	6.5	0.23	J	16.7
Aciphyllene	SC-QW07-SD-802 (0.50,1.00)	2	0.37	0.33	J	18
Adamantane, 1,3-dimethyl-	SC-QE05-SD-801 (0.00,0.50)	2	0.26	0.24	J	20.3
Adenine	SC-QE09-SD-702 (0.50,1.00)	1	1.5	1.5	2	13.6
Allopregnane	SC-QW03-SD-802 (0.50,1.00)	1	1.5	1.5	J	23.9
Alnulin	SC-QW07-SD-702 (0.50,1.00)	1	0.6	0.6	1	19.8
Androst-4-ene-3,17-dione, 15-hydroxy-, (15.alph!	SC-QE03-SD-802 (0.50,1.00)	1	5	5	Jz	22.9
Androstane, (5.beta.)-	SC-QE06-SD-703 (3.00,3.50)	1	1	1	1	17.8
Anthracene, 2-methyl-	SC-QE02-SD-702 (0.50,1.00)	2	5.4	0.2	2	17.7
Anthracene, 9-butyltetradecahydro-	SC-QE08-SD-801 (0.00,0.50)	2	18	4.9	J	33.3
Anthracene, 9-dodecyltetradecahydro-	SC-QE06-SD-801 (0.00,0.50)	4	7	0.96	J	41.6
Anthracene, 9-methyl-	SC-QE06-SD-601 (0.00,0.50)	3	4.5	0.67	2	37.2
Aromatic Hydrocarbon	SC-QE08-SD-702 (0.50,1.00)	65	15	0.16		38.9
Azulene, 1,2,3,5,6,7,8,8A-octahydro-1,4-dimethy!	SC-QW01-SD-801 (0.00,0.50)	1	3.9	3.9	Jz	34.8
Baccharane	SC-QE08-SD-802 (0.50,1.00)	3	58	0.63	J	27.5
Bacchotricuneatin c	SC-QE09-SD-701 (0.00,0.50)	1	0.25	0.25	1	13.8
Benz[j]aceanthrylene, 3-methyl-	SC-QE02-SD-702 (0.50,1.00)	1	5.2	5.2	2	17.7
Benzaldehyde, 3-methyl-,oxime	SC-QE09-SD-803 (1.50,2.01)	1	0.95	0.95	J	16.7
Benzaldehyde, 4-methyl-, oxime	SC-QE09-SD-802 (0.50,1.00)	1	6.2	6.2	J	15.2
Benzenamine, 3,4,5-trichloro-	SC-QE06-SD-801 (0.00,0.50)	1	0.29	0.29	J	41.6
Benzenamine, 3,5-dimethyl-	SC-QE09-SD-1201 (0.00,0.50)	2	1.5	0.36	1	13.3
Benzene, (1-ethoxyethyl)-	SC-QE09-SD-702 (0.50,1.00)	2	1.8	0.18	1	13.6
Benzene, 1-nitro-4-(phenylthio)-	SC-QE01-SD-801 (0.00,0.50)	1	1.3	1.3	J	38
Benzene, hexaethyl-	SC-QE09-SD-801 (0.00,0.50)	1	0.61	0.61	J	18.8
Benzenesulfonamide, 4-methyl-	SC-QE09-SD-702 (0.50,1.00)	1	0.28	0.28	2	13.6
Benzo(b)fluoranthene	SC-QW01-SD-701 (0.00,0.50)	3	0.69	0.39	2	12.4
Benzo(e)pyrene	SC-QE03-SD-601 (0.00,0.50)	16	20	0.42	2	61
Benzo(j)fluoranthene	SC-QW03-SD-801 (0.00,0.50)	1	6.5	6.5	J	26.1
Benzo[b]chrysene	SC-QE02-SD-702 (0.50,1.00)	1	10	10	2	17.7
Benzo[b]naptho[2,1-d]thiophene	SC-QE02-SD-801 (0.00,0.50)	1	1.2	1.2	J	42.7
Benzo[ghi]fluoranthene	SC-QE02-SD-702 (0.50,1.00)	2	3.9	2.2	2	17.7
Benzo[j]fluoranthene	SC-QW04-SD-602 (0.50,1.00)	2	0.77	0.43	2	38.8
Benzothiazole	SC-QE09-SD-1201 (0.00,0.50)	3	1.5	0.28	1	13.3
Bicyclo[2.2.1]heptane, 1,3,3-trimethyl-	SC-QE06-SD-803 (4.00,4.50)	1	3.4	3.4	J	27.6
Bicyclo[3.2.1]octan-2-one, 1-(1-propenyl)-	SC-QW06-SD-801 (0.00,0.50)	1	0.21	0.21	J	18
Boric acid (H3BO3), trihexyl ester	SC-QE06-SD-801 (0.00,0.50)	1	4.4	4.4	J	41.6
Butanoic acid	SC-QW04-SD-602 (0.50,1.00)	1	0.26	0.26	2	38.8
Butanoic acid, 2-methyl-, methyl ester	SC-QW02-SD-801 (0.00,0.50)	1	0.41	0.41	J	50.2
Caprolactam	SC-QE01-SD-701 (0.00,0.50)	2	0.82	0.49	1	15.1
Carbazole	SC-QE02-SD-702 (0.50,1.00)	9	7.8	0.19	3	17.7
Carboxylic acid	SC-QW03-SD-501 (0.00,0.50)	4	6.8	0.18		48
Chlorinated Compound	SC-QE02-SD-701 (0.00,0.50)	8	1.3	0.28		21.2
Chlorinated compound	SC-QW03-SD-701 (0.00,0.50)	1	0.42	0.42		34.1
Chloroethane	SC-QE11-SD-702 (0.50,1.00)	1	0.17	0.17	2	17
Cholest-23-ene, (5.beta.)-	SC-QE07-SD-701 (0.00,0.50)	1	0.6	0.6	1	21.8
Cholest-7-en-3-ol, 14-methyl-,(3.beta.)-	SC-QE06-SD-803 (4.00,4.50)	1	5.6	5.6	J	27.6
Cholestan-3-one, 4,4-dimethyl-,(5.alpha.)-	SC-QW02-SD-602 (0.50,1.00)	1	0.43	0.43	1	26.5
Cholestane	SC-QE08-SD-802 (0.50,1.00)	2	4.2	2.5	J	27.5
Cholestane, 3-ethoxy-,(3.beta.,5.alpha.)-	SC-QE01-SD-801 (0.00,0.50)	2	1.5	1	J	38
Cholestane, 4,5-epoxy-, (4.alpha.,5.alpha.)-	SC-QE09-SD-803 (1.50,2.01)	2	1	0.56	J	16.7
Cholestanol	SC-QE09-SD-803 (1.50,2.01)	6	2.9	0.53	J	16.7

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Cholesterol	SC-QE05-SD-601 (0.00,0.50)	5	2	0.33	2	15.6
Chromone, 3,5-dibromo-6-hydroxy-2-methyl-	SC-QE07-SD-801 (0.00,0.50)	7	2.9	0.44	J	11.1
cis-1-Ethinyl-2-methyl-1-cyclohexanol	SC-QE06-SD-801 (0.00,0.50)	1	1.7	1.7	J	41.6
cis-Tetrahydroionol	SC-QE08-SD-802 (0.50,1.00)	1	4.4	4.4	J	27.5
Costunolide-dihydroketolacetone	SC-QE08-SD-801 (0.00,0.50)	1	6.2	6.2	J	33.3
Cyclic Hydrocarbon	SC-QE08-SD-702 (0.50,1.00)	32	15	0.2		38.9
Cyclohexane, (1-methylethyl)-	SC-QE08-SD-802 (0.50,1.00)	1	2.5	2.5	J	27.5
Cyclohexane, (1-octylnonyl)-	SC-QW04-SD-601 (0.00,5.00)	1	0.4	0.4	1	21.1
Cyclohexane, (2-methylpropyl)-	SC-QE09-SD-601 (0.00,0.50)	1	4.9	4.9	1	32.1
Cyclohexane, (4-methylpentyl)-	SC-QE08-SD-801 (0.00,0.50)	2	6.7	2.8	J	33.3
Cyclohexane, 1,1,3,5-tetramethyl-,cis-	SC-QE05-SD-801 (0.00,0.50)	1	0.38	0.38	J	20.3
Cyclohexane, 1,1,3,5-tetramethyl-,trans-	SC-QE08-SD-801 (0.00,0.50)	1	2.8	2.8	J	33.3
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.alph!	SC-QW07-SD-801 (0.00,0.50)	1	0.33	0.33	J	29.8
Cyclohexane, 1,3,5-trimethyl-2-octadecyl-	SC-QE03-SD-802 (0.50,1.00)	1	4.3	4.3	J	22.9
Cyclohexane, 1,4-dimethyl-	SC-QE03-SD-802 (0.50,1.00)	1	2.3	2.3	J	22.9
Cyclohexane, 1-(cyclohexylmethyl)-3-methyl-, tra!	SC-QE06-SD-802 (0.50,1.00)	2	1.6	0.82	Jz	31.8
Cyclohexane, 1-(cyclohexylmethyl)-ethyl-,trans-	SC-QE03-SD-802 (0.50,1.00)	1	2.8	2.8	J	22.9
Cyclohexane, 1-ethyl-2-propyl-	SC-QE03-SD-802 (0.50,1.00)	2	6.5	3.2	J	22.9
Cyclohexane, 2-butyl-1,1,3-trimethyl-	SC-QE05-SD-801 (0.00,0.50)	1	0.19	0.19	J	20.3
Cyclohexane, decyl-	SC-QE06-SD-802 (0.50,1.00)	1	2.8	2.8	J	31.8
Cyclohexane, pentyl-	SC-QE06-SD-601 (0.00,0.50)	2	2.9	1.8	1	37.2
Cyclohexanone, 2-(2-butynyl)-	SC-QE05-SD-801 (0.00,0.50)	1	0.19	0.19	J	20.3
Cyclohexanone, 2-isopropyl-2,5-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	1	2	2	J	33.3
Cyclooctanecarboxylic acid, 4,5-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	1	2.2	2.2	J	33.3
Cyclopentadecane	SC-QE09-SD-601 (0.00,0.50)	1	5.7	5.7	1	32.1
Cyclopentane, 1,1'-ethylidenebis-	SC-QE05-SD-801 (0.00,0.50)	1	0.18	0.18	J	20.3
Cyclopentane, 1-butyl-2-propyl-	SC-QE06-SD-802 (0.50,1.00)	1	1.2	1.2	J	31.8
Cyclopentane, 1-methyl-3-(1-methylethyl)-	SC-QE08-SD-702 (0.50,1.00)	1	13	13	2	38.9
Cyclopentanecarboxylic acid, 2-amino-, trans-	SC-QE10-SD-702 (0.50,1.00)	1	0.67	0.67	2	17.6
Cyclopentanone, 2,4,4-trimethyl-	SC-QE03-SD-802 (0.50,1.00)	1	3.1	3.1	J	22.9
Cyclopropa[5,6]stigmast-22-en-3-one, 3',6-dihyd!	SC-QE01-SD-801 (0.00,0.50)	1	2.4	2.4	Jz	38
Cyclopropane, 1,2-dimethyl-1-pentyl-	SC-QE06-SD-801 (0.00,0.50)	1	1.2	1.2	J	41.6
Cyclotetradecane	SC-QE03-SD-802 (0.50,1.00)	1	5.4	5.4	J	22.9
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methylet!	SC-QE08-SD-702 (0.50,1.00)	6	18	0.98	1z	38.9
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methyleth	SC-QW02-SD-701 (0.00,0.50)	1	0.24	0.24	1	33
D-Friedoolean-14-ene, 3-methoxy-,(3.beta.)-	SC-QE10-SD-803 (2.50,3.00)	11	2.9	0.17	J	26.6
D-Glycero-L-gulo-Octitol, 2,6:5,7-dianhydro-8-de!	SC-QE07-SD-801 (0.00,0.50)	1	0.35	0.35	Jz	11.1
d-Homoandrostane, (5.alpha.,13.alpha.)-	SC-QW03-SD-702 (0.50,1.00)	17	3.1	0.21	1	23.5
D-Norandrostan-16-ol,(5.alpha.,16.beta.)-	SC-QE09-SD-801 (0.00,0.50)	1	0.96	0.96	J	18.8
D:A-Friedooleanan-3-one	SC-QE05-SD-801 (0.00,0.50)	1	0.48	0.48	J	20.3
Decane, 2,6,7-trimethyl-	SC-QE04-SD-801 (0.00,0.50)	1	0.17	0.17	J	21.6
Decane, 2-methyl-	SC-QE06-SD-601 (0.00,0.50)	1	1.9	1.9	1	37.2
Decane, 3,3,6-trimethyl-	SC-QE08-SD-801 (0.00,0.50)	1	2.4	2.4	J	33.3
Decane, 3,8-dimethyl-	SC-QE03-SD-802 (0.50,1.00)	2	4.7	0.44	J	22.9
Decane, 5-propyl-	SC-QE06-SD-803 (4.00,4.50)	2	3.6	2.4	J	27.6
Desoxyanisoin	SC-QE08-SD-802 (0.50,1.00)	1	3.8	3.8	J	27.5
Dibenz(a,c)anthracene	SC-QE03-SD-601 (0.00,0.50)	2	12	2.1	2	61
Dibenz(a,e)pyrene	SC-QE03-SD-801 (0.00,0.50)	2	4.8	4.4	J	25.1
Dibenz[a,j]anthracene	SC-QE08-SD-601 (0.00,0.50)	1	2.4	2.4	2	16.3
Dibenzo[def,mno]chrysene	SC-QE03-SD-601 (0.00,0.50)	4	10	2.7	2	61
Dibenzothiophene	SC-QE02-SD-702 (0.50,1.00)	4	4.6	0.54	2	17.7
Diethylphosphinothioic azide	SC-QE09-SD-702 (0.50,1.00)	1	1.1	1.1	2	13.6
Diphenylamine	SC-QE09-SD-701 (0.00,0.50)	1	0.25	0.25	1	13.8
Docosane	SC-QE06-SD-801 (0.00,0.50)	6	32	0.44	J	41.6
Docosane, 11-decyl-	SC-QE06-SD-801 (0.00,0.50)	1	1.8	1.8	J	41.6
Docosane, 7-hexyl-	SC-QE06-SD-801 (0.00,0.50)	3	10	2.7	J	41.6
Dodecane	SC-QE06-SD-803 (4.00,4.50)	1	2	2	J	27.6

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Dodecane, 2,6,10-trimethyl-	SC-QW04-SD-603 (2.50,3.00)	1	0.21	0.21	2	34
Dodecane, 2,7,10-trimethyl-	SC-QE06-SD-601 (0.00,0.50)	1	3.2	3.2	1	37.2
Dodecane, 2-methyl-8-propyl-	SC-QE09-SD-803 (1.50,2.01)	1	1.2	1.2	J	16.7
Dodecane, 4,6-dimethyl-	SC-QE08-SD-802 (0.50,1.00)	2	4.7	1.2	J	27.5
Dodecanedioic acid, 6-hydroxy-	SC-QE01-SD-701 (0.00,0.50)	1	0.84	0.84	1	15.1
Dotriacontane	SC-QE06-SD-801 (0.00,0.50)	1	3.2	3.2	J	41.6
Eicosane	SC-QE08-SD-802 (0.50,1.00)	6	10	0.2	J	27.5
Eicosane, 10-methyl-	SC-QE06-SD-803 (4.00,4.50)	2	2.1	0.78	J	27.6
Eicosane, 2-methyl-	SC-QE09-SD-801 (0.00,0.50)	1	0.72	0.72	J	18.8
Ergost-22-en-3-ol, (3.beta.,5.alpha.,22E,24R)-	SC-QW02-SD-602 (0.50,1.00)	1	0.92	0.92	1	26.5
Ergost-25-ene-3,5,6-triol,(3.beta.,5.-alpha.,6.!	SC-QE06-SD-702 (0.50,1.00)	2	5.5	0.67	1z	22.7
Ergost-5-en-3-ol, (3.beta.)-	SC-QE09-SD-602 (0.50,1.00)	5	4.1	0.27	1	30.9
Ergost-7-en-3-ol, (3,.beta.)-	SC-QW07-SD-801 (0.00,0.50)	1	0.2	0.2	J	29.8
Ergosta-5,22-dien-3-ol, (3.beta.,22E)-	SC-QE05-SD-601 (0.00,0.50)	1	0.53	0.53	2	15.6
Ethanamine, 1-(2,4-cyclopentadien-1-ylidene)-N,N	SC-QE09-SD-1201 (0.00,0.50)	2	1.6	1.2	1z	13.3
Ethanoic acid, S-methyl ester	SC-QE04-SD-701 (0.00,0.50)	2	1.2	0.35	2	19.4
Ethanol, 2-(tetradecyloxy)-	SC-QE06-SD-802 (0.50,1.00)	1	2.4	2.4	J	31.8
Ethanol, 2-methoxyphenyl-	SC-QE09-SD-802 (0.50,1.00)	1	0.37	0.37	J	15.2
Ferrocene, (3-oxo-1-butenyl)-	SC-QE02-SD-801 (0.00,0.50)	1	1.5	1.5	J	42.7
Fumariline	SC-QE08-SD-802 (0.50,1.00)	1	14	14	J	27.5
Furan, 2,3-dihydro-4-(1-methylethyl)-	SC-QE05-SD-801 (0.00,0.50)	1	0.29	0.29	J	20.3
Glaucic acid	SC-QE09-SD-703 (3.00,4.00)	1	0.21	0.21	1	16.7
Glycine, N-(2-methoxybenzoyl)-,methyl ester	SC-QE11-SD-801 (0.00,0.50)	1	0.27	0.27	J	23.9
Heneicosane	SC-QE08-SD-801 (0.00,0.50)	2	7.4	3.5	J	33.3
Heptachloronaphthalene isomer	SC-QE07-SD-601 (0.00,0.50)	1	2.2	2.2		34
Heptadecane	SC-QE07-SD-801 (0.00,0.50)	2	0.31	0.24	J	11.1
Heptadecane, 2,6,10,14-tetramethyl-	SC-QE06-SD-801 (0.00,0.50)	1	4.1	4.1	J	41.6
Heptadecane, 2,6,10,15-tetramethyl-	SC-QE06-SD-801 (0.00,0.50)	1	1.7	1.7	J	41.6
Heptadecane, 3-methyl-	SC-QE08-SD-802 (0.50,1.00)	1	4.1	4.1	J	27.5
Heptadecane, 9-octyl-	SC-QE06-SD-601 (0.00,0.50)	1	2.1	2.1	1	37.2
Heptane, 3-ethyl-2-methyl-	SC-QW04-SD-703 (2.00,2.50)	1	0.33	0.33	2	19.2
Heptane, 4-ethyl-	SC-QE08-SD-801 (0.00,0.50)	1	2.3	2.3	J	33.3
Heptanenitrile	SC-QE06-SD-802 (0.50,1.00)	1	1.4	1.4	J	31.8
Heptanoic acid, 3-nitrophenyl ester	SC-QE09-SD-1201 (0.00,0.50)	1	0.54	0.54	2	13.3
Hexachlorobiphenyl isomer	SC-QW03-SD-702 (0.50,1.00)	6	3.1	0.29		23.5
Hexachlorobiphenyls	SC-QW05-SD-701 (0.00,0.50)	1	0.29	0.29	2	17.3
Hexachloronaphthalene isomer	SC-QE07-SD-601 (0.00,0.50)	4	1.9	1.1		34
Hexacosane	SC-QE08-SD-802 (0.50,1.00)	4	10	0.55	J	27.5
Hexadecane	SC-QE08-SD-801 (0.00,0.50)	4	7	2.1	J	33.3
Hexadecane, 2,6,10,14-tetramethyl-	SC-QE08-SD-802 (0.50,1.00)	13	7.1	1	J	27.5
Hexadecane, 2,6,11,15-tetramethyl-	SC-QE06-SD-803 (4.00,4.50)	1	3	3	J	27.6
Hexadecane, 3-methyl-	SC-QE09-SD-801 (0.00,0.50)	1	0.66	0.66	J	18.8
Hexadecanoic acid	SC-QE09-SD-802 (0.50,1.00)	3	1.2	0.26	J	15.2
Hexanedioic acid, bis(2-ethylhexyl)ester	SC-QW03-SD-802 (0.50,1.00)	3	2.5	0.38	J	23.9
Hexanedioic acid, dioctyl ester	SC-QE05-SD-701 (0.00,0.50)	1	0.41	0.41	2	17
Hexatriacontane	SC-QE08-SD-801 (0.00,0.50)	4	2.2	0.28	J	33.3
Hop-22(29)-en-3.beta.-ol	SC-QW01-SD-801 (0.00,0.50)	3	1.4	0.23	J	34.8
Hyoscyamine	SC-QW03-SD-801 (0.00,0.50)	1	3.7	3.7	J	26.1
Isocopalane	SC-QE06-SD-602 (0.50,1.00)	1	2.7	2.7	1	25.5
Isophthalic acid, 2,4-dimethoxy-6-methyl-, 3-meth!	SC-QE09-SD-1201 (0.00,0.50)	1	0.26	0.26	1z	13.3
Ketone	SC-QE01-SD-601 (0.00,0.50)	6	0.63	0.23		21.2
Ketone, 2,2-dimethylcyclohexyl methyl	SC-QE09-SD-601 (0.00,0.50)	1	11	11	1	32.1
Ledol	SC-QE02-SD-801 (0.00,0.50)	1	24	24	J	42.7
Longifolenaldehyde	SC-QE09-SD-701 (0.00,0.50)	1	0.47	0.47	2	13.8
n-Amylcyclohexane	SC-QE09-SD-601 (0.00,0.50)	1	14	14	2	32.1
n-Nonylcyclohexane	SC-QE06-SD-801 (0.00,0.50)	1	1.7	1.7	J	41.6
n-Octacosane	SC-QE03-SD-802 (0.50,1.00)	1	3.2	3.2	J	22.9

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Naphthalene, 1,2,3,4-tetrachloro-	SC-QE07-SD-601 (0.00,0.50)	4	1.7	0.46	2	34
Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-di!	SC-QE10-SD-802 (0.50,1.00)	3	2.5	0.24	J	25
Naphthalene, 1,3,5,7-tetrachloro-	SC-QE07-SD-801 (0.00,0.50)	2	0.66	0.56	J	11.1
Naphthalene, 1,3,7-trichloro-	SC-QE07-SD-602 (0.50,1.00)	5	4.1	0.48	2	26.9
Naphthalene, 1,4,6,7-tetrachloro-	SC-QE07-SD-701 (0.00,0.50)	6	0.73	0.24	2	21.8
Naphthalene, 1,4-dichloro-	SC-QE09-SD-603 (2.50,3.00)	1	0.57	0.57	2	17.9
Naphthalene, 1,5-dichloro-	SC-QE07-SD-601 (0.00,0.50)	2	1.1	0.025	2	34
Naphthalene, 2,3,6-trichloro-	SC-QE06-SD-803 (4.00,4.50)	3	2.1	0.22	J	27.6
Naphthalene, 2,3-dichloro-	SC-QE07-SD-602 (0.50,1.00)	3	2.2	0.3	2	26.9
Naphthalene, 2-(1-methylethyl)-	SC-QE05-SD-601 (0.00,0.50)	1	0.28	0.28	2	15.6
Naphthalene, 2-(phenylmethyl)-	SC-QE02-SD-801 (0.00,0.50)	1	2.6	2.6	J	42.7
Naphthalene, 2-phenyl-	SC-QE02-SD-702 (0.50,1.00)	2	3.3	0.48	2	17.7
Naphthalene, decahydro-, trans-	SC-QE09-SD-601 (0.00,0.50)	2	4.7	0.3	2	32.1
Naphthalene, decahydro-1,6-dimethyl-	SC-QE05-SD-801 (0.00,0.50)	1	0.26	0.26	J	20.3
Naphthalene, decahydro-2-methyl-	SC-QE09-SD-601 (0.00,0.50)	10	5.8	0.32	2	32.1
Naphthalene, decahydro-4a-methyl-1-methylene-7-	SC-QW07-SD-801 (0.00,0.50)	1	0.27	0.27	Jz	29.8
Nitrogen compound	SC-QE06-SD-601 (0.00,0.50)	6	9.6	0.26	1	37.2
Nitrogen Compound	SC-QE08-SD-702 (0.50,1.00)	4	16	0.51		38.9
Nonacosane	SC-QE08-SD-801 (0.00,0.50)	5	8.8	0.43	J	33.3
Nonadecane	SC-QE06-SD-803 (4.00,4.50)	1	3.6	3.6	J	27.6
Nonadecane	SC-QE08-SD-801 (0.00,0.50)	1	3.6	3.6	J	33.3
Nonadecane, 9-methyl-	SC-QE08-SD-801 (0.00,0.50)	3	7.6	0.19	J	33.3
Nonahexacontanoic acid	SC-QE11-SD-801 (0.00,0.50)	1	0.21	0.21	J	23.9
Nonane, 2-bromo-5-ethyl-	SC-QE06-SD-802 (0.50,1.00)	1	1.7	1.7	J	31.8
Nonane, 3-methyl-	SC-QE08-SD-801 (0.00,0.50)	1	2.8	2.8	J	33.3
Nonane, 3-methyl-5-propyl-	SC-QE05-SD-801 (0.00,0.50)	1	0.3	0.3	J	20.3
Nonanedioic acid, bis(2-ethylhexyl) ester	SC-QE05-SD-701 (0.00,0.50)	2	5.8	5.1	2	17
Octadecanal	SC-QW02-SD-601 (0.00,0.50)	1	0.56	0.56	2	28.4
Octadecane	SC-QE08-SD-801 (0.00,0.50)	7	60	0.23	J	33.3
Octadecane, 2,6-dimethyl-	SC-QE06-SD-801 (0.00,0.50)	1	1.2	1.2	J	41.6
Octadecane, 2-methyl-	SC-QE06-SD-802 (0.50,1.00)	1	2.6	2.6	J	31.8
Octadecanoic acid, butyl ester	SC-QE10-SD-702 (0.50,1.00)	2	0.42	0.26	2	17.6
Octane, 2,3,7-trimethyl-	SC-QE06-SD-601 (0.00,0.50)	2	5.2	1.3	2	37.2
Octane, 2,6-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	1	2.7	2.7	J	33.3
Octanethioic acid, S-hexyl ester	SC-QE05-SD-601 (0.00,0.50)	1	0.25	0.25	1	15.6
Octyl phenol isomer	SC-QE09-SD-601 (0.00,0.50)	2	12	6.9		32.1
Olean-12-ene	SC-QE01-SD-801 (0.00,0.50)	1	5.7	5.7	J	38
Olean-12-ene, 3-methoxy-, (3.beta.)-	SC-QW01-SD-801 (0.00,0.50)	1	0.95	0.95	J	34.8
Oleic Acid	SC-QE09-SD-602 (0.50,1.00)	1	3.6	3.6	2	30.9
Oxygenated Hydrocarbon	SC-QE07-SD-602 (0.50,1.00)	119	37	0.17		26.9
P-Terphenyl, 2,4,4",6-tetrachloro-	SC-QE07-SD-801 (0.00,0.50)	2	0.65	0.3	J	11.1
Pentachlorobiphenyl isomer	SC-QW03-SD-702 (0.50,1.00)	8	2.5	0.28		23.5
Pentachloronaphthalene isomer	SC-QE07-SD-601 (0.00,0.50)	2	1.3	1.1		34
Pentacosane	SC-QE06-SD-801 (0.00,0.50)	2	5	0.59	J	41.6
Pentadecane	SC-QE06-SD-601 (0.00,0.50)	4	5.5	0.44	1	37.2
Pentadecane, 2,6,10,14-tetramethyl-	SC-QE06-SD-803 (4.00,4.50)	5	10	1.3	J	27.6
Pentadecane, 4-methyl-	SC-QE06-SD-601 (0.00,0.50)	1	2.9	2.9	1	37.2
Perylene	SC-QE02-SD-702 (0.50,1.00)	18	18	0.46	2	17.7
Phenanthrene, 2,5-dimethyl-	SC-QE08-SD-602 (0.50,1.00)	1	3.4	3.4	2	38
Phenanthrene, 2-methyl-	SC-QE02-SD-702 (0.50,1.00)	1	4.5	4.5	2	17.7
Phenanthrene, 3-methyl-	SC-QW04-SD-701 (0.00,0.50)	2	0.75	0.3	2	35.5
Phenanthrene, 4-methyl-	SC-QE08-SD-802 (0.50,1.00)	3	5.8	0.58	J	27.5
Phenol, 2,6-bis(1,1-dimethylethyl)-4-methyl-	SC-QE06-SD-803 (4.00,4.50)	1	1.8	1.8	J	27.6
Phenol, 2-(1,1-dimethylethyl)-	SC-QE03-SD-702 (0.50,1.00)	1	1.4	1.4	2	21
Phenol, 2-(1,1-dimethylethyl)-4-methyl-	SC-QE09-SD-801 (0.00,0.50)	3	4.5	0.29	J	18.8
Phenol, 2-methyl-4-(1,1',3,3'-tetramethylbutyl)-	SC-QE09-SD-1201 (0.00,0.50)	2	2.5	1.9	1	13.3
Phenol, 4-(1,1,3,3-tetramethylbutyl)-	SC-QE08-SD-602 (0.50,1.00)	20	6.4	0.23	2	38

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Phenol, 4-(1,1-dimethylethyl)-2-methyl-	SC-QE10-SD-803 (2.50,3.00)	1	0.21	0.21	J	26.6
Phenol, 4-(1,1-dimethylpropyl)-	SC-QE09-SD-802 (0.50,1.00)	2	0.68	0.66	J	15.2
Phenol, 4-(2,2,3,3-tetramethylbutyl)-	SC-QE07-SD-602 (0.50,1.00)	20	5.2	0.19	2	26.9
Phenol, 4-(2,2,3,3-tetramethylbutyl)-	SC-QE09-SD-803 (1.50,2.01)	20	5.2	0.19	J	16.7
Phenol, 4-(2,2,4-trimethylpentyl)-	SC-QE08-SD-702 (0.50,1.00)	4	16	0.39	2	38.9
Phenol, 4-nonyl-	SC-QE09-SD-803 (1.50,2.01)	7	6.8	0.27	J	16.7
Phenol, dodecyl-	SC-QE10-SD-802 (0.50,1.00)	1	0.3	0.3	J	25
Phenol, nonyl-	SC-QE09-SD-602 (0.50,1.00)	38	8.3	0.18	2	30.9
Phosphine sulfide, triphenyl-	SC-QE09-SD-1201 (0.00,0.50)	2	0.4	0.25	2	13.3
Phosphoric acid, 2-ethylhexyl diphenyl ester	SC-QE08-SD-702 (0.50,1.00)	8	14	0.32	2	38.9
Phosphoric acid, tris(methylphenyl)ester	SC-QE06-SD-603 (2.50,3.00)	2	2.4	2.1	1	32.6
Phthalate	SC-QE07-SD-602 (0.50,1.00)	29	22	0.18		26.9
Polycyclic Hydrocarbon	SC-QE09-SD-503 (1.00,1.50)	2	4.2	1		21
Polynuclear Aromatic Hydrocarbon	SC-QE03-SD-601 (0.00,0.50)	84	28	0.16		61
Pregn-4-ene-3,20-dione, (10.alpha.)-	SC-QW04-SD-801 (0.00,0.50)	1	1.4	1.4	J	38.4
Propanoic acid, 2-methyl-,4-methylphenyl ester	SC-QE09-SD-802 (0.50,1.00)	1	0.65	0.65	J	15.2
Purin-8-ol, 6-amino-8,9-dihydro-	SC-QE09-SD-802 (0.50,1.00)	1	0.5	0.5	J	15.2
Purine-6(1H)-thione, 3,7-dimethylseleno-	SC-QE06-SD-801 (0.00,0.50)	1	1.3	1.3	J	41.6
Pyrazole, 3-(p-chlorophenyl)-5-methyl-	SC-QE01-SD-801 (0.00,0.50)	1	1.5	1.5	J	38
Pyrene, 1-methyl-	SC-QE07-SD-801 (0.00,0.50)	1	0.31	0.31	J	11.1
Pyrene, 2-methyl-	SC-QE03-SD-701 (0.00,0.50)	3	1.5	0.47	2	19.8
Pyridine, 2,4,6-trimethyl-	SC-QE09-SD-802 (0.50,1.00)	1	5.4	5.4	J	15.2
Pyridine, 4-(dimethylamino)-,^methyl iodide	SC-QE01-SD-501 (0.00,0.50)	1	0.74	0.74		21
Pyridine, 4-methyl-, 1-oxide	SC-QE01-SD-801 (0.00,0.50)	1	1.2	1.2	J	38
Saturated Hydrocarbon	SC-QW03-SD-801 (0.00,0.50)	27	6.8	0.18	J	26.1
Saturated Hydrocarbon: <C10	SC-QE08-SD-502 (0.50,1.00)	1	1	1		35
Saturated Hydrocarbon: >C20	SC-QE06-SD-601 (0.00,0.50)	91	34	0.17	1	37.2
Saturated Hydrocarbon: C10-C20	SC-QE11-SD-601 (0.00,0.50)	112	680	0.15		22.5
Silane, methyltriphenoxy-	SC-QE09-SD-702 (0.50,1.00)	1	0.46	0.46	1	13.6
Siloxane	SC-QE03-SD-601 (0.00,0.50)	32	14	0.17		61
Stannane, bromodibutyl(1-methylethyl)-	SC-QW05-SD-701 (0.00,0.50)	2	0.52	0.21	2	17.3
Stannane, bromotributyl-	SC-QW05-SD-601 (0.00,5.00)	2	1.1	0.2	2	20.1
Stannane, chlorotris(2-methylpropyl)-	SC-QW05-SD-601 (0.00,5.00)	2	0.96	0.16	2	20.1
Stannane, tributylchloro-	SC-QE02-SD-601 (0.00,0.50)	2	3.5	1.8	2	40.4
Stigmast-4-en-3-one	SC-QE06-SD-603 (2.50,3.00)	1	2.4	2.4	1	32.6
Stigmast-5-en-3-ol-, (3.beta.,24S)-	SC-QE01-SD-801 (0.00,0.50)	18	7.3	0.18	J	38
Stigmastane	SC-QE03-SD-802 (0.50,1.00)	2	12	3.5	J	22.9
Sulfur, mol. (S8)	SC-QE02-SD-601 (0.00,0.50)	10	7.2	0.19	2	40.4
Tetracosane	SC-QE08-SD-802 (0.50,1.00)	2	27	9.3	J	27.5
Tetracosane, 2,6,10,15,19,23-hexamethyl-	SC-QE06-SD-802 (0.50,1.00)	3	3.3	0.3	J	31.8
Tetradecane	SC-QE08-SD-801 (0.00,0.50)	4	9.7	0.21	J	33.3
Tetradecane, 2-methyl-	SC-QE06-SD-802 (0.50,1.00)	1	1.2	1.2	J	31.8
Tetratriacontane	SC-QE08-SD-801 (0.00,0.50)	1	14	14	J	33.3
TID Compound 23	SC-QW04-SD-801 (0.00,0.50)	1	1.5	1.5	J	38.4
Trachelanthamidine	SC-QE06-SD-802 (0.50,1.00)	1	1.1	1.1	J	31.8
Tricyclo[3.3.1.13,7]decane-2,6-dione, 4-bromo-	SC-QE09-SD-701 (0.00,0.50)	1	1.8	1.8	1	13.8
Tricyclo[3.3.1.13,7]decanone, 4-iodo-,(1.alpha.,!	SC-QE09-SD-702 (0.50,1.00)	1	1.3	1.3	2z	13.6
Tricyclo[4.3.1.13,8]undecane, 3-chloro-	SC-QE06-SD-802 (0.50,1.00)	1	1.2	1.2	J	31.8
Tridecane	SC-QE08-SD-801 (0.00,0.50)	3	9	0.19	J	33.3
Tridecane 7-cyclohexyl-, 7-cyclohexyl-	SC-QE03-SD-802 (0.50,1.00)	2	3.5	0.41	J	22.9
Tridecane, 2-methyl-	SC-QE08-SD-801 (0.00,0.50)	1	3.4	3.4	J	33.3
Tridecane, 6-methyl-	SC-QE08-SD-801 (0.00,0.50)	3	3.6	1.1	J	33.3
Tridecane, 7-methyl-	SC-QE08-SD-801 (0.00,0.50)	2	8.4	5	J	33.3
Undecane, 2 3-dimethyl-	SC-QE05-SD-801 (0.00,0.50)	1	0.67	0.67	J	20.3
Undecane, 2,10-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	2	2.3	0.19	J	33.3
Undecane, 2,5-dimethyl-	SC-QE05-SD-801 (0.00,0.50)	1	0.35	0.35	J	20.3
Undecane, 2,6-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	4	4.1	1.5	J	33.3

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Undecane, 3,5-dimethyl-	SC-QE06-SD-801 (0.00,0.50)	1	3.3	3.3	J	41.6
Undecane, 3,6-dimethyl-	SC-QE06-SD-601 (0.00,0.50)	3	2.3	0.26	2	37.2
Undecane, 3,8-dimethyl-	SC-QE09-SD-801 (0.00,0.50)	1	0.68	0.68	J	18.8
Undecane, 3-methyl-	SC-QE09-SD-802 (0.50,1.00)	1	0.32	0.32	J	15.2
Undecane, 5-methyl-	SC-QE06-SD-803 (4.00,4.50)	1	1.4	1.4	J	27.6
Undecane, 6-methyl-	SC-QE08-SD-602 (0.50,1.00)	1	3.9	3.9	2	38
Unknown	SC-QW03-SD-501 (0.00,0.50)	6	16	0.18		48
Unsaturated Hydrocarbon	SC-QW03-SD-601 (0.00,0.50)	41	9	0.17		54.2
Vitamin E	SC-QE06-SD-802 (0.50,1.00)	6	7.5	0.77	J	31.8
Xanthopterin	SC-QE03-SD-802 (0.50,1.00)	1	4.1	4.1	J	22.9
Zinc, bis[2-(1,1-dimethylethyl)-3,3-dimethylcycl!	SC-QE03-SD-802 (0.50,1.00)	1	2.3	2.3	Jz	22.9
Volatile Organics (mg/kg)						
.alpha.-Pinene	SC-QW01-SD-802 (0.50,1.00)	1	0.0075	0.0075	J	19.5
.beta.-Pinene	SC-QW01-SD-802 (0.50,1.00)	1	0.012	0.012	J	19.5
1,2,4-Trimethylbenzene	SC-QE08-SD-702 (0.50,1.00)	1	2.4	2.4	2	38.9
1,2-Dichlorobenzene	SC-QE08-SD-702 (0.50,1.00)	4	2	0.0081	2	38.9
1,3-Dichlorobenzene	SC-QE06-SD-703 (3.00,3.50)	1	0.012	0.012	2	17.8
1,4-Dichlorobenzene	SC-QE06-SD-803 (4.00,4.50)	3	0.068	0.0091	J	27.6
1-Ethyl-3-methylcyclohexane (c,t)	SC-QE09-SD-601 (0.00,0.50)	4	0.26	0.0078	2	32.1
1-Hexanol, 2-ethyl-	SC-QE08-SD-701 (0.00,0.50)	4	0.17	0.0098	1	57.7
1-Hexene, 3-methyl-	SC-QE09-SD-602 (0.50,1.00)	1	0.025	0.025	1	30.9
1-Nonene, 4,6,8-trimethyl-	SC-QE03-SD-601 (0.00,0.50)	1	0.084	0.084	1	61
1-Octanol, 2-butyl-	SC-QE09-SD-602 (0.50,1.00)	2	0.063	0.014	1	30.9
1-Tridecanol	SC-QE09-SD-603 (2.50,3.00)	1	0.058	0.058	1	17.9
2(1H)-Naphthalenone, octahydro-8a -methyl-, cis-	SC-QE06-SD-601 (0.00,0.50)	1	0.059	0.059	1	37.2
2,2,6,6-Tetramethylheptane	SC-QE02-SD-601 (0.00,0.50)	1	0.026	0.026	1	40.4
2-Octene, 2,6-dimethyl-	SC-QE09-SD-601 (0.00,0.50)	2	0.22	0.014	1	32.1
3-Dodecene, (Z)-	SC-QE08-SD-802 (0.50,1.00)	1	0.17	0.17	J	27.5
4,7-Methano-1H-inden-1-ol,octahydro-	SC-QE08-SD-801 (0.00,0.50)	1	0.047	0.047	J	33.3
4,7-Methano-1H-indene, octahydro-	SC-QW05-SD-801 (0.00,0.50)	2	0.032	0.013	J	14.6
4-Decanone	SC-QE03-SD-601 (0.00,0.50)	1	0.31	0.31	1	61
4-Decene, 6-methyl-, (E)-	SC-QE09-SD-602 (0.50,1.00)	4	0.13	0.0089	1	30.9
4-Hepten-3-one, 4-methyl-	SC-QE06-SD-601 (0.00,0.50)	1	0.17	0.17	1	37.2
4-Octen-3-one	SC-QE09-SD-803 (1.50,2.01)	1	0.031	0.031	J	16.7
4-Octene, 2,6-dimethyl-, [S-(E)]-	SC-QE06-SD-603 (2.50,3.00)	1	0.0056	0.0056	1	32.6
5-Dodecene, (Z)-	SC-QE08-SD-601 (0.00,0.50)	1	0.061	0.061	1	16.3
8-Octadecenal	SC-QE02-SD-701 (0.00,0.50)	1	0.02	0.02	1	21.2
Benserazide	SC-QW03-SD-702 (0.50,1.00)	1	0.016	0.016	1	23.5
Benzene, (1,1-dimethylpropyl)-	SC-QE07-SD-601 (0.00,0.50)	2	0.055	0.011	1	34
Benzene, (2-methyl-1-propenyl)-	SC-QE07-SD-601 (0.00,0.50)	1	0.24	0.24	1	34
Benzene, 1,2,4,5-tetramethyl-	SC-QE08-SD-702 (0.50,1.00)	1	2.6	2.6	2	38.9
Benzene, 1-ethyl-3-(1-methylethyl)-	SC-QE07-SD-601 (0.00,0.50)	1	0.11	0.11	1	34
Benzene, 1-methyl-3-(1-methylethyl)-	SC-QE08-SD-702 (0.50,1.00)	2	2.7	0.0082	2	38.9
Benzene, 2,4-dimethyl-1-(1-methylethyl)-	SC-QE07-SD-601 (0.00,0.50)	1	0.069	0.069	1	34
Benzene, 2-ethenyl-1,3-dimethyl-	SC-QE07-SD-602 (0.50,1.00)	1	0.033	0.033	1	26.9
Benzene, 2-ethyl-1,3-dimethyl-	SC-QE07-SD-601 (0.00,0.50)	1	0.21	0.21	2	34
Benzene, 2-ethyl-1,4-dimethyl-	SC-QE07-SD-702 (0.50,1.00)	1	0.0065	0.0065	1	19.2
Benzene, 4-ethyl-1,2-dimethyl-	SC-QE07-SD-601 (0.00,0.50)	2	0.15	0.021	2	34
Benzene, ethyl-1,2,4-trimethyl-	SC-QE07-SD-602 (0.50,1.00)	1	0.007	0.007	2	26.9
Bicyclo[2.2.1]heptan-2-one,1,7,7-trimethyl-, (1R!	SC-QW01-SD-802 (0.50,1.00)	2	0.019	0.012	Jz	19.5
Bicyclo[2.2.1]heptane, 2-methyl-, exo-	SC-QE02-SD-702 (0.50,1.00)	1	0.0065	0.0065	1	17.7
Bicyclo[4.1.0.]heptane, 3,7,7-trimethyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.017	0.017	J	16.7
Bicyclo[4.1.0]heptan-3-one, 4,7,7-trimethyl-,[1R!	SC-QE03-SD-801 (0.00,0.50)	2	0.033	0.007	Jz	25.1
Bicyclo[4.1.0]heptan-3-one,4,7,7-trimethyl-, [1R!	SC-QE06-SD-803 (4.00,4.50)	1	0.024	0.024	Jz	27.6
Butanal	SC-QW04-SD-701 (0.00,0.50)	1	0.014	0.014	1	35.5
Butanoic acid, 3-methyl-	SC-QW05-SD-701 (0.00,0.50)	1	0.0093	0.0093	2	17.3
cis-1,2-Dichloroethene	SC-QW04-SD-602 (0.50,1.00)	4	0.026	0.0094	3	38.8

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
cis-1-Ethyl-3-methyl-cyclohexane	SC-QE06-SD-803 (4.00,4.50)	2	0.035	0.027	J	27.6
Cyclic Hydrocarbon	SC-QE09-SD-601 (0.00,0.50)	32	0.33	0.0037		32.1
Cyclododecane	SC-QE02-SD-701 (0.00,0.50)	3	0.021	0.011	1	21.2
Cycloheptane, methyl-	SC-QE08-SD-701 (0.00,0.50)	6	0.17	0.0076	1	57.7
Cycloheptanone, 2-methyl-	SC-QE06-SD-703 (3.00,3.50)	1	0.01	0.01	2	17.8
Cyclohexane, (2,2-dimethylcyclopentyl)-	SC-QE06-SD-603 (2.50,3.00)	1	0.011	0.011	1	32.6
Cyclohexane, (2-methylpropyl)-	SC-QE06-SD-601 (0.00,0.50)	2	0.21	0.013	1	37.2
Cyclohexane, 1,1,2,3-tetramethyl-	SC-QE08-SD-602 (0.50,1.00)	4	5.5	0.0042	2	38
Cyclohexane, 1,1,3,5-tetramethyl-,cis-	SC-QE03-SD-801 (0.00,0.50)	1	0.0079	0.0079	J	25.1
Cyclohexane, 1,1,3-trimethyl-	SC-QE08-SD-702 (0.50,1.00)	6	1.8	0.0069	2	38.9
Cyclohexane, 1,1-dimethyl-	SC-QE09-SD-601 (0.00,0.50)	2	0.7	0.023	1	32.1
Cyclohexane, 1,1-dimethyl-2-propyl-	SC-QE03-SD-801 (0.00,0.50)	2	0.049	0.028	J	25.1
Cyclohexane, 1,2,3-trimethyl-	SC-QE09-SD-802 (0.50,1.00)	1	0.011	0.011	J	15.2
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.beta!	SC-QE06-SD-803 (4.00,4.50)	5	0.056	0.0094	Jz	27.6
Cyclohexane, 1,2,4-trimethyl-	SC-QE09-SD-601 (0.00,0.50)	2	0.26	0.018	2	32.1
Cyclohexane, 1,2,4-trimethyl-,(1.alpha.,2.beta.,!	SC-QE09-SD-602 (0.50,1.00)	3	0.028	0.015	Iz	30.9
Cyclohexane, 1,2-diethyl-3-methyl-	SC-QE08-SD-702 (0.50,1.00)	1	3.1	3.1	2	38.9
Cyclohexane, 1,2-dimethyl-, cis-	SC-QE09-SD-603 (2.50,3.00)	3	0.0056	0.0016	1	17.9
Cyclohexane, 1,2-dimethyl-, trans-	SC-QE06-SD-603 (2.50,3.00)	1	0.0015	0.0015	2	32.6
Cyclohexane, 1,3,5-trimethyl-2-octadecyl-	SC-QE03-SD-802 (0.50,1.00)	1	0.011	0.011	J	22.9
Cyclohexane, 1,3-dimethyl-, trans-	SC-QE09-SD-601 (0.00,0.50)	3	0.38	0.088	1	32.1
Cyclohexane, 1,4-dimethyl-	SC-QE06-SD-601 (0.00,0.50)	2	0.036	0.013	1	37.2
Cyclohexane, 1,4-dimethyl-, cis-	SC-QE08-SD-702 (0.50,1.00)	3	2.5	0.016	2	38.9
Cyclohexane, 1,4-dimethyl-, trans-	SC-QE08-SD-602 (0.50,1.00)	1	3	3	2	38
Cyclohexane, 1-(cyclohexylmethyl)-3-methyl-, tra!	SC-QE06-SD-802 (0.50,1.00)	1	0.058	0.058	Jz	31.8
Cyclohexane, 1-ethyl-2,3-dimethyl-	SC-QE06-SD-601 (0.00,0.50)	2	0.033	0.014	1	37.2
Cyclohexane, 1-ethyl-2-methyl-	SC-QE09-SD-602 (0.50,1.00)	1	0.036	0.036	1	30.9
Cyclohexane, 1-ethyl-4-methyl-, cis-	SC-QE06-SD-803 (4.00,4.50)	1	0.028	0.028	J	27.6
Cyclohexane, 1-ethyl-4-methyl-,trans-	SC-QE08-SD-602 (0.50,1.00)	4	1.1	0.0094	2	38
Cyclohexane, 1-methyl-2-propyl-	SC-QE06-SD-601 (0.00,0.50)	6	0.046	0.0079	1	37.2
Cyclohexane, 1-methyl-4-(1-methylethyl)-	SC-QE09-SD-803 (1.50,2.01)	1	0.019	0.019	J	16.7
Cyclohexane, 2,4-diethyl-1-methyl-	SC-QE09-SD-602 (0.50,1.00)	2	0.17	0.088	1	30.9
Cyclohexane, 2-butyl-1,1,3-trimethyl-	SC-QE06-SD-801 (0.00,0.50)	2	0.096	0.0082	J	41.6
Cyclohexane, butyl-	SC-QE08-SD-702 (0.50,1.00)	4	2.1	0.013	2	38.9
Cyclohexane, ethyl-	SC-QE02-SD-702 (0.50,1.00)	1	0.014	0.014	1	17.7
Cyclohexane, methyl-	SC-QE08-SD-702 (0.50,1.00)	8	10	0.011	2	38.9
Cyclohexane, pentyl-	SC-QE08-SD-801 (0.00,0.50)	2	0.062	0.049	J	33.3
Cyclohexane, propyl-	SC-QE08-SD-702 (0.50,1.00)	1	2.5	2.5	2	38.9
Cyclohexanol, 2,6-dimethyl-	SC-QE09-SD-702 (0.50,1.00)	1	0.0061	0.0061	1	13.6
Cyclohexanone, 2,3-dimethyl-	SC-QE06-SD-803 (4.00,4.50)	1	0.05	0.05	J	27.6
Cyclohexanone, 3-methyl-2-(1-methylethyl)-, cis-!	SC-QE08-SD-602 (0.50,1.00)	1	3.7	3.7	Iz	38
Cyclohexanone, 5-methyl-2-(1-methylethylidene)-	SC-QE06-SD-803 (4.00,4.50)	1	0.041	0.041	J	27.6
Cyclohexene, 1-pentyl-	SC-QE09-SD-602 (0.50,1.00)	1	0.064	0.064	1	30.9
Cyclooctane, butyl-	SC-QE09-SD-602 (0.50,1.00)	1	0.022	0.022	1	30.9
Cyclopentane, 1,1,3-trimethyl-	SC-QE02-SD-701 (0.00,0.50)	1	0.019	0.019	1	21.2
Cyclopentane, 1-ethyl-3-methyl-, trans-	SC-QE09-SD-803 (1.50,2.01)	1	0.042	0.042	J	16.7
Cyclopentane, 1-methyl-2-propyl-	SC-QE06-SD-702 (0.50,1.00)	1	0.0089	0.0089	1	22.7
Cyclopentane, 1-methyl-3-(1-methylethyl)-	SC-QE09-SD-601 (0.00,0.50)	1	1	1	1	32.1
Cyclopentane, pentyl-	SC-QE03-SD-802 (0.50,1.00)	1	0.0079	0.0079	J	22.9
Cyclopropane, 1-(2-methylbutyl)-1-methylpropyl)-	SC-QE09-SD-601 (0.00,0.50)	1	0.71	0.71	1	32.1
Cyclopropane, 1-butyl-1-methyl-2-propyl-	SC-QE08-SD-801 (0.00,0.50)	2	0.1	0.042	J	33.3
Cylohexane, 1,3,5-trimethyl-	SC-QE02-SD-601 (0.00,0.50)	1	0.0076	0.0076	1	40.4
Decanal	SC-QE06-SD-703 (3.00,3.50)	1	0.0065	0.0065	2	17.8
Decane	SC-QE09-SD-802 (0.50,1.00)	1	0.051	0.051	J	15.2
Decane, 2,3,5-trimethyl-	SC-QE03-SD-601 (0.00,0.50)	1	0.48	0.48	1	61
Decane, 2,6,7-trimethyl-	SC-QE05-SD-601 (0.00,0.50)	2	0.088	0.068	1	15.6
Decane, 3-ethyl-3-methyl-	SC-QW02-SD-801 (0.00,0.50)	1	0.014	0.014	J	50.2

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations
for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Decane, 3-methyl-	SC-QE06-SD-803 (4.00,4.50)	5	0.095	0.01	J	27.6
Decane, 4-methyl-	SC-QE08-SD-602 (0.50,1.00)	16	1.7	0.0063	2	38
Decane, 5-propyl-	SC-QE02-SD-701 (0.00,0.50)	1	0.019	0.019	1	21.2
Dodecane	SC-QE08-SD-701 (0.00,0.50)	3	0.5	0.04	1	57.7
Dodecane, 2,6,10-trimethyl-	SC-QE06-SD-801 (0.00,0.50)	1	0.035	0.035	J	41.6
Dodecane, 3-methyl-	SC-QE03-SD-802 (0.50,1.00)	2	0.084	0.032	J	22.9
Dodecane, 4,6-dimethyl-	SC-QE05-SD-601 (0.00,0.50)	1	0.0067	0.0067	1	15.6
Dodecane, 6-methyl-	SC-QE06-SD-603 (2.50,3.00)	1	0.0088	0.0088	1	32.6
Eicosane	SC-QE06-SD-703 (3.00,3.50)	1	0.013	0.013	2	17.8
Eucalyptol	SC-QW01-SD-802 (0.50,1.00)	1	0.018	0.018	J	19.5
Heptane, 2,2-dimethyl-	SC-QE07-SD-602 (0.50,1.00)	1	0.0084	0.0084	1	26.9
Heptane, 2-methyl-	SC-QE08-SD-702 (0.50,1.00)	1	8.8	8.8	2	38.9
Heptane, 3-ethyl-2-methyl-	SC-QE06-SD-803 (4.00,4.50)	8	0.084	0.016	J	27.6
Heptane, 3-methyl-	SC-QE08-SD-702 (0.50,1.00)	1	4.4	4.4	2	38.9
Heptane, 4-propyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.046	0.046	J	16.7
Hexane	SC-QE08-SD-702 (0.50,1.00)	2	2.5	0.0037	3	38.9
Hexane, 2,2,3-trimethyl	SC-QE03-SD-802 (0.50,1.00)	1	0.16	0.16	J	22.9
Hexane, 2,2,5,5-tetramethyl-	SC-QE06-SD-802 (0.50,1.00)	2	0.021	0.011	J	31.8
Hexane, 2,3,4-trimethyl-	SC-QE08-SD-702 (0.50,1.00)	1	2.1	2.1	2	38.9
Hexanoic acid	SC-QW06-SD-701 (0.00,0.50)	2	0.013	0.008	1	19.7
n-Amylcyclohexane	SC-QE08-SD-602 (0.50,1.00)	2	3.2	0.021	2	38
N-Nitroso-n-methylurea	SC-QW04-SD-703 (2.00,2.50)	1	0.0068	0.0068	2	19.2
Naphthalene	SC-QE07-SD-702 (0.50,1.00)	2	0.079	0.015	2	19.2
Naphthalene, decahydro-	SC-QE08-SD-602 (0.50,1.00)	4	2.1	0.023	2	38
Naphthalene, decahydro-, cis-	SC-QE09-SD-802 (0.50,1.00)	1	0.01	0.01	J	15.2
Naphthalene, decahydro-, trans-	SC-QE08-SD-702 (0.50,1.00)	16	3.7	0.0063	2	38.9
Naphthalene, decahydro-2-methyl-	SC-QE08-SD-602 (0.50,1.00)	9	2.4	0.0081	2	38
Nonanal	SC-QE07-SD-701 (0.00,0.50)	1	0.0067	0.0067	1	21.8
Nonane, 3,7-dimethyl-	SC-QE03-SD-601 (0.00,0.50)	4	0.49	0.018	1	61
Nonane, 3-methyl-	SC-QE08-SD-602 (0.50,1.00)	9	1.3	0.0071	2	38
Nonane, 3-methyl-5-propyl-	SC-QE08-SD-701 (0.00,0.50)	2	0.059	0.019	1	57.7
Nonane, 5-methyl-5-propyl-	SC-QE03-SD-601 (0.00,0.50)	2	0.17	0.039	1	61
None Detected	SC-QE03-SD-802 (0.50,1.00)	1	0.36	0.36	J	22.9
Octadecane, 1-(ethenyloxy)-	SC-QE08-SD-701 (0.00,0.50)	1	0.19	0.19	1	57.7
Octadecane, 2,6-dimethyl-	SC-QE07-SD-801 (0.00,0.50)	1	0.011	0.011	J	11.1
Octane, 1,1'-oxybis-	SC-QE08-SD-801 (0.00,0.50)	2	0.033	0.015	J	33.3
Octane, 2,2,6-trimethyl-	SC-QE08-SD-602 (0.50,1.00)	1	1.5	1.5	1	38
Octane, 2,2-dimethyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.057	0.057	J	16.7
Octane, 2,3,7-trimethyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.13	0.13	J	16.7
Octane, 2,3-dimethyl-	SC-QE06-SD-603 (2.50,3.00)	1	0.0099	0.0099	1	32.6
Octane, 2,4,6-trimethyl-	SC-QE03-SD-601 (0.00,0.50)	1	0.22	0.22	1	61
Octane, 2,6-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	2	0.029	0.007	J	33.3
Octane, 3,6-dimethyl-	SC-QE06-SD-801 (0.00,0.50)	8	0.28	0.011	J	41.6
Octane, 4-ethyl-	SC-QE08-SD-802 (0.50,1.00)	1	0.078	0.078	J	27.5
Octane, 5-ethyl-2-methyl-	SC-QE09-SD-803 (1.50,2.01)	1	0.039	0.039	J	16.7
Octane, 6-ethyl-2-methyl-	SC-QE06-SD-802 (0.50,1.00)	3	0.017	0.0087	J	31.8
Oxirane, [(dodecyloxy)methyl]-	SC-QE08-SD-701 (0.00,0.50)	1	0.38	0.38	1	57.7
Oxygenated Hydrocarbon	SC-QE02-SD-1001 (0.00,0.50)	7	0.38	0.00074		21
Oxygenated Hydrocarbon	SC-QE09-SD-601 (0.00,0.50)	7	0.38	0.00074		32.1
Oxygenated Hydrocarbon	SC-QW07-SD-601 (0.00,0.50)	7	0.38	0.00074		28
p-Isopropyltoluene (p-Cymene)	SC-QE07-SD-602 (0.50,1.00)	1	0.031	0.031	2	26.9
Pulegone	SC-QE06-SD-601 (0.00,0.50)	1	0.063	0.063	1	37.2
Saturated Hydrocarbon	SC-QE06-SD-802 (0.50,1.00)	6	0.18	0.011	J	31.8
Saturated Hydrocarbon	SC-QW04-SD-802 (0.50,1.00)	6	0.18	0.011	J	20.7
Saturated Hydrocarbon	SC-QW06-SD-801 (0.00,0.50)	6	0.18	0.011	J	18
Saturated Hydrocarbon: <C10	SC-QE07-SD-503 (3.00,4.00)	1	0.01	0.01		19
Saturated Hydrocarbon: C10-C20	SC-QE08-SD-701 (0.00,0.50)	6	0.21	0.0065		57.7

TABLE B-18
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Sediment

Compound Name	Client Description	Reporting Frequency	Maximum Result	Minimum Result	Footnotes	% Water
Siloxane	SC-QE03-SD-601 (0.00,0.50)	33	3.4	0.0062		61
Spiro[5.5]undecane	SC-QE08-SD-602 (0.50,1.00)	1	2	2	1	38
Tetradecane	SC-QE07-SD-801 (0.00,0.50)	1	0.0083	0.0083	J	11.1
Tetradecane, 2,5-dimethyl-	SC-QE03-SD-601 (0.00,0.50)	1	0.17	0.17	1	61
Tridecane	SC-QE05-SD-601 (0.00,0.50)	1	0.02	0.02	1	15.6
Tridecane, 7-methyl-	SC-QE08-SD-801 (0.00,0.50)	7	0.37	0.015	J	33.3
Undecane	SC-QE05-SD-601 (0.00,0.50)	1	0.05	0.05	1	15.6
Undecane, 2,5-dimethyl-	SC-QE02-SD-601 (0.00,0.50)	1	0.045	0.045	1	40.4
Undecane, 2,6-dimethyl-	SC-QE08-SD-701 (0.00,0.50)	7	0.76	0.068	1	57.7
Undecane, 2,9-dimethyl-	SC-QE03-SD-801 (0.00,0.50)	1	0.062	0.062	J	25.1
Undecane, 3,6-dimethyl-	SC-QE08-SD-601 (0.00,0.50)	2	0.19	0.0094	1	16.3
Undecane, 3-methyl-	SC-QE06-SD-802 (0.50,1.00)	1	0.012	0.012	J	31.8
Undecane, 4,4-dimethyl-	SC-QE08-SD-801 (0.00,0.50)	1	0.076	0.076	J	33.3
Undecane, 4,7-dimethyl-	SC-QE08-SD-602 (0.50,1.00)	2	1.3	0.029	2	38
Undecane, 4-methyl-	SC-QE08-SD-801 (0.00,0.50)	1	0.084	0.084	J	33.3
Undecane, 6,6-dimethyl-	SC-QE06-SD-702 (0.50,1.00)	1	0.0072	0.0072	1	22.7
Unknown	SC-QE03-SD-802 (0.50,1.00)	11	0.18	0.00031	J	22.9
Unknown	SC-QE10-SD-502 (0.50,1.00)	11	0.18	0.00031		21
Unknown	SC-QE10-SD-802 (0.50,1.00)	11	0.18	0.00031	J	25
Unsaturated Hydrocarbon	SC-QE08-SD-701 (0.00,0.50)	12	0.078	0.0013		57.7
Urea	SC-QE09-SD-603 (2.50,3.00)	2	0.042	0.0088	1	17.9

TABLE B-19
Statistical Evaluation of Analytes Tentatively Identified in Surface Water Samples

Compound Name	Reporting Frequency	Maximum Result	Minimum Result
Semivolatile Organics (mg/L)			
1,3-Propanediol, 2,2-dimethyl-	5	0.04	0.0043
1,4,7,10,13,16-Hexaoxacyclooctadecane	1	0.0049	0.0049
1,8-Nonanediol, 8-methyl-	1	0.0057	0.0057
1-D1-Aziridine	1	0.017	0.017
1-Propanol, 2-phenoxy-	1	0.059	0.059
11H-Dibenzo[b,E][1,4]diazepin-11-one, 5-(3-amin!	1	0.0044	0.0044
13H-dibenzo[a,i]carbazole	1	0.0054	0.0054
1H-Imidazole, 1-methyl-4-nitro-	1	0.03	0.03
1H-Inden-1-one, 2,3-dihydro-	3	0.0071	0.0047
1H-Indol-5-ol	8	0.11	0.0051
1H-Indole, 2-phenyl-	1	0.012	0.012
1H-Indole-2,3-dione, 3-(phenylhydrazone)	1	0.0094	0.0094
2,3-o-Cyclohexylidene-4-c-(2-methoxymethoxyphen	1	0.01	0.01
2,4-D2-1-Naphthyl-isocyanide	1	0.006	0.006
2,4-Decadienal	2	0.026	0.014
2,4-Imidazolidinedione, 1-(hydroxymethyl)-5,5-di!	7	0.033	0.0063
2,4-Imidazolidinedione, 5,5-dimethyl-	2	0.039	0.015
2,4-Pentanediol, 2-methyl-	2	0.016	0.0081
2,5,8,11,14-Pentaoxapentadecane	1	0.0047	0.0047
2-Butanol, 3-methyl-	1	0.0056	0.0056
2-Butenal, 2-methyl-	1	0.0047	0.0047
2-Butenoic acid, 3-ethoxy-,ethyl ester	1	0.026	0.026
2-Decenal, (E)-	1	0.0047	0.0047
2-Fluorophenol	1	0.11	0.11
2-Hexanol, 3-methyl-	2	0.0067	0.0047
2-Propanol, 1,1'-[(1-methyl-1,2-ethanediyl)bis!	3	0.011	0.0053
2-Propanol, 1-(2-ethoxypropoxy)-	1	0.016	0.016
2-Propanol, 1-(2-methoxy-1-methylethoxy)-	4	0.025	0.0047
2-Propanol, 1-(2-methoxypropoxy)-	4	0.01	0.0041
2-Propanol, 1-[2-(2-methoxy-1-methyl-ethoxy)-1-m!	2	0.011	0.0053
2-Propanol, 1-chloro-	1	0.0042	0.0042
2-Propanone, 1-phenoxy-	1	0.0063	0.0063
2-Pyridinecarbonitrile	10	0.042	0.0039
2-Pyrrolidinone, 1-methyl-	11	0.3	0.004
2-Tridecanone	1	0.0054	0.0054
2H-1-Benzopyran-2-one, 7-(diethylamino)-	1	0.0054	0.0054
2H-Inden-2-one, 1,3-dihydro-	2	0.0076	0.0052
2H-Indol-2-one, 1,3-dihydro-	17	0.14	0.0045
2H-Indol-2-one, 3-[(4-aminophenyl)imino]-1,3-dih!	1	0.0047	0.0047
2H-Pyran, tetrahydro-	2	0.027	0.0046
3-Heptanone, 2-methyl-	1	0.008	0.008
3-Hexanol	1	0.034	0.034
3-Octanol, 2-methyl-	1	0.0054	0.0054
3-Octanone-N-methyl-N-formylhydrazone	1	0.01	0.01
3-Pyridinecarbonitrile	7	0.025	0.005
4-Pyridinecarbonitrile	6	0.0089	0.0048
5,6-Decanedione	1	0.0052	0.0052

TABLE B-19
Statistical Evaluation of Analytes Tentatively Identified in Surface Water Samples

Compound Name	Reporting Frequency	Maximum Result	Minimum Result
7-Tridecanone	2	0.017	0.015
9-Octadecenal, (Z)-	1	0.012	0.012
Acetaldehyde, dimethylhydrazone	1	0.013	0.013
Aromatic Hydrocarbon	10	0.082	0.0045
Benzenamine, N-(4-pyridinyl methylene)-	1	0.0087	0.0087
Benzene, 1-azido-2-methyl-	1	0.0048	0.0048
Benzene, 1-isocyanato-2-methyl-	1	0.019	0.019
Benzene, 1-isocyanato-3-methyl-	1	0.051	0.051
Benzene, 1-isocyanato-4-methyl-	2	0.042	0.028
Benzene, isocyano-	1	0.0076	0.0076
Benzenemethanol, .alpha.-methyl-2-(trifluorometh!	1	0.0046	0.0046
Benzenesulfonamide, 4-methyl-	7	0.011	0.004
Benzo[b]selenophene-2-carbonitrile,3-(hydroxymet!	1	0.013	0.013
Bicyclo[4.2.0]octa-1,3,5-triene	1	0.0063	0.0063
Butyl caprylate	1	0.017	0.017
Caffeine	1	0.0053	0.0053
Carbonic acid, bis(1-methylpropyl)ester	1	0.023	0.023
Chlorinated Hydrocarbon	1	0.0069	0.0069
Cholestanol	1	0.0075	0.0075
Cholesterol	1	0.006	0.006
Cyclodecane, methyl-	1	0.014	0.014
Cyclopentadecanone, 2-hydroxy-	1	0.0078	0.0078
Cyclopentanecarboxylic acid, 2-amino-, trans-	1	0.0061	0.0061
Diphenylmethyl (D)propiolate	2	0.022	0.016
Ethane, 1-ethoxy-1-methoxy-	1	0.0054	0.0054
Ethanol, 2-(1,1-dimethylethoxy)-	1	0.0073	0.0073
Ethanol, 2-(2-butoxyethoxy)-	1	0.0053	0.0053
Ethanol, 2-(2-methoxyethoxy)-	6	0.02	0.0041
Ethanol, 2-(diethylamino)-	8	1	0.076
Ethanol, 2-(diethylamino)-,hydrochloride	1	0.006	0.006
Ethanol, 2-[2-(2-ethoxyethoxy)ethoxy]-	1	0.0051	0.0051
Ethanol, 2-[2-[4-(1,1,3,3-tetramethylbutyl)pheno!	2	0.011	0.0051
Ethanol, 2-[4-(1,1-dimethylethyl)phenoxy]-	5	0.028	0.006
Ethanol, 2-butoxy-	6	0.028	0.004
Ethanol, 2-butoxy-, phosphate (3:1)	1	0.0069	0.0069
Ether, 3-butenyl pentyl	1	0.011	0.011
Formamide, N,N'-diethyl-	2	0.0073	0.0068
Formic acid, 1-methylpropyl ester	1	0.0068	0.0068
Heptane	1	0.013	0.013
Heptanoic acid, anhydride	2	0.03	0.027
Hexadecanoic acid	1	0.0084	0.0084
Hexadecanoic acid, 9,10,16-trihydroxy-(R@,S@)-(!	1	0.0044	0.0044
Hexadecanoic acid, butyl ester	1	0.011	0.011
Hexanal	3	0.096	0.014
Hexane, 2,5-dimethyl-	1	0.011	0.011
Hexanoic acid, 3,5,5-trimethyl-	1	0.0055	0.0055
Hydrazine, 1,1-dipropyl-	1	0.0065	0.0065
Isopropanol	1	0.0063	0.0063

TABLE B-19
Statistical Evaluation of Analytes Tentatively Identified in Surface Water Samples

Compound Name	Reporting Frequency	Maximum Result	Minimum Result
Isopropyl Ether	1	0.0021	0.0021
Ketone	3	0.047	0.014
Methanamine, 1-methoxy-N-methyl-N-nitroso-	1	0.0044	0.0044
Morpholine, 4-ethyl-	2	0.061	0.026
N-Aminopyrrolidine	1	0.024	0.024
Naphthalene, 2-(1-methylethyl)-	1	0.016	0.016
Nitrogen compound	3	0.019	0.0048
None Detected	0		
Octanethioic acid, S-hexyl ester	1	0.012	0.012
Oxygenated Hydrocarbon	25	0.056	0.0043
Pantolactone	1	0.009	0.009
Pentanoic acid, 4-methyl-	1	0.62	0.62
Phosphine oxide, triphenyl-	2	0.079	0.051
Phosphoric acid, tris(3-methylphenyl)ester	1	0.0081	0.0081
Phosphoric acid, tris(methylphenyl)ester	1	0.016	0.016
Polynuclear Aromatic Hydrocarbon	7	0.079	0.0096
Propane, 1,1'-oxybis[2-chloro-	2	0.014	0.0054
Propane, 1-(1,1-dimethylethoxy)-2-methyl-	2	0.0057	0.0045
Propane, 2,2'-[ethylidenebis(oxy)]bis-	1	0.011	0.011
Propane, 2-ethoxy-	1	0.0043	0.0043
Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hyd!	1	0.0049	0.0049
Pyrrolidine, 1-acetyl-	1	0.029	0.029
Pyrrolo[1,2-a]-1,3,5-triazine-7-carboxylic acid!	3	0.048	0.014
Saturated Hydrocarbon: >C20	4	0.0085	0.0043
Silacyclohexane, 1,1-dimethyl-	1	0.018	0.018
Siloxane	9	0.029	0.004
Simazine	6	0.007	0.0037
Stannane, diethyldimethyl-	1	0.047	0.047
TID Compound 2	0		
TID Compound 3	0		
TID Compound 4	0		
TID Compound 5	0		
TID Compound 6	0		
TID Compound 7	0		
TID Compound 8	0		
TID Compound 9	0		
TID Compound 10	0		
TID Compound 11	0		
TID Compound 12	0		
TID Compound 13	0		
TID Compound 14	0		
TID Compound 15	0		
TID Compound 16	0		
TID Compound 17	0		
TID Compound 18	0		
TID Compound 19	0		
TID Compound 20	0		
TID Compound 21	0		

TABLE B-19
Statistical Evaluation of Analytes Tentatively Identified in Surface Water Samples

Compound Name	Reporting Frequency	Maximum Result	Minimum Result
TID Compound 22	0		
TID Compound 23	0		
TID Compound 24	0		
TID Compound 25	0		
TID Compound 26	0		
TID Compound 27	0		
TID Compound 28	0		
TID Compound 29	0		
TID Compound 30	0		
Tetrahydrofurfuryl chloride	1	0.013	0.013
Undecane	1	0.011	0.011
Unsaturated Hydrocarbon	1	0.0043	0.0043
p-Toluidine, N,N-dimethyl-.alpha.-(trimethylsilo!	1	0.013	0.013
p-tert-Amyl phenoxy ethanol	2	0.026	0.008
Volatile Organics (mg/L)			
Benzene, 1-methyl-2-(1-methylethyl)-	1	0.0061	0.0061
None Detected	0		
Siloxane	1	0.022	0.022
TID Compound 2	0		
TID Compound 3	0		
TID Compound 4	0		
TID Compound 5	0		
TID Compound 6	0		
TID Compound 7	0		
TID Compound 8	0		
TID Compound 9	0		
TID Compound 10	0		
TID Compound 11	0		
TID Compound 12	0		
TID Compound 13	0		
TID Compound 14	0		
TID Compound 15	0		
TID Compound 16	0		
TID Compound 17	0		
TID Compound 18	0		
TID Compound 19	0		
TID Compound 20	0		
Unknown	18	0.081	0.0051
cis-1,2-Dichloroethene	1	0.058	0.058
trans-1,2-Dichloroethene	1	0.033	0.033

TABLE B-20
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Surface Water

Compound Name	Client Description	Maximum Result	Footnotes
Semivolatile Organics (mg/L)			
1,3-Propanediol, 2,2-dimethyl-	SC-QE02-SW-601 (0.00,0.00)	0.04	2
1,4,7,10,13,16-Hexaoxacyclooctadecane	SC-QE10-SW-601 (0.00,0.00)	0.0049	1
1,8-Nonanediol, 8-methyl-	SC-QE10-SW-601 (0.00,0.00)	0.0057	2
1-D1-Aziridine	SC-QW02-SW-601 (0.00,0.00)	0.017	1
1-Propanol, 2-phenoxy-	SC-QE10-SW-601 (0.00,0.00)	0.059	2
11H-Dibenzo[b,E][1,4]diazepin-11-one, 5-(3-amin!	SC-QE07-SW-701 (0.00,0.00)	0.0044	1z
13H-dibenzo[a,i]carbazole	SC-QE10-SW-601 (0.00,0.00)	0.0054	2
1H-Imidazole, 1-methyl-4-nitro-	SC-QE02-SW-601 (0.00,0.00)	0.03	1
1H-Inden-1-one, 2,3-dihydro-	SC-QE09-SW-801 (0.00,0.00)	0.0071	J
1H-Indol-5-ol	SC-QE02-SW-801 (0.00,0.00)	0.11	J
1H-Indole, 2-phenyl-	SC-QE10-SW-601 (0.00,0.00)	0.012	1
1H-Indole-2,3-dione, 3-(phenylhydrazone)	SC-QE10-SW-601 (0.00,0.00)	0.0094	1
2,3-o-Cyclohexylidene-4-c-(2-methoxymethoxyphen	SC-QE10-SW-601 (0.00,0.00)	0.01	1z
2,4-D2-1-Naphthyl-isocyanide	SC-QE03-SW-601 (0.00,0.00)	0.006	1
2,4-Decadienal	SC-QE05-SW-801 (0.00,0.00)	0.026	J
2,4-Imidazolidinedione, 1-(hydroxymethyl)-5,5-di!	SC-QE02-SW-701 (0.00,0.00)	0.033	2z
2,4-Imidazolidinedione, 5,5-dimethyl-	SC-QE03-SW-601 (0.00,0.00)	0.039	2
2,4-Pentanediol, 2-methyl-	SC-QE02-SW-801 (0.00,0.00)	0.016	J
2,5,8,11,14-Pentaoxapentadecane	SC-QE10-SW-601 (0.00,0.00)	0.0047	2
2-Butanol, 3-methyl-	SC-QE01-SW-701 (0.00,0.00)	0.0056	2
2-Butenal, 2-methyl-	SC-QE05-SW-801 (0.00,0.00)	0.0047	J
2-Butenoic acid, 3-ethoxy-,ethyl ester	SC-QE02-SW-601 (0.00,0.00)	0.026	1
2-Decenal, (E)-	SC-QE05-SW-801 (0.00,0.00)	0.0047	J
2-Fluorophenol	SC-QE09-SW-801 (0.00,0.00)	0.11	JB
2-Hexanol, 3-methyl-	SC-QE07-SW-601 (0.00,0.00)	0.0067	2
2-Propanol, 1,1'-[(1-methyl-1,2-ethanediyl)bis!	SC-QW04-SW-701 (0.00,0.00)	0.011	2z
2-Propanol, 1-(2-ethoxypropoxy)-	SC-QE07-SW-701 (0.00,0.00)	0.016	2
2-Propanol, 1-(2-methoxy-1-methylethoxy)-	SC-QE07-SW-701 (0.00,0.00)	0.025	2
2-Propanol, 1-(2-methoxypropoxy)-	SC-QW04-SW-701 (0.00,0.00)	0.01	1
2-Propanol, 1-[2-(2-methoxy-1-methyl-ethoxy)-1-m!	SC-QW04-SW-701 (0.00,0.00)	0.011	2z
2-Propanol, 1-chloro-	SC-QE01-SW-801 (0.00,0.00)	0.0042	J
2-Propanone, 1-phenoxy-	SC-QE10-SW-601 (0.00,0.00)	0.0063	2
2-Pyridinecarbonitrile	SC-QE05-SW-801 (0.00,0.00)	0.042	J
2-Pyrrolidinone, 1-methyl-	SC-QW02-SW-701 (0.00,0.00)	0.3	2
2-Tridecanone	SC-QW07-SW-801 (0.00,0.00)	0.0054	J
2H-1-Benzopyran-2-one, 7-(diethylamino)-	SC-QE10-SW-601 (0.00,0.00)	0.0054	2
2H-Inden-2-one, 1,3-dihydro-	SC-QE11-SW-801 (0.00,0.00)	0.0076	J
2H-Indol-2-one, 1,3-dihydro-	SC-QE03-SW-801 (0.00,0.00)	0.14	J
2H-Indol-2-one, 3-[(4-aminophenyl)imino]-1,3-dih!	SC-QE07-SW-701 (0.00,0.00)	0.0047	1z
2H-Pyran, tetrahydro-	SC-QE03-SW-601 (0.00,0.00)	0.027	1
3-Heptanone, 2-methyl-	SC-QE03-SW-601 (0.00,0.00)	0.008	1
3-Hexanol	SC-QE07-SW-701 (0.00,0.00)	0.034	2
3-Octanol, 2-methyl-	SC-QE05-SW-801 (0.00,0.00)	0.0054	J
3-Octanone-N-methyl-N-formylhydrazone	SC-QE02-SW-601 (0.00,0.00)	0.01	1
3-Pyridinecarbonitrile	SC-QE03-SW-601 (0.00,0.00)	0.025	2
4-Pyridinecarbonitrile	SC-QE03-SW-801 (0.00,0.00)	0.0089	J
5,6-Decanedione	SC-QE03-SW-601 (0.00,0.00)	0.0052	2

TABLE B-20
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Surface Water

Compound Name	Client Description	Maximum Result	Footnotes
7-Tridecanone	SC-QE03-SW-601 (0.00,0.00)	0.017	1
9-Octadecenal, (Z)-	SC-QE01-SW-801 (0.00,0.00)	0.012	J
Acetaldehyde, dimethylhydrazone	SC-QE02-SW-601 (0.00,0.00)	0.013	1
Aromatic Hydrocarbon	SC-QE02-SW-601 (0.00,0.00)	0.082	
Benzenamine, N-(4-pyridinyl methylene)-	SC-QE10-SW-801 (0.00,0.00)	0.0087	J
Benzene, 1-azido-2-methyl-	SC-QE04-SW-801 (0.00,0.00)	0.0048	J
Benzene, 1-isocyanato-2-methyl-	SC-QE04-SW-701 (0.00,0.00)	0.019	1
Benzene, 1-isocyanato-3-methyl-	SC-QE10-SW-801 (0.00,0.00)	0.051	J
Benzene, 1-isocyanato-4-methyl-	SC-QE04-SW-601 (0.00,0.00)	0.042	2
Benzene, isocyano-	SC-QE03-SW-601 (0.00,0.00)	0.0076	1
Benzenemethanol, .alpha.-methyl-2-(trifluorometh!	SC-QE05-SW-601 (0.00,0.00)	0.0046	1z
Benzenesulfonamide, 4-methyl-	SC-QE03-SW-701 (0.00,0.00)	0.011	2
Benzo[b]selenophene-2-carbonitrile,3-(hydroxymet!	SC-QE10-SW-601 (0.00,0.00)	0.013	1z
Bicyclo[4.2.0]octa-1,3,5-triene	SC-QE08-SW-801 (0.00,0.00)	0.0063	J
Butyl caprylate	SC-QE02-SW-601 (0.00,0.00)	0.017	1
Caffeine	SC-QE03-SW-601 (0.00,0.00)	0.0053	2
Carbonic acid, bis(1-methylpropyl)ester	SC-QE07-SW-701 (0.00,0.00)	0.023	1
Chlorinated Hydrocarbon	SC-QE05-SW-601 (0.00,0.00)	0.0069	
Cholestanol	SC-QE11-SW-601 (0.00,0.00)	0.0075	1
Cholesterol	SC-QE11-SW-601 (0.00,0.00)	0.006	2
Cyclodecane, methyl-	SC-QE05-SW-801 (0.00,0.00)	0.014	J
Cyclopentadecanone, 2-hydroxy-	SC-QE03-SW-801 (0.00,0.00)	0.0078	J
Cyclopentanecarboxylic acid, 2-amino-, trans-	SC-QE06-SW-801 (0.00,0.00)	0.0061	J
Diphenylmethyl (D)propiolate	SC-QE10-SW-601 (0.00,0.00)	0.022	1
Ethane, 1-ethoxy-1-methoxy-	SC-QE07-SW-801 (0.00,0.00)	0.0054	J
Ethanol, 2-(1,1-dimethylethoxy)-	SC-QE11-SW-601 (0.00,0.00)	0.0073	1
Ethanol, 2-(2-butoxyethoxy)-	SC-QE02-SW-801 (0.00,0.00)	0.0053	J
Ethanol, 2-(2-methoxyethoxy)-	SC-QE02-SW-801 (0.00,0.00)	0.02	J
Ethanol, 2-(diethylamino)-	SC-QW02-SW-601 (0.00,0.00)	1	2
Ethanol, 2-(diethylamino)-,hydrochloride	SC-QW02-SW-601 (0.00,0.00)	0.006	1
Ethanol, 2-[2-(2-ethoxyethoxy)ethoxy]-	SC-QE02-SW-801 (0.00,0.00)	0.0051	J
Ethanol, 2-[2-[4-(1,1,3,3-tetramethylbutyl)pheno!	SC-QE07-SW-701 (0.00,0.00)	0.011	1z
Ethanol, 2-[2-[4-(1,1,3,3-tetramethylbutyl)pheno!	SC-QE07-SW-701 (0.00,0.00)	0.011	2z
Ethanol, 2-[4-(1,1-dimethylethyl)phenoxy]-	SC-QE11-SW-601 (0.00,0.00)	0.028	1
Ethanol, 2-butoxy-	SC-QE02-SW-801 (0.00,0.00)	0.028	J
Ethanol, 2-butoxy-, phosphate (3:1)	SC-QE06-SW-601 (0.00,0.00)	0.0069	2
Ether, 3-butenyl pentyl	SC-QE05-SW-801 (0.00,0.00)	0.011	J
Formamide, N,N'-diethyl-	SC-QW02-SW-601 (0.00,0.00)	0.0073	2
Formic acid, 1-methylpropyl ester	SC-QE04-SW-601 (0.00,0.00)	0.0068	2
Heptane	SC-QE05-SW-801 (0.00,0.00)	0.013	J
Heptanoic acid, anhydride	SC-QE02-SW-601 (0.00,0.00)	0.03	1
Hexadecanoic acid	SC-QE11-SW-601 (0.00,0.00)	0.0084	2
Hexadecanoic acid, 9,10,16-trihydroxy-(R@,S@)-(!	SC-QE05-SW-601 (0.00,0.00)	0.0044	1z
Hexadecanoic acid, butyl ester	SC-QW04-SW-601 (0.00,0.00)	0.011	2
Hexanal	SC-QE05-SW-801 (0.00,0.00)	0.096	J
Hexane, 2,5-dimethyl-	SC-QE05-SW-801 (0.00,0.00)	0.011	J
Hexanoic acid, 3,5,5-trimethyl-	SC-QE06-SW-601 (0.00,0.00)	0.0055	2
Hydrazine, 1,1-dipropyl-	SC-QE05-SW-601 (0.00,0.00)	0.0065	1

TABLE B-20
Maximum Detected Concentrations and Associated Sample Locations for Tentatively Identified Compounds in Surface Water

Compound Name	Client Description	Maximum Result	Footnotes
Isopropanol	SC-QE10-SW-601 (0.00,0.00)	0.0063	1
Isopropyl Ether	SC-QE01-SW-601 (0.00,0.00)	0.0021	1
Ketone	SC-QE02-SW-601 (0.00,0.00)	0.047	
Methanamine, 1-methoxy-N-methyl-N-nitroso-	SC-QE04-SW-801 (0.00,0.00)	0.0044	J
Morpholine, 4-ethyl-	SC-QW02-SW-601 (0.00,0.00)	0.061	2
N-Aminopyrrolidine	SC-QE02-SW-601 (0.00,0.00)	0.024	1
Naphthalene, 2-(1-methylethyl)-	SC-QE03-SW-601 (0.00,0.00)	0.016	2
Nitrogen compound	SC-QE03-SW-601 (0.00,0.00)	0.019	
Octanethioic acid, S-hexyl ester	SC-QE03-SW-601 (0.00,0.00)	0.012	1
Oxygenated Hydrocarbon	SC-QE02-SW-601 (0.00,0.00)	0.056	
Pantolactone	SC-QE03-SW-801 (0.00,0.00)	0.009	J
Pentanoic acid, 4-methyl-	SC-QE07-SW-701 (0.00,0.00)	0.62	1
Phosphine oxide, triphenyl-	SC-QE11-SW-601 (0.00,0.00)	0.079	2
Phosphoric acid, tris(3-methylphenyl)ester	SC-QE03-SW-601 (0.00,0.00)	0.0081	2
Phosphoric acid, tris(methylphenyl)ester	SC-QE02-SW-601 (0.00,0.00)	0.016	2
Polynuclear Aromatic Hydrocarbon	SC-QE11-SW-601 (0.00,0.00)	0.079	
Propane, 1,1'-oxybis[2-chloro-	SC-QE11-SW-601 (0.00,0.00)	0.014	1
Propane, 1-(1,1-dimethylethoxy)-2-methyl-	SC-QE02-SW-801 (0.00,0.00)	0.0057	J
Propane, 2,2'-[ethylidenebis(oxy)]bis-	SC-QE03-SW-801 (0.00,0.00)	0.011	J
Propane, 2-ethoxy-	SC-QE04-SW-801 (0.00,0.00)	0.0043	J
Propanoic acid, 2-methyl-, 2,2-dimethyl-1-(2-hyd!	SC-QE03-SW-801 (0.00,0.00)	0.0049	Jz
Pyrrolidine, 1-acetyl-	SC-QE02-SW-601 (0.00,0.00)	0.029	1
Pyrrolo[1,2-a]-1,3,5-triazine-7-carboxylic acid!	SC-QE11-SW-601 (0.00,0.00)	0.048	2z
Saturated Hydrocarbon: >C20	SC-QE02-SW-601 (0.00,0.00)	0.0085	
Silacyclohexane, 1,1-dimethyl-	SC-QE03-SW-601 (0.00,0.00)	0.018	2
Siloxane	SC-QE06-SW-801 (0.00,0.00)	0.029	J
Simazine	SC-QE06-SW-601 (0.00,0.00)	0.007	2
Stannane, diethyldimethyl-	SC-QE10-SW-601 (0.00,0.00)	0.047	2
Tetrahydrofurfuryl chloride	SC-QE05-SW-801 (0.00,0.00)	0.013	J
Undecane	SC-QW07-SW-801 (0.00,0.00)	0.011	J
Unsaturated Hydrocarbon	SC-QE01-SW-601 (0.00,0.00)	0.0043	
p-Toluidine, N,N-dimethyl-.alpha.-(trimethylsilo!	SC-QE10-SW-601 (0.00,0.00)	0.013	1z
p-tert-Amyl phenoxy ethanol	SC-QE11-SW-601 (0.00,0.00)	0.026	2
Volatile Organics (mg/L)			
Benzene, 1-methyl-2-(1-methylethyl)-	SC-QW02-SW-701 (0.00,0.00)	0.0061	2
Siloxane	SC-QE10-SW-801 (0.00,0.00)	0.022	JB
Unknown	SC-QE07-SW-601 (0.00,0.00)	0.081	
cis-1,2-Dichloroethene	SC-QW04-SW-701 (0.00,0.00)	0.058	2
trans-1,2-Dichloroethene	SC-QW04-SW-601 (0.00,0.00)	0.033	3