Engineering Evaluation and Cost Analysis for Former Carter Carburetor Site 2840 N. Spring Avenue St. Louis, Missouri

Prepared for:
ACF Industries LLC
101 Clark Street
St. Charles, MO 63301

Prepared by:
MACTEC Engineering and Consulting, Inc.
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

MACTEC Project Number 3250055164

September 22, 2010

MACTEC

EXECUTIVE SUMMARY

This Engineering Evaluation and Cost Analysis (EE/CA) Report for the former Carter Carburetor Site (Site) primarily located at 2840 North Spring Avenue in St. Louis, Missouri was prepared to fulfill the obligations of ACF Industries LLC (Respondent) under the United States Environmental Protection Agency's (USEPA) Administrative Settlement Agreement and Order On Consent (Settlement Order) for Removal Action Comprehensive Environmental Response, Compensation, and Liability Act 07-2005-0372. ACF Industries Inc. owned the property from 1956 until April 26, 1985. In 1985, ACF Industries, Incorporated deeded the Site property and buildings to the Land Reutilization Authority of the City of St. Louis (LRA). Although some cleanup activities have taken place at the Site, sampling conducted by ACF since 2003 has indicated that polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) at concentrations above risk-based Site cleanup levels are present in soils and building materials at the Site. The USEPA and Respondent have entered into this Settlement Order for the purpose of conducting investigations to support and complete an EE/CA that will evaluate removal alternatives to address contamination at the Site.

ACF or its predecessors manufactured carburetors and other equipment for gasoline and diesel-powered equipment at the Site as early as the 1920s. Aluminum and zinc were die cast and machined into carburetor components. These components were then assembled on Site. Active production took place at the Site until 1984, when ACF ceased production, dismantled the manufacturing lines, and either sold the equipment or shipped the equipment to other locations. Prior to 1978, PCB containing hydraulic fluid, Pydraul®, was used in the manufacturing process. The results of the sampling conducted during the Site evaluation that Respondent performed from 2003 thru 2008 under the Settlement Agreement indicate that PCBs at concentrations exceeding the remedial action goals (RAGs) approved by the USEPA in the Streamlined Risk Evaluation (SRE) are present in surface and subsurface soil surrounding portions of the building and throughout the floors, wall, and support columns of the building.

In addition to PCBs, chlorinated solvents were detected at the Site. Primarily, TCE and its associated breakdown products dichloroethylene (DCE) and vinyl chloride (VC) are present. The results of the sampling conducted during the Site evaluation that the Respondent performed from 2005 through 2008 under the Settlement Order indicates that TCE, DCE and VC at concentrations exceeding the RAGs are present in surface and subsurface soil surrounding portions of the building.

Four separate areas of the Site with contamination above the RAGs are addressed in this EE/CA. These areas are the CBI Building, the Willco Plastics Building, the Die Cast area, and the TCE AST area. Within the CBI Building, PCBs above the RAGs are present within concrete floor slabs on portions of all four floors and on portions of the walls (brick/masonry) of the CBI Building. Asbestos and lead-based paint are also present within the CBI Building. Within the Willco Plastics Building, PCBs were found within the concrete floor and asbestos is present on the second floor of the building. PCB impacted soils and concrete above the RAGs are present in the former Die Cast area, with minor amount of impacted soils located at depth at the former location of substation #4 at the northeast corner of the former Die Cast buildings. TCE impacted soils above the removal action goal are present near the former location of the TCE AST.

As a result of the findings of the Site Evaluation, the SRE, and as required by the Settlement Order, removal technologies for the PCB and solvent contamination at the Site were identified and evaluated as part of the EE/CA process. The following ten (10) technologies were evaluated as potential removal actions for the Site buildings and surrounding soils. The technologies were considered separately and in combination with each other to develop the selected remedy.

- No Action (as required per the Settlement Order)
- Institutional Controls
- Building Rehabilitation/Epoxy Encapsulation
- Mechanical Removal of Surface Layer (Scabbling/Scarifying)
- In-Situ Thermal Desorption/Vapor Extraction
- Excavation
- Impermeable Cap
- Groundwater Corrective Action System
- Partial Building Removal and Replacement
- Demolition and Disposal

The removal options were evaluated based on their potential effectiveness in achieving the Site specific PCB and solvent RAGs that are protective of human health and the environment as required by the USEPA under the Settlement Order, their implementability and their cost.

The No Action alternatives were determined to be unacceptable in meeting the removal goals for both the Site buildings and Site soil.

The four remedies selected for further evaluation for the Site are summarized below, with detailed discussion in Sections 5 and 6. The estimated costs associated with each alternative are presented in 2009 dollars, with actual costs dependent on economic conditions and costs at the time the remedies are performed.

The Institutional Complete Building Demolition Alternative evaluated for use in the CBI Building were determined to be effective at meeting the removal goals and is the recommended remedy for the CBI Building. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is approximately $12,890,000.

The Partial Removal and Replacement of Impacted Building Materials Alternative evaluated for use in the Willco Plastics Building were determined to be effective at meeting the removal goals and is the recommended remedy for that building. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is approximately $1,260,000.

The In-Situ Thermal Desorption and Vapor Extraction evaluated for use in the Former Die Cast Area soils was determined to be effective at meeting the removal goals and is the recommended remedy for the soil in that area. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is approximately $9,857,000.

The In-Situ Thermal Desorption and Vapor Extraction alternative evaluated for use in the TCE AST Area soils was determined to be effective at meeting the removal goals and is the recommended remedy for the soil in that area. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is approximately $2,529,000 (2009 Dollars).The final costs are dependent upon a variety of factors, including but not limited to the amount of material required to be disposed of at a TSCA disposal facility, energy costs, and transportation costs.

All of the selected remedies are protective of public health and the environment. The total cost for implementing the selected remedies is $26,536,000.

(2009 Dollars).The final costs are dependent upon a variety of factors, including but not limited to the amount of material required to be disposed of at a TSCA disposal facility, energy costs, and transportation costs.

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

Table of Contents (continued)

List of Tables

Table of Contents (continued)

List of Figures

Table of Contents (continued)

Table of Contents (continued)

List of Attachments

Table of Contents (continued)

List of Abbreviations and Acronyms

ACF	ACF Industries LLC
ACM	asbestos containing material
AST	aboveground storage tank
bgs	below ground surface
BTEXN	benzene, toluene, ethylbenzene, xylenes, and naphthalene
BTOC	below top of casing
CBI	Carter Building, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOT	Department of Transportation
DRO	diesel range organics
EE/CA	Engineering Evaluation and Cost Analysis
EP&R	Emergency Planning and Response Branch
ESE	Environmental Science and Engineering, Inc.
GRO	gasoline range organic
HHBGC	Herbert Hoover Boys and Girls Club
ID	identification
LRA	Land Reutilization Authority of the City of St. Louis, Missouri
MDNR	Missouri Department of Natural Resources
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MRBCA	Missouri Risk-Based Corrective Action
MSD	Metropolitan St. Louis Sewer District
OD	outside diameter
ORO	oil range organics
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
ppbv	parts per billion by volume
ppm	parts per million
PVC	polyvinyl chloride
RAGS	Removal Action Goals
RBTL	Risk-Based Target Level
RCRA	Resource Conservation and Recovery Act
Settlement Order	Administrative Settlement Agreement and Order on Consent for Removal Action
SI	Site Inspection
SRE	Streamlined Risk Evaluation
SVOC	semi-volatile organic compound
TCE	trichloroethylene
TPH	total petroleum hydrocarbon
TSCA	Toxic Substances Control Act
UAO	Unilateral Administrative Order for Removal Response Activities
USC	United States Code
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
UST	underground storage tanks
VC	vinyl chloride
VOC	volatile organic compound

1.0 Introduction

This Engineering Evaluation and Cost Analysis (EE/CA) Report for the former Carter Carburetor Site (the Site) primarily located at 2840 North Spring Avenue in St. Louis, Missouri (Figure 1-1) was prepared to fulfill the obligations of ACF Industries LLC (ACF) under the United States Environmental Protection Agency (USEPA) Administrative Settlement Agreement and Order On Consent for Removal Action (Settlement Order) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-07-2005-0372. ACF Industries Inc. owned the property from 1956 until April 26, 1985. In 1985, ACF Industries, Incorporated deeded the Site property and buildings to the Land Reutilization Authority of the City of St. Louis (LRA). Although some cleanup activities have taken place at the Site, sampling conducted by ACF since 2003 has indicated that polychlorinated biphenyls (PCBs) and trichloroethylene (TCE) at concentrations above RAGs are present in soils and building materials at the Site.

The following subsections present the objectives of the EE/CA, a detailed site description and a regulatory environmental history of the site, and the report organization.

1.1 Objectives

This EE/CA is based on the results of the sampling conducted at the Site and documented in the *Environmental Field Investigation Report for Former Carter Carburetor Site, MACTEC, August 2003; Limited Groundwater Investigation Report for the Former Carter Carburetor Site, St. Louis, Missouri, MACTEC, October 2005; Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site, MACTEC, October 2005; Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data, St. Louis Missouri, MACTEC, November 2006; Interim Data Submission Report for the Former Carter Carburetor Site, Round 2 Field Data - 2007, St. Louis, Missouri, MACTEC, December 13, 2007; and UST Areas Characterization Results, CBI Building/LRA Property, Former Carter Carburetor Site, St. Louis, Missouri, MACTEC, March 6, 2008.* As set forth in the Settlement Order, the objectives of the EE/CA are:

- Comparatively evaluate all appropriate response action alternatives for the Site and recommend an alternative based on this evaluation;
- Prepare and submit a Streamlined Risk Evaluation (SRE), including Removal Action Goals, with the SRE and RAGs included as Attachment 1 to this EE/CA;
- Evaluate, at a minimum, the No Action alternative, various encapsulation/containment scenarios, and removal and off-site disposal alternatives;
- Prepare good faith cost estimates for proposed alternatives;
- Conduct a comparative analysis of proposed alternatives, to include the relative effectiveness, implementability, and cost of each alternative;
- Discuss removal and disposal options and ultimate destinations of all removed materials; and
- Present all analytical results.

1.2 Site Location

The Carter Carburetor Site is located at 2800-2840 North Spring Street (Figure 1-2) in the north-central portion of the City of St. Louis, in a mixed residential and commercial neighborhood. The Site is located on the west side of Grand Boulevard and is bounded by St. Louis Avenue to the south, Dodier Street to the north, and North Spring Avenue to the west. The western half of the site is occupied by the former Carter Carburetor building, a four story building, with a two-story addition (the Willco Plastics Building) located at the southeast corner of the former Carter Carburetor building. The east half of the Site is partially paved, with concrete floor remaining in place after the demolition of the former warehouse and die cast buildings. Sidewalks border the Site on all four sides. The Site includes property located to the west of North Spring Avenue, with a street address of 2827 N. Spring Avenue. This property is the former location of an aboveground storage tank (AST) which held TCE. This portion of the Site (TCE AST area) is vacant, with some ground-level concrete structures in place.

Surrounding property use includes residential and commercial properties on the east side of Grand Boulevard, commercial and vacant properties south of St. Louis Avenue, vacant property on the west side of Spring Avenue, and the Herbert Hoover Boys and Girls Club (HHBGC) on the north side of Dodier Street. A figure showing the surrounding property use is included as Figure 1-3.

The Site is 80 feet in elevation above the Mississippi River which is located approximately 6,800 feet to the east. The Site is not within a 100 year flood plain zone.

1.3 Regulatory Environmental Site History

The site history with emphasis on environmental issues is summarized in this section. A chronology of site ownership and summary of environmental investigations are summarized in the following subsections.

1.3.1 Site Ownership

- ACF owned the property from 1956 until April 26, 1985. ACF Industries, Inc. became ACF Industries LLC (ACF) in May 2003. ACF or its predecessors manufactured carburetors and other equipment for gasoline and diesel-powered equipment at the Site as early as the 1920s. Aluminum and zinc were die cast and machined into carburetor components. These components were then assembled on Site. Active production took place at the Site until 1984, when ACF ceased production, dismantled the manufacturing lines, and either sold the equipment or shipped the equipment to other locations. ACF deeded the Site to the LRA on April 26, 1985.
- On April 26, 1985, LRA deeded the Site to Hubert and Sharon Thompson (the Thompsons). On January 9, 1986, the Thompsons sold the northeastern portion of the Site (the Die Cast property) to Edward Pivirotto and his wife (the Pivirottos). The Die Cast property is the portion of the Site formerly occupied by the North Die Cast Building, the South Die Cast Building, and a warehouse. Due to non-payment of taxes, the Die Cast property was offered for sale at a Sheriff's sale and, after no substantive bids were made, the Die Cast property reverted to the LRA.

- The remainder of the Site, occupied by the Carter Carburetor building and the Willco Plastics building, remained the property of the Thompsons. On June 20, 1989, Carter Building, Inc., a Delaware Corporation (CBI) (not affiliated with Carter Carburetor), entered into a lease and option to purchase agreement with the Thompsons. Following the filing of a suit for breach of contract and for specific performance and a subsequent foreclosure proceeding, CBI received a Trustee's deed (Under Foreclosure) for the portion of the Site occupied by the Carter Carburetor building, the Willco Plastics building, and the parking lot at the southeast corner of the Site.
- The portion of the Site (2827-9 N. Spring Avenue) located on the west side of Spring Avenue, formerly occupied by a TCE AST, is currently owned by the HHBGC. The remaining parcels on the west side of N. Spring Avenue between Dodier St. on the north and St. Louis Avenue on the south are owned by the LRA (Figure 1-3).

1.3.2 Site Investigations

The following list of site investigations is taken directly from the Settlement Order findings of fact for the Carter Carburetor site:

- In the early 1980s, ACF was required by the Industrial Pollution Control Section of the Metropolitan St. Louis Sewer District to monitor and control waste water discharges containing PCBs. ACF instituted physical and procedural controls to reduce PCBs in their waste water discharges. A source of the current PCB contamination was PCB-contaminated hydraulic fluid in machinery and equipment used in the Carter Carburetor manufacturing processes at the Facility.
- In August 1987, EPA conducted a Toxic Substances Control Act (TSCA) inspection of the Facility which led to the issuance of a Complaint and Notice of Hearing to Hubert Thompson. In April 1988, Mr. Thompson contracted with U.S. Pollution Control Inc. to clean up and remove the PCB containing transformers.
- In June 1988, a Consent Order issued by EPA required Mr. Thompson to remove and dispose of the PCB transformers. Following the response actions by the Thompsons, a cleanup verification study was performed by Environmental Operations, Inc. in November 1989. This study indicated that PCBs were still present in the pump room (electrical substation #1).
- In February 1989, the Missouri Department of Natural Resources (MDNR) conducted an inspection at the Site. The inspection revealed that transformers, transformer oil, switches, and contaminated concrete had been shipped offsite for disposal. Samples collected during the MDNR inspection revealed PCB contamination in soils under an old transformer area. In April 1989, EPA collected samples at the Site and found PCB concentrations in the soils ranging from 17.2 parts per million (ppm) to 18.5 ppm.
- In March 1990, EPA conducted another TSCA inspection to determine if further cleanup action was necessary. Analysis of samples collected during this inspection indicated that surface wipe samples still exceeded regulatory cleanup standards and that a PCB transformer and two drums of PCB containing material remained on-site.
- Another PCB study was conducted by Environmental Science and Engineering, Inc. (ESE) in September 1990 on behalf of Mr. Thompson. This study focused solely on the first floor pump room (electrical substation #1) which had originally contained six transformers. As a result of

this study, EPA requested Mr. Thompson to provide a description of completed and/or planned cleanup activities at the Site. In February 1991, Mr. Thompson responded, indicating that he did not have the assets to continue the cleanup activities at the Site.

- The EPA Emergency Planning and Response Branch (EP&R) conducted Site investigations in November 1993 and January 1994. The primary reason for the investigations was to collect environmental samples and conduct an assessment of the Site to determine if anyone had access to and could be exposed to the areas previously determined to contain PCBs. Samples were collected from areas at the facility known or suspected to have significant concentrations of PCBs. These areas included: (a) a vaulted pump room near the center of the CBI portion of the Facility that contained pumps, old boilers and other equipment, and once housed electrical substation #1; (b) locations near and below electrical substation #3 which was on the roof of the LRA portion of the Facility; and (c) locations near electrical substation #4 which was in the northeast corner of the LRA portion of the Facility. Analysis of a sediment sample taken from the floor drain in the pump room indicated the presence of PCB contamination; however, it could not be determined if PCB contamination had or was capable of being released to the city sewer system through this floor drain. Analytical results from samples taken during the November 1993 and January 1994 investigations confirmed the presence of high levels of PCBs at and near two large PCB transformers at electrical substations #3 and #4, indicating that releases of PCBs had occurred from each transformer. Two drums of oil containing PCBs were also found near the PCB transformer at electrical substation #4. A large PCB stained area, approximately 15 by 40 feet in size, was discovered immediately west of the drums of PCB oil. Analytical results from samples collected also indicated that PCBs were on certain areas of the floors in the main part of the manufacturing building. As a result of the discoveries, EPA requested the LRA to immediately over pack and secure the two drums of PCB oil, restrict access to the Site and post PCB warning stickers.
- The USEPA conducted another Site investigation in March of 1994. The purpose of this investigation was to collect additional air, wipe and dust samples to further characterize the Site and determine the potential threat to those individuals who were in the building on a daily basis. Analytical results from the air sampling and from fifty (50) wipe samples of the floors, walls and equipment at the facility confirmed the existence of PCBs.
- In December 1995 and January 1996, USEPA and its contractors conducted an Integrated Assessment Investigation in order to complete a Preliminary Assessment (PA) and Site Inspection (SI) to determine if off-site migration had occurred and to provide recommendations for further action based on the results of the PA/SI. This investigation of PCBs was based on the operational history and past investigations. The potential sources of PCBs within the facility were:

  a) Transformers. One of the two 100-gallon PCB transformers was located on the roof on the western portion of the south die cast building (electrical substation #3). The second transformer was located on the northeast corner of the north die cast building (electrical substation #4). Seventeen (17) 1-gallon PCB and/or PCB containing transformers/located inside both the north and south die cast buildings and the south warehouse facility.

b) Drums. Two (2) drums were staged in a room south of the south die cast building with PCB placarding on the drums.

c) Metal shavings. An unknown volume of metal shavings were spread throughout the facility in both the north and south die cast buildings. Analytical results indicated the shavings were contaminated with PCBs, cyanide and heavy metals.

d) Smokestack/exhaust ventilation. Analysis of wipe samples collected from the smokestack/ exhaust ventilation system in the north and south die cast buildings revealed the presence of PCBs.

e) Sumps and trenches. Five (5) sumps and/or trenches were located in the north and south die casting buildings. Most of the sumps contained liquids and sediments. One sump sample indicated the presence of PCBs.

f) Building material and dust. Analytical results of wipe samples and building material samples indicated areas, primarily in the die casting rooms, which contained PCBs.

- Outside Contamination.

g) Based upon analytical results from samples taken during USEPA's November 16, 1993 and January 6, 1994 investigations, significant PCB contamination existed outside of the Facility structures in the north parking lot area. This PCB contamination was at least partially the result of releases from a PCB transformer (electrical substation #4) located on the northeast corner of the north die cast building.

h) As part of the Integrated Assessment Investigation, soil samples were collected from the nearby Herbert Hoover Boy's Club and from two occupied residential properties and analyzed for PCB contamination. The area of observed contamination on the Boy's Club property is within 200 feet of the Boy's Club building. One residence is located approximately 100 feet east of the Facility, and the second residence is located approximately 100 feet northeast of the Facility. Analytical results of the samples from these properties revealed low levels of PCBs in surface soils. In addition, on-site screening of additional surface soil samples indicated PCB contamination existed in all four directions from the Facility.

- Analysis of wipe samples collected around smokestack/exhaust ventilation areas during the Integrated Assessment Investigation indicated the presence of PCB contamination.
- On March 18, 1996, USEPA determined that a time-critical removal action should be performed at the Site in order to reduce the immediate threat to human health and the environment posed by conditions at the Site. The USEPA's determination that such action was necessary and a description of the actions that needed to be taken were described in the Removal Action Memorandum, signed by the Regional Administrator of the USEPA, Region VII on March 18, 1996.
- In July 1996, USEPA issued a Unilateral Administrative Order for Removal Response Activities (UAO), Docket Number VII-96-F-0026, pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a), to Respondent, ACF. The UAO required ACF to undertake the actions identified in the March 1996 Removal Action Memorandum, which included: (a) the removal and disposal of a PCB transformer; (b) characterization, removal and disposal of all contaminated building

material and debris located on the north side of the north die cast building; (c) characterization and disposal of the contents of the two die cast buildings and south warehouse, followed by the demolishing of the three structures and of-site disposal of the demolition debris; and (c) the installation of an interim cover over the die cast buildings foundation floors following the demolition of the two die cast buildings and south warehouse.

- In May of 1997, ACF began on-site removal action pursuant to the 1996 UAO. The time-critical removal action required by the UAO primarily focused on the demolition and disposal of PCB and asbestos in buildings on the eastern portion of the Site. These buildings included two die cast buildings and the south warehouse. The south warehouse was completely demolished, including the foundations and floor. The die cast buildings were partly demolished; leaving the PCB contaminated foundation walls and floors of the die cast buildings in place but coated with epoxy and covered with limestone aggregate. ACF has complied with the requirements of the UAO.
- In July 1998, USEPA conducted an investigation at the Site and collected chip, wipe and water samples from the Carter Carburetor Manufacturing Building (also known as the CBI building), the largest remaining Site building, which was then owned by Carter Building, Inc. Results of analyses of the wipe samples and concrete chip samples collected on the first floor indicated the presence of PCBs inside the CBI building on the first floor. Results of analyses of two water samples collected from a pit on the first floor indicated PCB contamination present within water contained in the pit. On the second floor, only one wipe sample analytical result exceeded 10 µg/100 cm^2. The third floor sample analytical results also indicated the presence of PCBs.
- In April 2003, Respondent contracted with a consulting company to conduct additional environmental sampling at the Site. Several soil boring samples were collected at the Site, the majority of which were collected from beneath the concrete foundation floor of the two former die cast buildings. The analytical results from these soil samples indicated the presence of PCBs. primarily beneath the Die Cast building floors. Tetrachloroethylene and TCE were also identified in subsurface soils at the Site.

Subsequent to the investigations outlined in the Settlement Order, ACF contracted with MACTEC to conduct additional Site characterization sampling. Several rounds of sampling were conducted at the Site.

In 2005, MACTEC conducted sampling of the concrete floor of the former North and South Die Cast buildings, the soils below the floor of the North and South Die Cast buildings, soils adjacent to the former location of Substation #4, and soils surrounding the underground storage tanks located north of the North Die Cast building. All samples were analyzed for PCBs. The concrete floor and soils beneath the footprint of the former North and South Die Cast buildings were found to contain PCBs. In addition to the soil samples which were collected, groundwater samples were collected from piezometers located outside the footprint of the North and South Die Cast buildings. Minor petroleum and solvent impacts were noted in the soil and groundwater samples collected. The results of this sampling event were compiled and submitted to the USEPA as the *Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site: PCB Delineation of the North and South Diecast Buildings, St. Louis, Missouri*, October 2005.

In 2006, MACTEC conducted sampling within the CBI, Inc. and Willco Plastics buildings and at the former location of the TCE AST. In order to determine the appropriate level of respiratory protection, MACTEC conducted asbestos sampling of the ambient air within the CBI and Willco Plastics buildings. Airborne asbestos fibers were detected, mandating the use of air purifying respirators for all work within the CBI building. The samples collected consisted of bulk concrete samples collected from discrete depths in the concrete floors, brick chip samples collected from the walls, wipe samples from the walls, sediment samples from the sewer lines, and soil samples from locations within the CBI building and from the AST TCE area. The analytical results were compiled and submitted to the USEPA in the report titled *Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data, St. Louis, Missouri*, November 2006.

Following the completion of the first round of sampling in 2006, ACF contracted the cleaning of the sewer lines within the building, conducted characterization sampling of the USTs closed in place in 1983-1984, and prepared and submitted work plans for additional characterization of the Site.

Following approval of the additional characterization work plans, MACTEC collected soil samples in the TCE AST area, from the perimeter of the North and South Die Cast buildings, and from nine UST tank clusters. In addition, wipe samples were collected from the CBI building and wipe and bulk concrete samples were collected in connection with a PCB remediation pilot study.

In September, 2008, the USEPA conducted sub-slab vapor sampling beneath a relict floor slab adjacent to the TCE AST and below the floor slab of the CBI and Willco Plastics buildings. The sampling was conducted on a randomized grid pattern and samples were analyzed by the USEPA using their on-site mobile laboratory.

1.4 Report Organization

This EE/CA is divided into the following sections:

- Section 1.0 - Introduction: Describes the objectives, general location and background of the Site, and outlines the organization of the EE/CA.
- Section 2.0 - Site Characterization: Summarizes the findings of the Site Characterization efforts at the former Carter Carburetor Site.
- Section 3.0 - Removal Action Objectives: Describes the risk-based action goals which were submitted under separate cover as the Streamlined Risk Evaluation. This section also includes a discussion of the Applicable or Relevant and Appropriate Requirements (ARARs) for the Site.
- Section 4.0 - Identification and Screening of Response Technologies: Identifies and screens potential response technologies.
- Section 5.0 - Evaluation and Cost Analysis of Individual Alternatives: Provides an evaluation and cost analysis of individual alternatives for four areas of the site requiring remedy.
- Section 6.0 – Recommended Alternative. Provides a recommended alternative which includes recommended alternatives for each of the four areas of the Site.
- Section 7.0 - References: Lists references used in the preparation of this EE/CA.

2.0 Site Characterization

This site characterization was developed to define the nature and extent of contamination, fill data gaps, and summarize local site conditions that may impact remedy selection. The site characterization is discussed in the following subsections:

- Characterization Sampling – summary of recent investigation activities conducted to support the development of this EE/CA and fill data gaps identified in previous investigations;
- Local Geology – summary of regional and local geology that may impact remedy selection;
- Hydrogeology – a summary of site hydrogeology that may impact remedy selection;
- Nature and Extent of Contamination – a summary for the various media impacted on the site; and
- Structural Evaluation – an evaluation of the integrity of site structures relative to remedy selection.

2.1 Characterization Sampling

To accurately characterize the nature and extent of impacts at the site, soil samples (surface and subsurface), groundwater samples, concrete/masonry samples, air samples, and surface wipe samples were collected at the Site. In addition, samples of suspected ACM and suspected lead based paint samples were collected. The collection methods are described in the following sections.

2.1.1 Soil Sampling

Soil boring activities were completed using a hydraulic probe rig (GeoProbe® or equivalent) using a 2.0-inch outside diameter (OD) macro-core sampler and 1.25-inch OD steel probing rods. Prior to soil boring installation, the ancillary rig equipment was decontaminated to eliminate cross-contamination between successive drilling locations. The soil sampling rods and samplers were cleaned and rinsed between sampling locations. To prevent cross-contamination between samples, the sampler wore disposable nitrile gloves during the collection of the samples. The sampler donned a new pair of disposable gloves before collecting each sample. Water derived from decontamination was containerized for proper disposal.

Continuous soil samples were collected to refusal on bedrock or to predetermined depths in each boring for field screening, lithographic description, and subsequent chemical analysis. Each disposable sampling tube liner was opened and scanned with a photoionization detector (PID) to identify the presence of organic compounds. The highest PID reading measured for each interval scanned was recorded on the boring log form in units of parts per million (ppm). Each soil sample was then described and classified in accordance with the Unified Soil Classification System (USCS).

The first round of soil samples, collected in 2003, was collected as a part of a Phase II investigation. Continuous soil samples were collected to refusal on bedrock or to predetermined depths in each boring for field screening, lithographic description, and subsequent chemical analysis. Each disposable sampling tube liner was opened and scanned with a photoionization detector (PID) to identify the presence of organic compounds. The highest PID reading measured for each interval scanned was recorded on the boring log form in units of parts per million (ppm). Each soil sample was then described and classified in accordance with the USCS.

During subsequent soil sampling events, up to four soil samples were collected from each boring in order to delineate vertical impacts. The four soil samples were collected from the surface soil interval (0 to 3 feet below ground surface), from the shallow subsurface soil interval (between 3 and 10 feet below ground surface), from the capillary fringe (between 10 and 18 feet below ground surface), and from the interval immediately above bedrock.

Soil samples collected from beneath the former pump room were collected using a stainless steel hand auger. The pump room is not accessible to drill rigs.

Soil samples collected for volatile organic compound (VOC) and total petroleum hydrocarbon (TPH) gasoline range organic (GRO) analysis (Method 8260) were placed into laboratory-supplied Terra-Core® (or equivalent) sample containers, which are pre-preserved in accordance with USEPA's Method 5035 “Closed System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples.” Soil samples collected for TPH-diesel range organics (DRO), TPH-oil range organics (ORO), or polynuclear aromatic hydrocarbons (PAHs) analyses were analyzed by USEPA Method 8270. Soil samples collected for PCB analysis were analyzed by USEPA Method 8082. Soil samples collected for Resource Conservation and Recovery Act (RCRA) Metals analysis were analyzed by USEPA Method 6010-ICP with the exception of mercury, which was analyzed by USEPA Method 7471. The non-volatile samples (TPH-DRO, TPH-ORO, PAHs, and Resource Conservation and Recovery Act (RCRA) Metals) were collected into laboratory supplied jars. After collection, each sample was labeled and placed into an ice-filled cooler for transport to the Pace Analytical, Lenexa, Kansas laboratory for analysis. Strict chain-of-custody procedures were followed during the collection and transportation of the samples.

Upon completion of soil sampling, each shallow soil boring was filled with granular bentonite. Soil cuttings generated were containerized in 55-gallon Department of Transportation (DOT)-approved drums for subsequent characterization and disposal.

2.1.2 Groundwater Sampling

During the installation of the soil borings associated with the UST characterization, the on-site geologist selected one boring in each UST area for the installation of a small-diameter groundwater monitoring well. The selection of the boring was based on the conditions of the soils within the borings, including visual indications of impact, screening of the soils with a PID, and the presence of petroleum odors within the soils. The temporary piezometer/small diameter monitoring wells were constructed of 20 feet of pre-pack 0.010 - inch slotted PVC screen to an approximate depth of 28 feet below ground surface (the average depth to bedrock) with blank PVC riser to the surface. A flush mount protective casing was then cemented in place.

Small diameter groundwater wells were also installed on the northeast portion of the site in order to assess groundwater levels and gradient. These wells were sampled in 2005 for select parameters and, with the exception of PZ-03, were sampled again in 2007.

The groundwater wells were sampled using disposable bailers and nylon twine. A minimum of three well volumes was purged from each well, monitoring groundwater parameters, and then collecting the sample into laboratory supplied pre-preserved sample jars. The groundwater samples were analyzed for volatile organic constituents (VOCs), benzene, toluene, ethylbenzene, xylenes, and naphthalene, (BTEXN), and gasoline range organics (GRO) by USEPA Method 8260. The samples were analyzed for polynuclear aromatic hydrocarbons (PAHs) by USEPA Method 8270, for PCBs by USEPA Method 8082, and for RCRA Metals by USEPA Methods 6010 and 7470.

Not all groundwater samples were subjected to the full range of analyses. The analyses conducted were based on the known contents of the USTs located nearest the monitoring wells and on the results of soil sampling conducted near the USTs.

2.1.3 Concrete Sampling - Floors

To collect concrete samples from the floor of the building, the project field team utilized the sampling procedure as described in the "Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data", MACTEC Engineering and Consulting, Inc., November 2006. Bulk concrete samples were collected from selected quadrants on each floor, with sample frequency and quadrant size based on known past uses of the area. The concrete samples were collected, labeled, and submitted to the Pace Analytical, Lenexa, Kansas laboratory under chain-of-custody procedures for analysis of PCB content by USEPA Method 8082.

2.1.4 Brick/Masonry Sampling - Walls

The collection of wall samples followed the same general procedure as the collection of the floor samples. The wall sample locations were based on known PCB use within the area of the CBI Building sampled, with the samples collected from an approximate height above floor of 36-42 inches. The samples were collected into laboratory supplied containers, labeled, and shipped to the Pace Analytical, Lenexa, Kansas laboratory under chain-of-custody procedures for analysis of PCB content by USEPA Method 8082.

2.1.5 Wipe Samples

The PCB wipe samples were collected in a manner consistent with the EPA Mega Rule guidelines for the collection of wipe samples. In most instances, a 10 cm by 10 cm template (a new template for each sample location, supplied by the laboratory) was held in place over the sample location; the hexane soaked pad was wiped within the 10 cm by 10 cm area; placed into the sample jar; and sealed, labeled, and placed into the sample cooler. In some cases, a 20 cm by 5 cm area was sampled, using a template as above.

2.1.6 Sub-Slab Vapor Samples

The sub-slab vapor samples were collected by drilling a hole through the concrete slab and then installing a sub-slab probe into the hole and grouting the probe in place. All probes were installed flush with the slab and a removable Teflon cap was used to seal the probe. The samples were collected into Tedlar® bags with confirmation samples collected into 24-hour Summa® canisters.

2.1.7 Boring Location Survey

Each of the soil borings were surveyed to allow the generation of accurate maps. The boring and monitoring well locations shown on the attached figures were based on the results of the survey.

2.2 Geology

The regional and local geology of the site are presented in the following subsections.

2.2.1 Regional Geology

Subsurface geologic units in the area of the Site is mainly composed of a silt-rich loess layer, clay-rich loess layer, and one layer of residual soil overlying St. Louis Limestone or the Cherokee Group (Lutzen and Rockaway, 1971). Bedrock at the Site was encountered at depths ranging from 23 feet below ground surface to 29 feet below ground surface.

The Cherokee Group is part of the Desmoinesian Series of the Pennsylvanian System. The Cherokee Group contains most of the mineable coal beds in Missouri, and consists primarily of shale beds interlayered with minor carbonate and sandstone beds. The Center for Applied Research and Environmental Systems (CARES) mapping system shows the presence of relict mines in the area of the site, indicating the presence of the Cherokee Group. The rock layers within the Cherokee Group are described by the Missouri Geological Survey in “Water Resources Report 30: Water Resources of the St. Louis Area, Missouri”, as relatively impermeable with yields ranging from 0 – 10 gallon per minute. The impermeable/low yield nature of the Cherokee Group indicates that the unit acts as a confining layer, limiting or eliminating the vertical transport of groundwater.

Underlying the Cherokee Group is the Meramecian Series of the Mississippian System. The Meramecian Series consists of the St. Louis Limestone, the Salem Formation, and the Warsaw Formation, with the St. Louis Limestone nearest the surface. The St. Louis Limestone is a finely crystalline limestone which is greater than 100 feet thick in the St. Louis region. Finely crystalline limestone is typically relatively impermeable, which limits the movement of groundwater and acts as an aquitard. In most areas of St. Louis, the Cherokee group is not present and the St. Louis Limestone is the initial bedrock encountered. While the St. Louis Limestone is relatively impermeable, it is also subject to solution activity and the development of solution channels and karst-like features, which have been described within one-mile of the Site.

2.2.2 Local Geology

Site soil borings were completed as part of the Supplemental Environmental Field Investigation to provide site-specific stratigraphic and hydrogeologic data. Soil boring data indicate the presence of three general soil stratigraphic units overlying the bedrock surface at the Site. These general units are defined in descending order as (1) Fill Unit, (2) Silty Clay Unit, and (3) Clay Unit.

The Fill unit ranges from three to fifteen feet in thickness and consists of varied fill material. The Silty Clay unit ranges from six to nineteen feet in thickness and is fairly consistent in soil type across the Site. The Clay unit is five to ten feet in thickness, consists of clay and weathered bedrock, and overlies the limestone bedrock.

2.3 Hydrogeology

Groundwater on the Carter Carburetor Site was encountered at approximately 24 feet below ground surface at the soil/bedrock interface during the 1995 Preliminary Assessment/Site Inspection (E&E, 1995c). Groundwater was not encountered during the April 2003 site investigation. Groundwater was measured at depths ranging from 9.58 feet below ground surface to 19.00 feet below ground surface during the 2007 UST investigation.

The shallow groundwater table may be locally modified at the Site due to the presence of buildings or parking lots. Based on the measurement made during the UST investigation, shallow groundwater flow at the site is toward the southeast, toward the Mississippi River, which is located approximately 1.75 miles east of the Site. Given the low permeability and the thickness of the unconsolidated deposits underlying the Site, direct connection to deeper bedrock aquifers is not expected.

General surface water drainage at the Site is by overland flow to storm sewer intakes located on Site or to the City of St. Louis curb and gutter system, with surface water entering the storm sewer system. The storm sewers discharge into the Metropolitan St. Louis Sewer District (MSD) conveyances.

2.4 Nature and Extent of Contamination

Based on historical records, past investigations, and the on-going investigations associated with the Settlement Order, the following chemicals of concern (COC) are present on-site.

- Polychlorinated biphenyls (PCBs);
- Volatile organic compounds (VOCs), primarily TCE and its degradation products of cis-DCE, trans-DCE, and VC;
- petroleum hydrocarbons, including 1,2,4-trimethylbenzene;
- ACM; and
- Lead-based paint.

PCBs originated from the PCB-containing oils which were used as hydraulic and dielectric fluids in the manufacturing equipment on Site and are the predominant chemical contaminant found at the Site. PCBs are a group of man-made organic chemicals which are typically mixed with oily liquids and are often found as mixtures of different compounds rather than as a single compound. In the United States, PCBs were known by a variety of trade names, such as Aroclor.

PCBs are very stable compounds which do not easily degrade due to temperature, aging, or microbial activity. PCBs have a high viscosity, have no odor in their pure form, and are not considered volatile at ambient temperatures.

PCB residuals from past operations were found within the CBI building on floors and walls where PCB oil spills or releases may have occurred. At the time ACF transferred ownership of the building to the LRA, the electrical substations and all attendant equipment were intact and operational. To a lesser extent, PCB residuals have been found on the floor slabs of the Willco Plastics Building. Soil samples collected from the exterior and beneath the CBI building and the former North and South Die Cast buildings were found to contain PCBs to varying degrees.

TCE is an industrial solvent reportedly used on site. TCE has been found to degrade by microbial action under primarily anaerobic conditions to cis-DCE and trans-DCE, then to VC, and finally to non-toxic end products including carbon dioxide. TCE has a boiling point below that of water and is considered a volatile organic compound at standard temperatures and pressures.

TCE impacts have been found at the site, with the highest concentrations detected in soils located near the former TCE AST, on the west side of Spring Avenue. Additional impacts have been noted within groundwater samples, sub-slab vapor samples, and to lesser extent, in subsurface soils under the CBI building.

Petroleum hydrocarbons and associated compounds (primarily benzene; toluene; ethylbenzene; xylenes (BTEX); 1,2,4-trimethylbenzene; and naphthalene) are present within soils and groundwater at the Site. These impacts were generally restricted to the areas immediately surrounding the UST clusters.

ACM were commonly used in commercial and industrial construction as fire-proofing material and are commonly found in ceiling tiles, floor tiles, pipe insulation material, and other insulating material. ACM was found in all areas of the CBI Building and on the second floor of the Willco Plastics Building, either as debris piles on the floors, as insulating material associated with the boilers and associated piping, within the wall materials, in the window glazing material, and as an integral part of the cooling towers located on the roof of the building. Air sampling conducted at the Site detected airborne asbestos fibers within the CBI Building.

Lead based- or lead-bearing paint was commonly used in industrial settings and has been found within the paint on walls, man-door components, stair risers, and other miscellaneous painted surfaces within the CBI Building and on door components on the second floor of the Willco Plastics Building.

A summary of the detected COCs on site can be found in Tables 2-1 thru 2-6. Table 2-1, Carter Carburetor Overall Parameter Maximum and Minimum Results, contains results for 71 VOCs, 9 TPH parameters, 16 SVOCs (PAHs specifically), 8 PCB congeners and 8 RCRA metals. Thirty-seven (37) out of seventy-one (71) VOC COCs were detected at the Site in one or more of the 16 areas delineated within the report. The maximum VOC detection was for trichloroethene (62,000,000 µg/Kg) from a sample taken from Area #4 (TCE UST) with an associated minimum detection of 4.8 µg/Kg in the vapor intrusion study. Primarily, the additional VOCs detected were breakdown daughter products of the TCE; namely 1,2-DCEs (cis, trans and total) and vinyl chloride; and VOCs associated with TPH fractions from gasoline and diesel range organics. The maximum TPH fraction concentration detected for TPH was reported from a sample taken from beneath the former die cast building (830,000,000 µg/Kg). All PAHs were detected in conjunction with the investigations for the CBI Building, Pump Room and closed-in-place USTs. The maximum detection for PAHs was for fluoranthene in Area 14, sample UST-1-1-2 (8,490 µg/Kg). The minimum detection for PAHs was for phenanthrene reported from Area 14, sample UST-7-1-20 (4.0 µg/Kg). Aroclors 1242, 1248, 1254 and 1260 were detected at the site in concrete, soil, brick, chip and wipes. The range of detects for aroclors is broad based on site conditions and previous site activities. AR1242 was detected beneath the former die cast buildings at a maximum concentration of 270,000,000 µg/Kg in sample G-09-09-03 and at a minimum concentration of 570 µg/Kg beneath the former die cast buildings in sample G-04-02-04D. AR1248 was detected beneath the former die cast buildings at a maximum concentration of 200,000,000 µg/Kg in sample G-05-01-08 and at a minimum concentration of 43 µg/Kg within the first floor of the CBI Building (Area 1) in sample 1SS-L12-J13-01-01. AR1260 was detected beneath the north parking lot at a maximum concentration of 1,400,000 µg/Kg in sample SS4-02-16 (former transformer site) and at a minimum concentration of 454 µg/Kg within the pump room of the CBI Building (Area 13) in sample 0SS-G4-F5-01-01. AR 1254 was detected in sample G-03-05-08 at a concentration of 10,000 µg/Kg within the die cast building. Six of the RCRA metals were detected (Se and Ag non-detects). The maximum detected concentration was for barium at location SB-31-05 in the south parking lot (201,000 µg/Kg) with the minimum detected concentration for mercury in the former die cast buildings at 27 µg/Kg (4 discrete sample locations).

Table 2-2, Carter Carburetor Summary of Concrete Samples by Aroclor, summarizes the minimum and maximum results for each aroclor by Site location - Areas 0, 1, 2, 3, 5, 7, 8, 12, and 13. Table 2-3, Carter Carburetor PCB Sample and Detection Frequency for Concrete Samples, summarizes the number of detections versus the number of samples per aroclor by area. Aroclor 1248 was detected in 84% of the samples. As indicated by Tables 2-4 and 2-6, Summary of PCB Samples and Detection Frequency for Brick Chip Samples and Sediment (Sewer) Samples, Aroclor 1248 was detected with the highest frequency. Aroclor 1242 was the most frequent congener detected in the soil samples (Table 2-5). It should be noted that over time, PCBs can degrade based on environmental and geological conditions making the discreet identification of AR1242/1248 difficult.

2.4.1 Surface Soil

Surface soil samples (0- to 1-foot below ground surface or 0- to 1-foot below the extent of paved surfaces) were collected for analysis from the CBI building, from the former Die Cast buildings, from the TCE AST area, and from locations adjacent to the former USTs. The analyses conducted on the samples were targeted to constituents known or suspected to be present, based on previous investigations and the history of the Site.

PCBs were detected in surface soil samples collected from below the former Die Cast Building, from surface soil samples collected from one boring within the CBI Building adjacent to the former Die Cast Building location, and from a surface soil sample collected near the northeast corner of the North Die Cast Building, near the former location of Substation #4. The sample locations and concentrations are shown on Figure 2-1.

Fifteen (15) of thirty-five (35) surface soil samples collected from beneath the CBI building floor slab were found to contain PCBs above the method detection limit. The surface soil sample locations and the PCB concentrations are shown on Figure 2-1. During the investigation of UST clusters within the CBI building, surface soil samples were found to contain constituents associated with the contents of the storage tanks, including total petroleum hydrocarbons (diesel-, gas-, and oil-range organics), semi-volatile organic compounds (SVOCs), metals, and xylenes. The constituents associated with the former content of the USTs and the risks associated with those constituents are included within the Streamlined Risk Evaluation (SRE), included as Attachment 1.

The surface soil samples collected from the TCE AST area were found to contain TCE at concentrations above the risk based levels established in the SRE. This area was investigated based on reports of a reported TCE spill. The surface soil sample locations in the TCE AST area are shown on Figure 2-2.

As detailed in the evaluations conducted in the SRE, the constituents of concern within surface soils at the site which exceed USEPA risk guidelines include the surface soils at the Die Cast Building area and the surface soils at the former TCE AST area.

2.4.2 Subsurface Soil

Subsurface soil samples (greater than 3-feet below ground surface or greater than 3-feet below the extent of paved surfaces) were collected for analysis from the CBI building, from the former Die Cast buildings, from the TCE AST area, and from locations adjacent to the former USTs. The analyses conducted on the samples were targeted to constituents known or suspected to be present, based on previous investigations and the history of the Site.

The subsurface soil samples collected from below the former Die Cast building were found to contain PCBs above the risk based levels established in the SRE. A total of twelve subsurface soil samples collected from the remainder of the Site were found to contain PCBs. Five of these detections were in the area formerly occupied by Substation #4, located at the northeast corner of the North Die Cast Building, three of the detections were from subsurface soils below the CBI building slab, and the remaining detections were from borings located along the north side of the North Die Cast building footprint. The sample locations and maximum PCB detections for each boring are shown on Figure 2-3.

The subsurface soil samples collected from the TCE AST area were found to contain TCE at concentrations above the risk-based levels established in the SRE. The sample locations and the maximum TCE concentrations are shown on Figure 2-4.

During the investigation of UST clusters on the Site, subsurface soil samples were found to contain constituents associated with the contents of the storage tanks, including total petroleum hydrocarbons (diesel-, gas-, and oil-range organics), semi-volatile organic compounds (SVOCs), metals, and xylenes. The UST clusters and sample locations are shown on Figures 2-5 through 2-14.

As detailed in the analyses conducted in the SRE, the constituents of concern within subsurface soils at the site which exceed USEPA risk guidelines include the PCBs within subsurface soils at the former Die Cast buildings, PCBs in subsurface soils adjacent to the former Die Cast buildings, and TCE in subsurface soils at the former TCE AST area.

2.4.3 Groundwater

The City of St. Louis has enacted an ordinance (Ordinance # 66777, sealed March 23, 2006) prohibiting the installation and use of potable water supply wells by public and private entities within the City. The Missouri Department of Natural Resources (MDNR) has issued a Memorandum of Understanding (MOU) between the MDNR and the City of St. Louis (September 5, 2006) formally accepting the ordinance as an institutional control. The effect of the city ordinance and the MDNR MOU is to remove drinking water as a risk exposure pathway.

Groundwater can still present an exposure pathway to construction workers if it is encountered during excavation activities and through the vapor intrusion pathway. At the Site, analysis of groundwater samples has shown that groundwater at the site has been impacted by TCE, VC, and 1,2,4-trimethylbenzene above USEPA risk guidelines.

2.4.4 Concrete/Masonry

Concrete samples were taken from the floor slab of the former North and South Die Cast buildings and from the concrete floors of the CBI and Willco Plastics building. The samples were analyzed for PCB content. Masonry (brick/mortar) samples were collected from the walls of the CBI building.

The concrete samples collected from the floor slab of the former Die Cast buildings were found to contain PCBs above the risk-based levels established in the SRE. All 25 samples collected were found to contain PCBs. The concrete sample locations are shown on Figure 2-15.

Concrete samples collected from the first floor and the pump room floor of the CBI Building were found to contain PCBs above the risk-based levels established in the SRE. A total of 245 samples, including duplicates, were collected from the first floor concrete slab and the pump room floor. The concrete sample locations and associated PCB in concrete sample concentration are shown on Figure 2-16.

Concrete samples collected from the second floor of the CBI Building were found to contain PCBs above the risk-based levels established in the SRE. A total of 27 samples were collected from the second floor concrete slab. The concrete sample locations and associated PCB concentrations are shown on Figure 2-17.

Concrete samples collected from the third floor of the CBI Building were found to contain PCBs above the risk-based levels established in the SRE. A total of 59 samples were collected from the third floor concrete slab. The concrete sample locations and associated PCB concentrations are shown on Figure 2-18.

Concrete samples collected from the fourth floor of the CBI Building were found to contain PCBs above the risk-based levels established in the SRE. A total of 18 samples were collected from the fourth floor concrete slab. The concrete sample locations and associated PCB concentrations are shown on Figure 2-19.

On the first floor of the CBI building, thirty-eight 38 masonry samples were collected from an approximate height of 36 to 42 inches above the floor. PCBs were found to be present within the masonry above the risk-based levels established in the SRE. The sample locations and PCB concentrations are shown on Figure 2-20.

On the second floor of the CBI building, five masonry samples were collected from an approximate height of 36-42 inches above the floor. PCBs were found to be present within the masonry above the risk-based levels established in the SRE. The sample locations and PCB concentrations are shown on Figure 2-21.

On the third floor of the CBI building, ten (10) masonry samples were collected from an approximate height of 36-42 inches above the floor. PCBs were found to be present within the masonry in nine of the ten samples collected. The sample locations and PCB concentrations are shown on Figure 2-22.

Due to the limited presence of PCBs on the fourth floor of the CBI building, no masonry samples were collected on the fourth floor.

2.4.5 Air

Prior to beginning the concrete and subsequent sampling within the CBI building, MACTEC collected ambient air samples for asbestos analysis using personal sampling devices. The sampling was conducted to determine the proper level of respiratory protection within the building. The samples resulted in a maximum detection of 0.167 fibers per cubic centimeter (f/cc) by Phase Contrast Microscopy and 0.111 asbestos structures per cubic centimeter (s/cc) by Transmission Electron Microscopy, resulting in the determination that half-face negative pressure respirators equipped with P-100 NIOSH approved cartridges were required for all personnel conducting work within the CBI building. The samples collected from within the first floor of the Willco Plastics building were non-detect for airborne asbestos. The results of the 52 sub-slab vapor samples collected indicate the presence of 1,1-dichloroethylene; cis-1,2-dichloroethylene; tetrachloroethylene; TCE; and VC. The sub-slab vapor sample locations and TCE analysis results are shown on Figure 2-23.

2.4.6 Tanks and Miscellaneous

Soil samples collected above the groundwater table from the different UST areas, while showing some level of impact, were not found to contain constituents of concern above MDNR Risk Based Target Levels (RBTLs) with two minor exceptions. Benzo(a)pyrene was detected in one sample above the MDNR RBTL near UST -1 and TPH-GRO was detected above the MDNR RBTL in a duplicate sample collected near UST-9. The results of the characterization of the UST areas were submitted to MDNR for appropriate action under the MDNR-Tanks Section. The MDNR-Tanks Section issued a "No Further Remedial Action" letter for the regulated USTs on April 7, 2008.

Sediment samples were collected from the storm sewer lines located below the CBI building. These samples were found to contain PCBs above the method detection limit. The sediments within the storm sewers were subsequently cleaned by the use of high pressure jetting equipment and vacuum trucks. All sediment and debris removed from the storm sewers was containerized, characterized, and disposed of in accordance with applicable regulations.

2.4.7 Asbestos and Lead Based Paint

Asbestos and lead-based paint inspections were conducted in the CBI Building and the Willco Plastics Building. Bulk samples of suspect ACM were collected and submitted for analysis. In summary, ACM was found on piping systems within the pump room, the boiler room, throughout the first-, second-, third-, and fourth floors, on piping systems located on the roof levels, and on piping located within the stairwells. ACM was also present in floor tile and mastic on all four floors, within the roofing materials, flashing, and roofing mastic, and mudded fittings within the roof-level mechanical systems. One roof-mounted air handling, two-roof-mounted cooling towers, and the boiler room roof were constructed with asbestos containing transite panels.

The lead-based paint inspection was conducted using an x-ray fluorescence (XRF) lead-in-paint analyzer. The XRF unit detects lead levels in the surface and underlying paint layers in a rapid and non-destructive manner. The inspection found that lead-based paint (lead content greater than 1.0 mg/cm^2) was present on the interior man door components, the fire door components, bumper posts, stair risers, handrails, support posts, bathroom stalls, and on the lower five feet of wall surfaces throughout the CBI building. The wall surfaces within the Willco Plastic building were not found to contain lead-based paint, although it was present in door components.

2.5 Structural Evaluation

A structural evaluation was conducted on the CBI Building and Willco Plastics Building to access potential future use relative to remedy selection.

The CBI building, measuring approximately 240 feet by 640 feet, is a concrete and masonry structure which has housed both offices and manufacturing spaces. The CBI building was built in stages, beginning in approximately 1920, with the final addition of the Willco Plastics building, measuring approximately 185 feet by 130 feet, in 1967. The Willco Plastics building was added to the southeast corner of the CBI building. Both buildings consist of a poured in place concrete superstructure with cast in place integrated concrete floor beam and flooring system. The CBI and Willco Plastics buildings are both brick faced.

The CBI building has internal structural columns which are uniquely identified by a combination of letters and numbers. The column spacing is not identical, but columns are generally spaced on twenty to twenty-five foot centers.

The procedures used to evaluate the structural integrity of the two buildings and a discussion of the current and future use for the buildings is presented in the following subsections.

2.5.1 Structural Evaluation Procedure

An evaluation of the CBI and Willco Plastics buildings was made by a competent Professional Engineer, in accordance with OSHA Standard 1926.850(a), Sub Part T, in order to assess the stability of the structure prior to characterization sampling.

The results of the inspection determined that, although some deterioration had occurred, the structural stability was sufficient for the planned site investigation activities. The inspection revealed some minor spalling of concrete on exterior exposed columns, some deformation of shoulders on concrete columns where water damage had occurred due to long term roof leakage, and some spalling of exterior masonry has occurred in 2008.

No quantitative testing of the load bearing capacity of the floors of the building has been conducted. As with any building, the owner of the building is responsible for determining if the structure is suitable for the owners' planned use of the building. No structural issues have been identified which require action prior to the implementation of remedial alternatives.

2.5.2 Current and Future Building Use

The most recent use of the CBI building has been as storage space, with various materials stored on the second, third, and fourth floors. Prior to re-use as a storage facility, the owner of the building should assess the load bearing capacity of the structure to determine the suitability of the structure for increased loads. In addition, persistent long-term leaks in the roof should be addressed to prevent further deterioration of the structure and to prevent damage to stored items. The windows within the building have also been damaged and portions of the building have been infested by pigeons, with resulting accumulations of pigeon guano. Deterioration of ACMs has caused the ACM to become friable, allowing asbestos fibers to become airborne and to spread throughout the CBI Building and the second floor of the Willco Plastics Building.

Prior to any future use of the building, at a minimum the following items will need to be addressed:

- repair of the roofing system;
- complete asbestos abatement; and
- repair/replacement of the window systems.

Renovation, at the owner's discretion, may be required dependent on the final intended usage of the CBI building. The Willco Plastics building is in relatively good condition and was constructed more recently (1967). Minimal renovation will be required to restore the Willco Plastics building dependent on the final intended usage of the building.

The Site may be developed for uses other than residential or child day care/school purposes in accordance with the Settlement Order. The HHBGC, an adjoining facility, has expressed an interest in redeveloping the Site for use primarily as athletic fields.

3.0 Removal Action Objectives

Removal action objectives are developed for the site by conducting a risk assessment and developing removal action objectives that address ARARs and environmental regulatory goals. Removal action objectives that are protective of human health and the environment are summarized.

3.1 Risk Assessment

Based on the data analyses conducted within the Streamlined Risk Evaluation (SRE) (Attachment 1), the chemicals of concern for the Site are PCBs, TCE, VC, and 1,2,4-trimethylbenzene. PCBs were identified in soils, concrete, and removable surface contamination above the removal action goals established in the SRE. TCE was identified above removal action goals in soils. TCE, VC, and 1,2,4-trimethylbenzene were identified in groundwater above the removal action goal for construction workers who may inhale vapors or contact groundwater during excavation activities.

3.1.1 Risk-based Calculations

Using data gathered during site characterization efforts, an evaluation of potential adverse health effects to humans which may result from exposure to chemicals at the Site based on current conditions was conducted. The estimates of risks to identified receptors under reasonable maximum exposure scenarios were used to determine remedial action goals for those chemicals which were found to exceed acceptable risk levels.

Since the Settlement Order includes the provision that the Site not be used in the future for residential or child day care/school purposes, these receptors were not evaluated.

The SRE identified the chemicals of potential concern in soil, groundwater, air, and dust, and evaluated risks to potentially exposed populations from the chemicals present on-site which exceeded the USEPA's risk assessment guidelines. The populations of receptors which were evaluated included:

- Commercial/Industrial Workers;
- Visitors to a commercial/industrial facility;
- Groundskeepers/landscape workers;
- Construction Workers;
- Adolescent trespassers;
- Adolescent athletes;
- Adult staff members of an athletic club; and
- Athletic event spectators.

The methodology and data used in determining the risk-based clean up levels is described in detail in the SRE, approved by the USEPA on January 30, 2009.

3.1.2 ARARs

This EE/CA has considered ARARS that may pertain to the Site and any removal action activities ultimately undertaken. ARARS are defined by USEPA guidance as follows:

- Applicable requirements are clean up standards, standards of control or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance present at the Site;
- Relevant and appropriate requirements are clean up standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not legally applicable to a hazardous substance, pollutant, containment, removal action, location, or other circumstance at a Site, address problems or situations sufficiently similar to those encountered at the Site such that their use is well-suited to the particular Site. If a review indicates that a requirement is both relevant and appropriate, it is to be complied with to the same degree as if it were applicable.

Proposed standards and non promulgated criteria, advisories, and/or guidance documents issued by either state or federal agencies are not ARARs. These nonpromulgated criteria, advisories, and/or guidance documents may be classified as "to be considered" (TBC) when no specific ARARs exist for a chemical or when ARARs are not sufficiently protective of human health and environment. TBCs may be used to interpret ARARs or determine whether clean up levels are protective of human health and environment. Since TBC are not promulgated standards they are not enforceable standards and compliance with TBCs may not be mandatory.

ARARs are divided into three categories: chemical-specific, location-specific, and action-specific. The definition of each of these categories is provided below:

- Chemical-Specific requirements may be health or risk based numerical values or methodologies that represent an acceptable amount or concentration in the medium of concern (groundwater, concrete, soil, or air) in the absence of consideration of site-specific exposure conditions. If a chemical has more than one standard, the more stringent standard is typically used as the appropriate ARAR.
- Location-Specific requirements are limitations on allowable concentrations of hazardous substances or on activities solely because they impact special locations including fragile ecosystems, floodplains, wetlands, or historic designations.
- Action-Specific requirements are technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes. The requirements are triggered not by the specific chemicals present at a Site but the particular removal activities that are selected.

Federal and State ARARs for the Site are summarized in Table 3-1 and Table 3-2, respectively.

3.1.3 Summary of Numerical Removal Action Goals

In addition to risk-based clean up levels, regulatory levels and requirements are also applicable to the Site. Together, these criteria are used as removal action goals. The following tables summarize the numerical levels for Chemicals of Concern determined by both risk calculations and by ARARs for different media. Table 3-3 summarizes the removal action goals in soil and Table 3-4 summarizes the removal action goals for groundwater.

The removal action goals assume that no institutional controls at the Site have been implemented and the impacted soils are present at the surface of the Site. The final Site cleanup levels will be determined by a variety of factors, including the depth to the contamination, the installation of an acceptable cover system ("cap") at the Site, and institutional controls enacted at the Site during closure.

The removal action goal for PCBs on non-porous interior building surfaces will be the PCB decontamination standard value published in the Toxic Substance Control Act (TSCA) amendment of 1998 (known as the "Mega Rule") of 10 micrograms per 100 square centimeters (µg/100 cm2) (USEPA, 1998) and will be evaluated using wipe samples. For porous surfaces, the TSCA high-occupancy cleanup standard for PCBs is 1 mg/kg, measured on a total waste basis (i.e., not a wipe sample). For low occupancy areas (defined in TSCA as being occupied by an individual for less than 335 hours in a calendar year), the cleanup standard for PCBs is 25 mg/kg. Therefore, porous surfaces exhibiting total PCB concentrations of greater than 1 mg/kg for high-occupancy areas or 25 mg/kg in low-occupancy areas will require decontamination, disposal, or isolation to prevent unacceptable exposures to identified receptors.

3.2 Scope of Removal Action

The objectives, extent of contamination and schedule for the removal action are discussed in the following subsections.

3.2.1 Objectives

Based on the risk assessment and the observed nature and extent of contaminants in and around the Site, the overall objectives of a removal action at the Site are to:

- Control current and future exposure to contaminants in the building.
- Control current and future exposure to contaminants in the surface soil, subsurface soil, and concrete at the former North and South Die Cast buildings; and
- Halt the further migration of contaminants into surrounding soils, air, surface waters, and groundwater.

3.2.2 Extent of Contamination Addressed in EE/CA

Four separate areas of the Site with contamination above the remedial action goals are addressed in this EE/CA. These areas are the CBI Building, the Willco Plastics Building, the Die Cast area, and the TCE AST area.

Within the CBI Building, PCBs above the removal action goals are present within concrete floor slabs on portions of all four floors and PCB impacted walls (brick/masonry) above the removal action goal are present in the CBI building. Asbestos and lead-based paint are also present within the CBI Building.

Within the Willco Plastics Building, PCBs were found within the concrete floor and friable ACM is present on the second floor of the building.

PCB impacted soils and concrete above the removal action goal are present in the former Die Cast area, with minor amount of impacted soils located at depth at the former location of substation #4 at the northeast corner of the former Die Cast buildings.

TCE impacted soils above the removal action goal are present near the former location of the TCE AST.

One or more actions are needed to address these conditions. These actions may include removal of contaminants, building rehabilitation and encapsulation of contaminants, and installation of impermeable cover systems (caps). For convenience, all of these actions are referred to as removal actions.

3.2.3 Removal Action Schedule

The removal action(s) for the Site will be selected by USEPA after public notice and comment. Once the USEPA selects the removal action, several activities will occur. The following is a conceptual schedule for the activities involved in performing the selected removal actions:

- Preparation and approval of Removal Action Work Plan:
- Negotiation of Access Agreements/Cost Sharing Arrangements
- Solicitation of bids, bid review and award, approval of contractor:
- Coordination of Removal Action Schedule
- Mobilization and Completion of Site Removal Action
- Preparation and approval of Closure Report

In order to reduce the amount of time necessary to complete the work, the contractor(s) selected to perform the removal actions will need to coordinate the removal actions between the impacted areas: the structures, the TCE AST area, and the former North and South Die Cast area. The actual time required to complete the removal actions will be dependent on the removal actions selected for each area and if the removal actions can be conducted concurrently or in succession.

4.0 Identification and Screening of Response Technologies

A preliminary screening of alternative technology was conducted to produce a manageable number of technologies for remedy selection in each of the four impacted areas of the site. The technologies are then discussed in greater detail as applied to each of the four impacted areas:

1) CBI Building,
2) Willco Plastics Building
3) Die Cast Area, and
4) TCE AST Area.

4.1 Technology Screening

Removal technologies for the Site were selected for comparative analysis based on their applicability to the chemicals of concern, the removal goals, and potential future uses of the Site and surrounding properties.

The technologies were screened based on their ability to control current and future exposure to chemicals of concern within soil, building materials, and air by meeting risk-based or regulatory clean up levels for PCBs, TCE (and VC), and asbestos and to prevent potential future off-site migration of the chemicals of concern.

The resulting post-removal action condition of the Site from the application of the selected technology should be conducive to the current surrounding area and to anticipated future area uses. The surrounding area is currently undergoing limited redevelopment. An adjoining facility, the HHBGC, has expressed interest in redeveloping the Site as athletic fields and for parking. The CBI property has expressed his desire to return to productive use after the removal action. Since the Site is currently owned by CBI, Inc. and the LRA, the future uses of the Site cannot be predicted with certainty. The screened and ultimately selected technologies considered a full range of potential uses for the property. As provided for in the Settlement Order, residential and day care/school use were not evaluated as potential future uses of the Site. Table 4-1 summarizes the various technologies screened for use at the Site.

4.2 Technology Selection

The technology evaluated for development of response alternatives for each of the four impacted areas of the site is presented in the following subsections.

4.2.1 CBI Building Response Alternatives

The following technologies were retained for detailed evaluation:

- Institutional Controls, including Access/Security Restrictions;
- Building Rehabilitation/Epoxy Encapsulation;
- Asbestos/Lead Abatement;
- Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying);

- Chemical Treatment/Extraction;
- Partial Removal and Replacement of PCB Impacted Building Materials;
- Partial Building Demolition and Impermeable Cap; and
- Building Demolition.

4.2.1.1 Institutional Controls

Institutional controls would limit access to the contaminated portions of the CBI Building. The specific methods could include the installation and maintenance of fencing around the buildings, sealing the portions of the buildings where the concentrations of the chemicals of concern are greater than the risk-based remedial action goals, deed restrictions/environmental covenants, or other methods of limiting access. This option would not remove the contaminants from the Site and, therefore, institutional controls as a standalone option were not selected for further evaluation. However, institutional controls may be implemented as an integral part of the selected alternative in conjunction with other alternatives.

4.2.1.2 Building Rehabilitation/Epoxy Encapsulation

Epoxy encapsulation is a proven technology and referenced as a candidate technology for addressing PCBs in the USEPA "Mega Rule", 40 CFR Part 761.

An epoxy seal could be applied to the surfaces of the CBI Building where PCBs in excess of removal action goals are present, thus creating a barrier and eliminating exposure to PCBs. Extensive care would be required in the field to ensure that the epoxy seal was applied so that an effective bond with the building surfaces was formed. A two-layer application, with the base coat a different color than the cover coat, would be applied in order to provide an indication that maintenance/repair of the surface coat was necessary. In addition, repairs to the building where water damage has occurred and a complete restoration of the roof and window systems would be necessary prior to the application of the epoxy coating. These building repairs would be independent of the PCB encapsulation.

On the first floor, the epoxy will be covered by a (minimum) four-inch concrete overlay which will seal the epoxy and prevent any degradation. The concrete will act as an additional barrier to prevent exposure to the PCBs. On the columns, walls, and upper floors, long term maintenance and inspection would be required to ensure the integrity of the coating, with reapplication of the epoxy coating expected at five to ten year intervals, depending on the level and type of traffic, especially on flooring surfaces. Future sampling would also be required to verify that PCBs were not migrating to the surface. The implementation of this alternative would allow for the CBI Building to be returned to use.

4.2.1.3 Asbestos/Lead Abatement

Prior to the implementation of the selected alternative for the CBI Building, the ACM within the CBI Building will require abatement following approved industry standard abatement methods. If the selected alternative involves the re-use of the CBI Building, the portions of the building where lead impacts are present may need to be addressed following approved industry standard abatement methods, depending on the lead levels present, the material the lead is present in, and the intended use of the building.

4.2.1.4 Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying)

Scabbling and scarifying are established physical/mechanical processes in which the contaminated surface of the building material is removed to a controlled depth. This process removes up to approximately one-half inch of concrete per pass. Since sampling established that PCB impacts penetrated the concrete and masonry to depths greater than one inch in the CBI Building, numerous passes over impacted locations would be required, with the removal of up to two or more inches of concrete necessary in some places. In several areas of the CBI Building, concrete floor thicknesses were measured at less than three inches, raising the possibility of structural damage occurring before the PCB impacted material was fully removed.

Scabbling and scarification of vertical surfaces can be done, although with limited effectiveness. Sampling of brick/masonry within the CBI Building determined that PCB impacts extended at least one-inch into the brick/masonry. Further sampling at greater depths within the brick/masonry was not conducted. Due to the porous nature of brick, the total depth of scabbling/scarification necessary to remove impacted material is not known

Scabbling/scarification are not viewed as an acceptable clean up method due to the depth at which PCB contamination was detected. It is doubtful that this method would be successful at removing all contaminants from the site. Therefore, scabbling/scarifying was not selected as a standalone option for further evaluation.

4.2.1.5 Chemical Treatment/Extraction

Chemical treatment, using an applied solvent and scrubbing action to remove PCBs from the concrete and brick/masonry impacted by PCBs, was evaluated through a pilot test on different sections of the CBI building. Two different solvents were used in accordance with the manufacturers recommendations, with each solvent tested on a section of concrete floor with PCB impacts (bulk samples) of approximately 230 mg/kg, on a section of concrete floor with PCB impacts (bulk samples) of approximately 900 mg/kg, and on a section of brick/masonry wall with PCB impacts (bulk samples) of approximately 50 to 75 mg/kg.

Information provided by the PCB extraction solvent manufacturers indicate that the process is limited to depths no greater than 1-2 inches and that several applications may be necessary to complete the process. The pre- and post-pilot study sampling bears that out, as bulk sample results were inconclusive as to the effectiveness of PCB removal from the concrete and brick/masonry test areas. In addition, a common phenomenon reported in conjunction with chemical solvent extraction indicates that PCBs may become more mobile with the application of the solvent and, following an initial lowering of measured PCB concentrations, PCBs are “wicked” to the surface for an indeterminate period of time after the completion of the process, requiring continued testing and possible additional treatments. The “wicking” phenomenon may have been the cause for a measured increase in one of the sample locations in the brick/masonry pilot study area.

While chemical treatment may meet removal action goals in the short term, additional testing and subsequent chemical treatments would be necessary for all affected areas of the CBI building. For these reasons, chemical treatment is not selected as a standalone option for further evaluation.

4.2.1.6 Partial Removal and Replacement of PCB-Impacted Building Materials

This alternative involves the removal and replacement of impacted floor slabs on the first, third, and fourth floors. This alternative would include epoxy encapsulation of horizontally-impacted support beams, members, and walls. Approximately 80 percent of the first floor slab, 80 percent of the third floor slab, and 35 percent of the fourth floor slab would require removal and replacement. Approximately 1 percent of the second floor slab exceeds the remedial action goal for the site and either floor scabbling or solvent cleaning would be employed to clean the impacted second floor slab.

In order to remove and replace the impacted concrete slabs on the third and fourth floors, the bay to be replaced and the adjoining bays would be shored from below, the bay to be replaced would be sawcut, lowered out of the way, and a new section of floor slab would be installed. The following is an overview of the steps required:

- Vacate the floor area and adjacent bays above and below the area of floor slab to be replaced;
- Disconnect and remove all equipment and interior finishes within the removal area;
- Shore the floor area to be replaced and the surrounding bays. The shoring under the floor area to be replaced will keep the sections of concrete from falling to the floor below and serve as a work platform as concrete is removed;
- Construct a temporary enclosure around the demolition area to contain dust as the sawcutting and demolition proceeds
- Remove the slab using a concrete saw or other non-impact methods. The removed sections should be preliminarily sized to allow for easy transport to the final sizing area prior to sampling and segregation;
- Dust generated and water used in the demolition process must be contained for proper disposal;
- After removing the concrete slab, install additional steel reinforcing bars to connect the new section of floor to existing floor slab;
- Form and support the bottom of the new slab;
- Add steel reinforcing to the new slab;
- Place, finish, and cure the new slab.
- Remove temporary enclosure; and
- After the new concrete has reached sufficient strength, verified through testing, the forms and shoring will be removed.

The removal and replacement of the bays would progress in a staged manner to allow for the replacement of non-adjoining slabs to maintain structural integrity. On-going monitoring of structural conditions would be required.

The replacement of the first floor slab would not require the extensive shoring required of the upper floors. The first floor slab replacement could be accomplished by saw cutting the impacted areas and using traditional methods to remove them from the building for resizing, segregation, and off-site disposal.

The removal and replacement of impacted portions of the building offers a removal alternative that could meet the removal action goals and is technically feasible. For that reason, Partial Removal and Replacement is retained for further evaluation.

4.2.1.7 Partial Building Demolition and Cap

Partial building demolition would involve the demolition and disposal of the upper floors of the CBI building coupled with the installation of an impermeable cap over the PCB impacted first floor slab. After completing the abatement of asbestos impacts, the demolition of the CBI building is a feasible removal alternative. Although attached to the Willco Plastics building, controlled demolition starting at the top floor and working down is feasible and, with suitable precautions and shoring, the Willco Plastics building would remain standing for future use. Care and precaution to minimize fugitive dust emissions would be required during demolition activities, with on-going monitoring during demolition. Control of storm water runoff would also be required. If wetting is used as a fugitive dust control measure, controls will be needed for any runoff generated. After the building material is transported to ground level, the material would be resized for transport, segregated on the basis of PCB content, and transported to an appropriate off-site disposal facility.

Appropriate activity and use limitations would be enacted to prevent excavation of or contact with PCB impacted soil and concrete. The impermeable cap will be maintained in compliance with TSCA requirements.

This removal alternative meets the requirements of limiting exposure to PCBs within the concrete and building materials, and long-term exposure to PCBs remaining beneath the cap can be minimized through activity and use limitations. A cap which meets TSCA requirements can be designed and constructed in order to meet the future use scenario of athletic fields or parking areas for the adjoining athletic club. This alternative is retained for further evaluation.

4.2.1.8 Building Demolition

Demolition of the CBI building is technically feasible and practically achievable. There are proven techniques for building demolition which can be safely implemented. It is unlikely that the building could be demolished by implosion because of the possible generation of PCB laden dust. Prior to demolition, remediation of asbestos impacts would be required. Although attached to the Willco Plastics building, controlled demolition starting at the top floor and working down is feasible and, with suitable precautions and shoring, the Willco Plastics building would remain standing for future use. Care and precaution to minimize fugitive dust emissions would be required during demolition activities, with on-going monitoring during demolition. Control of storm water runoff would also be required. If wetting is used as a fugitive dust control measure, controls will be needed for any runoff generated. After the building material is transported to ground level, the material will be resized for transport, segregated on the basis of PCB content, and transported to an appropriate off-site disposal facility.

This option would provide a permanent remedy and eliminate any future risk associated with the PCB impacted building components. The demolition alternative provides a permanent remedy and achieves the removal action goal for the building materials. For these reasons, the demolition option will be further evaluated.

4.2.1.9 Selected CBI Building Removal Action Alternatives

The technologies considered for the Site were scored based on the evaluation criteria, with the results tabulated in Table 4-2. The technologies retained based on the detailed evaluation are:

- Building Rehabilitation/Epoxy Encapsulation;
- Partial Removal and Replacement of Impacted Building Materials;
- Partial Building Demolition and Impermeable Cap; and
- Building Demolition.

4.2.2 Willco Plastics Building Remedial Alternatives

The following technologies were retained for detailed evaluation:

- Institutional Controls, including Access/Security Restrictions;
- Building Rehabilitation/Epoxy Encapsulation;
- Asbestos/Lead Abatement;
- Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying);
- Chemical Treatment/Extraction;
- Partial Removal and Replacement of PCB Impacted Building Materials;
- Partial Building Demolition and Impermeable Cap; and
- Building Demolition.

4.2.2.1 Institutional Controls

Institutional controls include controls which would limit access to the contaminated portions of the Willco Plastics Buildings. The specific methods could include the installation and maintenance of fencing around the buildings, sealing the portions of the buildings where the concentrations of the chemicals of concern are greater than the risk-based remedial action goals, or other methods of limiting access. This option would not remove the contaminants from the Site and, therefore, institutional controls as a standalone option were not selected for further evaluation. However, institutional controls may be implemented as an integral part of the selected alternative in conjunction with other alternatives.

4.2.2.2 Epoxy Encapsulation of Floor Surfaces

As discussed in the CBI Building remedial alternatives, an epoxy seal could be applied to the surfaces of the Willco Plastics Building where PCBs in excess of removal action goals are present, thus creating a barrier and eliminating exposure to PCBs. The interior building surfaces within the Willco Plastics Building are in good physical condition, allowing for an effective bond between the epoxy and the building surfaces to be sealed.

The impacted areas of the Willco Plastics Building are not extensive, which limits the areas to be coated and maintained. Although this option would not remove the contaminants from the Site, the application of an epoxy cover to impacted flooring surfaces within the Willco Plastics Building would provide for the protection of human health and the environment. A dual layer epoxy coat, with the base coat of a different color to provide an indication of required maintenance, would provide an effective means of eliminating exposure to the impacted concrete.

4.2.2.3 Asbestos/Lead Abatement

Prior to the implementation of the selected alternative for the Willco Plastics Building, the ACM within the building will require abatement following approved industry standard abatement methods. If the selected alternative involves the re-use of the Willco Plastics Building, the portions of the building where lead impacts are present may require abatement following approved industry standard abatement methods, depending on the lead levels present, the material the lead is present in, and the intended use of the building.

4.2.2.4 Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying)

Scabbling and scarifying could be utilized within the impacted areas of the Willco Plastics Building to remove the impacted concrete. The limitations noted for scabbling/scarifying the CBI Building (floor thicknesses and depth of penetration of PCBs) are not issues of concern within the impacted areas of the Willco Plastics Building.

Scabbling/scarification is considered to be an acceptable removal method for PCB impacted concrete within the Willco Plastics Building.

4.2.2.5 Chemical Treatment/Extraction

The Chemical Treatment alternative, discussed in Section 4.2.1.5, suffers from the same limitations in attempting to remove PCBs from the Willco Plastics Building and is not selected for further evaluation as an independent removal alternative. Isolated PCB hot spots within the Willco Plastics Building may be successfully remediated using chemical treatment/extraction methods.

4.2.2.6 Partial Removal and Replacement of PCB-Impacted Building Materials

This alternative involves limited removal and replacement of impacted floor slabs on the first and second floor of the Willco Plastics Building. Based on the results of the sampling conducted, up to 10 percent of the Willco Plastics Building first floor slab and 2 percent of the second floor slab may require removal and replacement. After the Willco Plastics building has been cleaned and known impacted slab materials have been scabbled, confirmation sampling of the floor slab will be conducted to define the portions of the floor slabs which need to be removed and replaced. In addition, spot cleaning using commercially available PCB solvent-based cleaners may be utilized.

The procedures for the removal and replacement of impacted floor slabs were detailed in Section 4.2.1.6 and would be used in the Willco Plastics Building.

The removal and replacement of impacted portions of the building offers a removal alternative that would meet the removal action goals and is technically feasible. For that reason, Partial Removal and Replacement is retained for further evaluation.

4.2.2.7 Partial Building Demolition and Cap

Partial building demolition would involve the demolition and disposal of the upper floor of the Willco Plastics Building coupled with the installation of an impermeable concrete cap over the PCB impacted first floor slab. The demolition of the upper floor of the Willco Plastics Building would be accomplished in a manner similar to that described for the CBI Building in Section 4.2.1.7.

Appropriate activity and use limitations would be enacted to prevent excavation of or contact with PCB impacted soil and concrete. The impermeable cap would be maintained in compliance with TSCA requirements.

This removal alternative meets the requirements of limiting exposure to PCBs within the concrete and building materials, and long-term exposure to PCBs remaining beneath the impermeable cap can be minimized through activity and use limitations. A cap which meets TSCA requirements can be designed and constructed in order to meet the future use scenario of athletic fields or parking areas for the adjoining athletic club. This alternative is retained for further evaluation.

4.2.2.8 Building Demolition

Demolition of the Willco Plastics Building is technically feasible and practically achievable. There are proven techniques for building demolition which can be safely implemented. The demolition of the Willco Plastics Building would follow the procedure as outlined in Section 4.2.1.8.

This option would provide a permanent remedy and eliminate any future risk associated with the PCB impacted building components. The demolition alternative provides a permanent remedy and achieves the removal action goal for the building materials. For these reasons, the demolition option will be further evaluated.

4.2.2.9 Selected Willco Plastics Building Removal Action Alternatives

The technologies considered for the Site were scored based on the evaluation criteria, with the results tabulated in Table 4-3. The technologies retained based upon the detailed evaluation are:

- Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying);
- Building Rehabilitation/Epoxy Encapsulation;
- Partial Removal and Replacement of Impacted Building Materials;

- Partial Demolition and Impermeable Cap; and
- Building Demolition.

4.2.3 Soil Remediation Technologies for Die Cast Area

The following technologies were retained for detailed evaluation for use in remediation of impacted soils/concrete at the Die Cast Area:

- Bioremediation;
- Impermeable Cap;
- Excavation and Off-Site Disposal
- Partial Excavation, Off-Site Disposal, and Cap;
- Institutional Controls;
- In-Situ Thermal Desorption (ISTD);
- Vapor Extraction (VE); and
- ISTD and VE Combined.

4.2.3.1 Bioremediation

Bioremediation is the process of allowing naturally occurring microorganisms to consume or breakdown the chemicals of concern, leaving non-toxic byproducts. Bioremediation can be augmented by injecting nutrients into the area to be remediated, stimulating the growth of the microorganisms. Bioremediation works best in homogeneous coarse-grained soils.

The use of bioremediation technology for the clean-up of PCB impacted soils is not well supported by the literature. The stability of PCBs, which is important for industrial uses, also inhibits the biodegradation of PCBs, making bioremediation an ineffective treatment for the PCB impacted soils.

4.2.3.2 Impermeable Cap

The installation of an impermeable cap involves the construction of an impermeable barrier over the impacted areas at the Die Cast Area, includes a drainage system to prevent infiltration of water into the impacted soils, regrading the Die Cast Area as necessary to accommodate the drainage system, and long term maintenance and monitoring of the impermeable cap. In addition, institutional controls restricting use of the Die Cast Area and restricting any excavation activities within the Die Cast Area would need to be implemented.

This removal alternative meets the requirements of limiting exposure to PCBs within the soils, and long-term exposure to PCBs remaining beneath the impermeable cap can be eliminated through activity and use limitations/institutional controls. Impermeable caps which provide protection to human health and limit exposure to PCBs can be designed and constructed in order to meet future use scenarios and would meet the applicable ARARS. This alternative is retained for further evaluation.

4.2.3.3 Excavation and Off-Site Disposal

Achieving site cleanup goals through the excavation and off-site disposal of impacted materials is an accepted removal alternative. The impacted material above the remedial action goals would be excavated using accepted industry procedures and transported to an off-site facility for disposal. Upon completion of the excavation activity, suitable fill material would be used to return the excavation to an acceptable grade.

This removal alternative meets the requirements of limiting exposure to PCBs within the soils, and long-term exposure to PCBs would be controlled by placement of the impacted material into either a permitted, properly constructed landfill or through destruction of the impacted material. This removal alternative would also meet the applicable ARARS and the proposed future use of the Site. This alternative is retained for further evaluation.

4.2.3.4 Partial Excavation, Off-Site Disposal, and Impermeable Cap

Achieving site cleanup goals through the excavation and off-site disposal of impacted materials and eliminating exposure to impacted soils through the installation of a protective cap are both accepted remedial alternatives. The PCB impacted materials would be excavated to a depth of 10'feet below ground surface, beyond the depth of construction activities, backfilled, and covered with an impermeable cap. Upon completion of the excavation and installation of the cap, institutional controls would be implemented restricting excavations within and use of the Die Cast Area. The PCB impacted material would be excavated using accepted industry procedures and transported to an off-site facility for disposal.

This removal alternative meets the requirements of limiting exposure to PCBs within the soils, and long-term exposure to PCBs would be controlled by placement of the excavated impacted material into either a permitted, properly constructed landfill or through destruction of the excavated impacted material. Exposure to the impacted material left in place would be eliminated due to the depth to the material, the implementation of institutional controls, and the installation of the protective cap. Combining the two alternatives with excavation to a depth of 10-feet below ground surface, backfilling with suitable fill, and installation of a properly constructed impermeable cap would also meet the applicable ARARS and the proposed future use of the Site. This alternative is retained for further evaluation.

4.2.3.5 Institutional Controls

The use of institutional controls as a remedial alternative at the Die Cast Area would involve securing the Site to restrict site access, enacting appropriate controls at the site through state and local government to prevent the use of the Site, and enacting appropriate controls to prohibit the excavation or disturbance of soils at the site. Institutional controls would limit short term exposure to PCB impacted soils at the site, but long term exposure through erosion by wind or water, migration, and incursions onto the site by unauthorized persons could occur. In addition, applicable ARARS would not be met. Consequently, this alternative is not retained for further evaluation as a standalone remedy but it may be used as part of the selected remedy.

4.2.3.6 In-Situ Thermal Desorption (ISTD)

The ISTD alternative, consisting of heating the impacted soils to temperatures sufficient to vaporize the PCBs may result in the release of vapors into the atmosphere. While ISTD has been shown to reduce concentrations of PCBs in the subsurface, it is not considered an acceptable stand alone alternative.

4.2.3.7 Vapor Extraction (VE)

Soil vapor extraction, also known as "soil venting" or "vacuum extraction", is an *in situ* remedial technology that reduces concentrations of volatile constituents adsorbed to soils in the unsaturated (vadose) zone. In this technology, a vacuum is applied through wells near the source of contamination in the soil. Volatile constituents of the contaminant mass "evaporate" and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. In areas of high groundwater levels, water table depression pumps may be required to offset the effect of upwelling induced by the vacuum.

Since PCBs are not volatile at ambient subsurface temperatures and adhere to soil particles, vapor extraction is excluded from further consideration as a stand-alone treatment alternative.

4.2.3.8 ISTD/VE Combined

ISTD/VE combines the elements of ISTD and VE into an integrated process. Thermal probes are installed at predetermined spacing, with vapor extraction wells installed between the thermal probes. An impermeable vapor barrier is installed over the existing ground surface to prevent the escape of vapors and to enhance the effectiveness of the vapor extraction wells. As the thermal probes are energized, the PCBs are volatilized and drawn to the extraction wells by the applied vacuum. Groundwater within the treatment zone is also treated through heating the groundwater above the boiling point, vaporization, and removal through the extraction wells. The PCB content within the soils is oxidized to carbon dioxide, water, and chloride or pyrolized (in the absence of oxygen), which strips off the chlorides, leaving behind the carbon portion of the PCB molecule.

The ISTD/VE alternative meets the requirements of limiting exposure to PCBs within the soils, eliminates long-term exposure to PCBs, and allows for the possible future use of the Die Cast Area as athletic fields, parking areas for the adjoining athletic club, or other uses. This alternative is retained for further evaluation.

4.2.3.9 Selected Die Cast Area Soil Remedial Action Alternatives

The technologies considered for the Site were scored based on the evaluation criteria, with the results tabulated in Table 4-4. The technologies retained based upon the detailed evaluation are:

- Excavation and Off-site Disposal;
- Partial Excavation, Off-Site Disposal, and Impermeable Cap;
- ISTD/VE; and
- Impermeable Cap.

4.2.4 Soil Remediation Technologies for TCE AST Area

The following technologies were retained for detailed evaluation:

- Bioremediation;
- Impermeable Cap;
- Excavation and Off-site Disposal;
- Partial Excavation, Off-site Disposal, Impermeable Cap, and GWCA System;
- Institutional Controls;
- In-Situ Thermal Desorption (ISTD);
- Vapor Extraction (VE); and
- ISTD and VE combined.

4.2.4.1 Bioremediation

Bioremediation is the process of allowing naturally occurring microorganisms to consume or breakdown the chemicals of concern, leaving non-toxic byproducts. Bioremediation can be augmented by injecting nutrients into the area to be remediated, stimulating the growth of the microorganisms. Bioremediation works best in homogeneous coarse-grained soils. The near-surface soils in the TCE AST area are not homogeneous, consisting of a mixture of fill material to an approximate depth of 8 to 10 feet bgs and the deeper soils consist of fine-grained silty clays and clay. The process for the bioremediation of TCE impacted soils is an accepted technology, although the presence of heterogeneous soils, the fine-grained soils at depth, and the TCE concentrations present at the site (up to 6,200 mg/kg) lead to the conclusion that in-situ bioremediation would not be an effective treatment for the TCE impacted soils. Therefore, in-situ bioremediation will not be retained for further evaluation for remediation of the soils in the TCE AST area.

4.2.4.2 Impermeable Cap

The installation of an impermeable cap involves the construction of an impermeable barrier over the TCE AST area, including a drainage system to prevent infiltration of water into the impacted soils, regrading the Site as necessary to accommodate the drainage system, long term maintenance and monitoring of the cap, and the installation, monitoring, and maintenance of a groundwater corrective action (GWCA) system to prevent off-site migration of impacted groundwater from the TCE AST area. In addition, institutional controls restricting use of the Site and restricting any excavation activities at the Site would need to be implemented.

The GWCA options may include:

- Monitored natural attenuation;
- Passive remediation barrier (zero-valent iron or other proprietary mix);
- Groundwater containment

This removal alternative meets the requirements of limiting exposure to TCE within the soils, and long-term exposure to TCE remaining beneath the impermeable cap can be minimized through activity and use limitations/institutional controls. Impermeable caps which provide protection to human health and limit exposure to the TCE impacted soils can be designed and constructed in order to meet future use scenarios. This alternative is retained for further evaluation.

4.2.4.3 Excavation and Off-Site Disposal

Achieving site cleanup goals through the excavation and off-site disposal of impacted materials is an accepted removal alternative. The impacted material above the remedial action goals would be excavated using accepted industry procedures, treated on-site to meet land ban requirements, and transported to an off-site facility for disposal. Upon completion of the excavation activity, suitable fill material would be used to return the excavation to an acceptable grade.

This removal alternative meets the requirements of limiting exposure to TCE within the soils and long-term exposure to TCE would be controlled by placement of the impacted material into either a permitted, properly constructed landfill or through destruction of the impacted material. This removal alternative would also meet the applicable ARARS and the proposed future use of the Site. This alternative is retained for further evaluation.

4.2.4.4 Partial Excavation, Off-Site Disposal, Impermeable Cap, and GWCA System

Achieving site cleanup goals through the excavation and off-site disposal of impacted materials and eliminating exposure to impacted soils through the installation of a protective cap are both accepted remedial alternatives. By combining the two alternatives with excavation to a depth of 10 feet below ground surface, on-site treatment of impacted soils to land ban requirements, backfilling with suitable fill, and installation of a properly constructed impermeable cap, the TCE AST Area could then be returned to use. Upon completion of the excavation and installation of the cap, institutional controls would be implemented restricting the use of the Site and restricting excavations at the Site.

The GWCA options may include:

- Monitored natural attenuation;
- Passive remediation barrier (zero-valent iron or other proprietary mix);
- Groundwater containment

This removal alternative meets the requirements of limiting exposure to TCE within the soils, and long-term exposure to TCE would be controlled by placement of the excavated impacted material into either a permitted, properly constructed landfill or through destruction of the excavated impacted material. Exposure to the impacted material left in place would be eliminated due to the depth to the material, the implementation of institutional controls, and the installation of the protective cap. This removal alternative would also meet the applicable ARARS and the proposed future use of the Site. This alternative is retained for further evaluation.

4.2.4.5 Institutional Controls

The use of institutional controls as a remedial alternative at the Site would involve securing the Site to restrict site access, enacting appropriate controls at the site through state and local government to prevent the use of the Site, and enacting appropriate controls to prohibit the excavation or disturbance of soils at the site. Institutional controls would limit short term exposure to TCE impacted soils at the site, but long term exposure through erosion by wind or water, migration, and incursions onto the site by unauthorized persons would occur. In addition, applicable ARARS would not be met. Consequently, this alternative is not retained for further evaluation as a standalone remedy but it may be used as part of the selected remedy.

4.2.4.6 In-Situ Thermal Desorption (ISTD)

The ISTD alternative, consisting of heating the impacted soils to temperatures sufficient to vaporize the TCE, may result in the release of vapors into the atmosphere. While ISTD has been shown to reduce concentrations of TCE in the subsurface, it is not considered an acceptable stand alone alternative.

4.2.4.7 Vapor Extraction (VE)

Soil vapor extraction, also known as "soil venting" or "vacuum extraction", is an *in situ* remedial technology that reduces concentrations of volatile constituents adsorbed to soils in the unsaturated (vadose) zone. In this technology, a vacuum is applied through wells near the source of contamination in the soil. Volatile constituents of the contaminant mass "evaporate" and the vapors are drawn toward the extraction wells. Extracted vapor is then treated as necessary (commonly with carbon adsorption) before being released to the atmosphere. In areas of high groundwater levels, water table depression pumps may be required to offset the effect of upwelling induced by the vacuum.

While vapor extraction of the TCE is readily achievable, the length of time required to achieve clean up goals, the decreased mobility of vapors through fine-grained soils, and the uneven removal of TCE due to the heterogeneous nature of the fill material precludes vapor extraction from further consideration as a stand-alone treatment alternative.

4.2.4.8 ISTD/VE Combined

ISTD/VE combines the elements of ISTD and VE into an integrated process. Thermal probes are installed at predetermined spacing, with vapor extraction wells installed between the thermal probes. An impermeable vapor barrier is installed over the existing ground surface to prevent the escape of vapors and to enhance the effectiveness of the vapor extraction wells. As the thermal probes are energized, the TCE is volatilized and drawn to the extraction wells by the applied vacuum. Groundwater within the treatment zone is also treated through heating the groundwater above the boiling point, vaporization, and removal through the extraction wells. The TCE content is typically removed from the subsurface in the vacuum extraction process due to the increased mobility from the application of heat and destroyed in the aboveground thermal oxidizer or adsorbed to granular activated carbon in the aboveground treatment process and is then disposed of at a permitted facility.

The ISTD/VE alternative meets the requirements of limiting exposure to TCE within the soils and eliminates long-term exposure to TCE. This removal alternative would also meet the applicable ARARS and the proposed future use of the Site. This alternative is retained for further evaluation.

4.2.4.9 Selected TCE Area Removal Action Alternatives

The technologies considered for the Site were scored based on the evaluation criteria, with the results tabulated in Table 4-5. The technologies retained based upon the detailed evaluation are:

- Excavation and Off-site Disposal;
- Partial Excavation, Off-Site Disposal, Impermeable Cap, and GWCA System;
- ISTD/VE Combined; and
- Impermeable Cap and GWCA System.

5.0 Evaluation and Cost Analysis of Individual Alternatives

An engineering and cost analysis of the individual removal alternatives is provided in this section as well as an overview of the evaluation criteria used for each individual removal alternative. The removal technology alternatives were evaluated according to their effectiveness, implementability and cost.

Effectiveness Evaluation

The criteria for evaluating the effectiveness of individual alternatives are:

- Overall Protection of Human Health and the Environment - This criterion assesses whether, and the extent to which, the risk from potential exposure pathways is reduced through treatment, engineering, or institutional controls;
- Reduction of Toxicity, Mobility, or Volume - This criterion evaluates the degree to which an alternative reduces the toxicity, mobility, or volume of residual at the Site. The evaluation includes the amount of waste treated or destroyed, the irreversibility of the treatment process, and the type and quantity of residuals from any treatment process;
- Compliance with ARARs - This criterion evaluates whether an alternative complies with identified ARARs;
- Short-term Implementation Risks - This criterion evaluates the difficulties imposed by implementation of an alternative, including the protection of workers and community during the removal action, environmental impacts from implementing the action, and the time required to achieve clean up goals;
- Long-Term Implementation Risks - This criterion evaluates the degree to which an alternative provides a long-term solution to exposure concerns at the Site. Factors include whether waste will remain at the Site, the extent to which long-term maintenance and monitoring are necessary, reliance on institutional controls, and reliability of such measures.

Implementability Evaluation

The criteria for evaluating implementability screening are:

- Technical Feasibility - this criterion evaluates the technical feasibility of the alternative to achieve removal objectives. This includes the relative degree of difficulty to construct and operate, and the equipment and specialists required to implement each individual alternative;
- Availability of Goods and Services - this criterion includes an evaluation of available goods and services necessary to implement each individual alternative;
- Administrative Feasibility - This criterion evaluates the anticipated environmental regulatory agency acceptance of technical and administrative issues and concerns the regulatory agencies may have regarding each alternative. This includes issues relating to substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition or construction activities;
- Maintenance Requirements - this criterion evaluates the ease of implementation and includes the effectiveness of maintenance requirements and the future flexibility of each individual alternative.

Cost Evaluation

The cost evaluation for each alternative includes projected capital costs, operation and maintenance costs, and total present worth costs. Supporting details for the cost estimates are located in Attachment 2. All costs are given in 2009 dollars. These costs are based on estimates from suppliers, generic unit costs, vendor information, conventional cost estimating guides, and prior experience. These costs are to be used as guidance only and are based on information available at the time the estimate was prepared. True labor and material costs, actual Site conditions, competitive market conditions, final project scope, implementation schedule and other variable factors will affect the actual project costs. The criteria used to evaluate the costs are:

- Capital Costs - Capital Costs include those costs needed to implement the removal action including both direct and indirect costs. Direct costs include those costs required to implement a removal alternative such as construction costs, equipment, labor, material, and disposal. Indirect costs include those costs required to implement a removal alternative such as those associated with engineering, substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition or construction activities, construction management, and other necessary services;
- Annual Operation and Maintenance Costs - These costs include operation labor, maintenance materials and labor, monitoring and laboratory costs, energy needs, and purchased services.

The cost estimates provided are based on MACTEC Engineering and Consulting, Inc.'s experience, qualifications, and judgment as environmental professionals. Actual rates, costs, schedules, etc. will be dependent on such variables as the timing of the removal actions, weather, cost and availability of labor, materials, and equipment, and economic and market conditions at the time the removal actions are implemented. A summary of removal action costs is included as Table 5-1.

The alternatives developed for each of the four areas of the site are discussed in detail in the following subsections. The four areas of the site that require remedy are:

1. CBI Building;
2. Willco Plastics Building;
3. Die Cast Area; and
4. TCE AST Area.

5.1 CBI Building Removal Alternative Comparative Evaluation

After screening the alternatives, the alternatives selected for comparative evaluation in the CBI Building are:

1. No Action Alternative (USEPA requirement);
2. Partial Removal and Replacement of Impacted Building Materials;
3. Partial Building Demolition and Impermeable Cap;
4. Building Rehabilitation/Epoxy Encapsulation; and
5. Building Demolition.

All removal options for the CBI building, with the exception of the No Action Alternative, will need to begin with the remediation of ACM and the removal of asbestos impacted debris. In addition to the asbestos impacted debris, debris associated with storage activities, such as symphony orchestra instrument cases, four-foot by four-foot by six-foot bales of clothing, unassembled office furniture components, debris from roofing repairs, and plaster/wallboard detritus will need to be disposed of in accordance with applicable regulations. If the CBI building is to remain standing, a sub-slab vapor collection system may need to be installed to prevent the infiltration of volatile organic vapors into the CBI building.

5.1.1 Alternative 1 - No Action Alternative

PCB contamination is present on building columns, walls, and floor slabs at concentrations in excess of the USEPA required removal action goals. Currently, access to the CBI building is partially restricted. ACF is not the owner of the CBI building and is unable to guarantee continuously controlled access in the future. The No Action Alternative provides no changes in Site chemical levels. The No Action Alternative does not include administrative or physical controls that would control future land use or exposure to PCBs remaining at the Site.

5.1.1.1 Effectiveness

Because current PCB levels are in excess of the USEPA required removal action goals and access to the Site is not fully restricted, the No Action Alternative would not be effective in reaching the goal of overall protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of contaminants, nor would it provide for short-term or long-term effectiveness. Additionally, the No Action Alternative would not comply with ARARs.

5.1.1.2 Implementability

The No Action Alternative is fully implementable.

5.1.1.3 Cost

The No Action Alternative includes no capital or operation and maintenance cost expenditures.

5.1.2 Alternative 2 - Partial Removal and Replacement Alternative

PCB contamination is present on building columns, walls, and floor slabs at concentrations in excess of the USEPA required removal action goals. The Partial Removal alternative would provide for the removal of PCBs in excess of removal action goals which would require the removal and replacement of approximately 80 percent of the first floor slab, 1 percent of the second floor slab, 50 percent of the third floor slab, and 10 percent of the fourth floor slab, based on modeling of impacted slab material using the bulk concrete sampling data included in the Round 1 Interim Data submission and rehab of building columns and walls.

After completion of asbestos remediation, removal and replacement of impacted concrete slabs could begin. Extensive shoring, to remain in place throughout the process, would be required for the removal of the upper floor slabs. Each section of floor slab to be removed and replaced would require shoring prior to and during saw cutting, during the removal of the slab, and during the placement and curing of the replacement slab. In addition, all water and dust generated during the saw cutting process would need to be captured, characterized, and disposed of in an appropriate manner. Concurrent with the removal and replacement of the first floor concrete slab, a sub-slab vapor collection could be installed.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be enacted include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying activity and use limitations (AULs) and required operation and maintenance plans (O&M plans), and notifying the city of St. Louis Building Division of restrictions on development or environmental covenants in place at the Site.

5.1.2.1 Effectiveness

Removal and Replacement of the PCB impacted building materials would reduce the toxicity and risk of exposure to PCBs by removing the PCBs. The alternative complies with ARARs because building materials with PCBs above the removal action goals would no longer be present and vapor intrusion would be mitigated, thereby achieving the long-term goal of overall protection of human health and the environment.

5.1.2.2 Implementability

The Partial Removal and Replacement Alternative is administratively feasible. All needed goods and services are available to perform this alternative. The time required for this alternative is estimated to be 36 months, provided sufficient crews are available for four crews to work simultaneously.

5.1.2.3 Cost

The estimated capital cost for the Partial Removal and Replacement alternative includes costs associated with the removal of debris from the CBI building, installation of a vapor collection system, shoring costs, removal and replacement of the impacted building materials, and disposal of wastes associated with the disposal of the building materials and wastes generated during the implementation of the alternative. No long term operation and maintenance costs are associated with this alternative. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.1.3 Alternative 3 - Partial Building Demolition and Disposal Alternative

The Partial Building Demolition and Disposal Alternative provides for the CBI building to be demolished to ground level, leaving the floor slab in place and covering the floor slab with a TSCA compliant cap. After completing the remediation of asbestos impacts, the demolition of the CBI building would begin. Although attached to the Willco Plastics building, controlled demolition starting at the top floor and working down is feasible and, with suitable precautions and shoring, the Willco Plastics building would remain standing for future use.

The building would be demolished and the building materials would be segregated based on PCB concentrations. The building materials would be disposed of at an appropriate disposal facility, with any material not impacted by PCBs segregated for possible recycling. The material would be transported to an appropriate disposal facility. After removing the upper stories of the building, the first floor slab would be covered with a TSCA compliant cap. Appropriate activity and use limitations would be enacted to prevent excavation of or contact with PCB impacted soil and concrete. The TSCA cap will be maintained in compliance with TSCA requirements.

It is anticipated that the detailed work plan for the demolition of the building will contain the type of dust control and storm water runoff to be utilized during the process. Dust control may include misting, enclosure, etc. with appropriate testing to ensure fugitive dust emissions are prevented.

Dismantled building materials would be transported to an appropriate disposal facility. Based on existing analytical data, building materials could be disposed at either a TSCA or sanitary landfill, depending upon the PCB concentrations present in the materials.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be enacted include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development or environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

Although some soil and concrete in excess of removal action goals would remain on-site, the Partial Building Demolition and Disposal Alternative would satisfy ARARs for the site by eliminating exposure to the impacted materials.

5.1.3.1 Effectiveness

The Partial Building Demolition and Disposal Alternative would provide for overall protection of human health and the environment. However, the toxicity and volume of material would not be reduced, but the exposure risk to PCBs in concrete and building material would be controlled. This alternative would be effective in the short term and in the long term, provided the requirements of installing and maintaining a TSCA cap are met in perpetuity.

5.1.3.2 Implementability

The Partial Building Demolition and Disposal Alternative is technically feasible. The controlled building demolition will use established procedures. The installation of a TSCA cap will also use established procedures.

Administratively, the application of activity and use limitations to control future activities at the site is challenging since the CBI building is not owned by ACF. All needed goods and services are available to perform this alternative. The preparation and implementation of an operating and maintenance plan is also feasible. This alternative is estimated to require approximately 18 months to complete.

5.1.3.3 Cost

The estimated capital cost for the Partial Building Demolition and Disposal Alternative is dependent upon several things, including the percent of demolition debris disposed of as TSCA waste and the percent disposed of as construction debris. In addition to the difference in tipping fees for the different disposal facilities, transportation cost fluctuations will also affect the capital cost. Based on the sampling results, 75 percent of the demolition debris will be classified as construction debris and 25 percent will be classified as TSCA waste. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

It should be noted that the disposal method for the building debris is dependent not only on the PCB concentration of the debris, but also on the willingness of local sanitary/construction/demolition debris landfills to accept the debris.

5.1.4 Alternative 4 – Building Rehabilitation/Epoxy Encapsulation Alternative

After completion of asbestos abatement, removal of miscellaneous debris from the interior of the CBI Building, and double pass power washing of the PCB-impacted building surfaces, the application of a protective epoxy coat would be accomplished, with the PCB impacted concrete sealed, preventing exposure from occurring. Two layers of epoxy would be required, with the first layer serving as an indicator of required maintenance and the second layer serving as a wearing surface. In conjunction with the installation of the epoxy, a sub-slab depressurization system will be installed to remove TCE vapors from the sub-slab environment. In addition to the epoxy coating, a protective concrete layer approximately four (4) inches thick would be installed on the first floor. This would add an additional level of protection to the facility. A maintenance plan would be required, detailing inspection procedures, maintenance requirements, and other steps necessary to ensure the protective cover remains intact, the vapor mitigation system remains operable.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls including changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development or environmental covenants in place at the Site.

5.1.4.1 Effectiveness

The application of a dual layer epoxy coating plus a concrete overlay on the first floor would be effective in preventing exposure to PCBs in the concrete within the CBI Building and would achieve the goal of protecting human health and the environment. The process would be effective in the short-term and the long-term, provided the coatings are applied and maintained correctly. It would not reduce the toxicity or volume of the PCBs, but would reduce the mobility of the PCBs by preventing the generation of PCB impacted concrete dust. The epoxy coating, coupled with the sub-slab depressurization system, would be effective in controlling vapor intrusion into the structure. Additionally, the Building Rehabilitation/Epoxy Encapsulation Alternative would comply with ARARs.

5.1.4.2 Implementability

The Building Rehabilitation/Epoxy Encapsulation Alternative is fully implementable. The estimated time required to complete this alternative is approximately fifteen (15) months.

5.1.4.3 Cost

The estimated capital cost for the application of an epoxy coat and a concrete overlay on the first floor includes costs associated with the removal of debris from the CBI Building, cleaning and prepping the surfaces to be coated, applying two layers of epoxy, and applying a concrete overlay on the first floor. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.1.5 Alternative 5 - Building Demolition

After completing the remediation of asbestos impacts, the demolition of the CBI building provides for the building to be demolished and building materials segregated based on PCB concentrations. Although attached to the Willco Plastics building, controlled demolition of the CBI building, starting at the top floor and working down is feasible and, with suitable precautions and shoring, the Willco Plastics building would remain standing for future use. After completion of the demolition and removal action, the lot would be regraded and seeded for future use. The Building Demolition and Disposal Alternative would achieve removal goals by removing the impacted building materials from the Site.

It is anticipated that the detailed work plan for the demolition of the building will contain the type of dust control and storm water runoff to be utilized during the process. Dust control may include misting, enclosure, etc. with appropriate testing to ensure fugitive dust emissions are prevented.

Dismantled building materials would be transported to an appropriate disposal facility. Based on existing analytical data, building materials could be disposed at either a TSCA or sanitary landfill, depending upon the PCB concentrations present in the materials.

In addition to removal of the building, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development and environmental covenants in place at the Site.

The Building Demolition and Disposal Alternative would satisfy ARARs for the Site.

5.1.5.1 Effectiveness

The Building Demolition and Disposal Alternative would provide for overall protection of human health and the environment. Although the overall volume and toxicity of the material would not be reduced, the mobility of the PCBs would be effectively controlled.

The Building Demolition and Disposal Alternative would satisfy ARARs for the Site and provides for short and long-term effectiveness.

5.1.5.2 Implementability

The Building Demolition and Disposal Alternative is technically feasible. Although the controlled demolition of the building is more complex than traditional demolition methods, the dismantling process is feasible and technically proven for the building.

Administratively, there are challenges associated with the Building Demolition and Disposal Alternative. As noted previously, ACF does not own the CBI and Willco Plastics buildings. All needed goods and services are available to perform this alternative. It is estimated that the completion of this alternative will require approximately twenty-four (24) months. There are no long term operation and maintenance requirements associated with this alternative.

5.1.5.3 Cost

The estimated capital cost for the Building Demolition and Disposal Alternative is dependent upon several things, including the percent of demolition debris disposed of as TSCA waste and the percent disposed of as construction debris. In addition to the difference in tipping fees for the different disposal facilities, transportation cost fluctuations will also affect the capital cost. Based on the sampling results, 75 percent of the demolition debris will be classified as construction debris and 25 percent will be classified as TSCA waste. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

It should be noted that the disposal method for the building debris is dependent not only on the PCB concentration of the debris, but also on the willingness of local sanitary/construction/demolition debris landfills to accept the debris.

5.1.6 Comparative Analysis

The five alternatives developed for the CBI building were compared using the following ten review criteria:

1. Protection of human health and the environment;
2. Reduction of toxicity, mobility and volume;
3. Compliance with ARARs;
4. Short-term Implementation Risks;
5. Long-term Implementation Risks;
6. Technical Feasibility;

7. Availability of Goods and Service;
8. Administrative Feasibility;
9. Maintenance Requirements; and
10. Cost Requirements.

A comparative analysis was performed for the following five alternatives:

- Alternative 1 (No action)
- Alternative 2 (Partial Removal and Replacement of Impacted Building Material)
- Alternative 3 (Partial Building Demolition, Soil Cap and Institutional Controls)
- Alternative 4 (Building Rehabilitation/Epoxy Encapsulation with Structure Intact)
- Alternative 5 (Building Demolition)

The no action alternative is included per USEPA requirements as a baseline. This alternative does not achieve ARARS or protection of human health and is not discussed further. Conclusions from this comparative analysis are as follows:

- Protectiveness – All remaining alternatives are protective of human health.
- Reduction of toxicity, mobility and volume – Alternatives 2 and 5 provide complete reduction of the volume of impacted concrete and building material by transfer of this material to a landfill. Placement of the material in a landfill reduces mobility but not toxicity. Alternative 3 provides moderate reduction of volume as only a portion of the building is removed. A cap reduces mobility of residual material but no reduction in toxicity. Alternative 4 reduces the mobility of the impacted materials but no volume or toxicity reduction.
- Compliance with ARARs – All remaining alternatives provide compliance with ARARs.
- Short-term Implementation Risks – Alternative 4 will have little impact to the local community during implementation of encapsulation technology. Alternatives 2, 3 and 5 have relatively high short-term implementation risk as the local public will be subjected to increased construction traffic during implementation.
- Long-term Implementation Risks – Alternatives 2 and 5 have the lowest long-term implementation risk as impacted materials no longer remain on site. Alternative 3 has moderate long-term risk as maintenance of the soil cap is required to protect the public from residuals in the slab foundation. Alternative 4 has moderate long-term risk as all impacted materials remain and epoxy encapsulated structures must be maintained.
- Technical Feasibility/Availability of Goods and Services – All four remaining alternatives provide a high level of technical feasibility. Alternatives 2, 3, and 5 can be implemented with readily available construction equipment. Alternative 4 is a proven technology for addressing PCB-impacted materials; the USEPA PCB "Mega Rule" (40 CFR part 761) supports the use of this technology. Specialty contractors for the application of epoxy encapsulation are readily available.
- Administrative Feasibility – All four remaining alternatives are administratively feasible. Alternative 5 is highly achievable only requiring substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition activities for implementation.

Alternative 2 is also highly achievable but would require substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to both demolition and construction activities. Alternative 3 is considered moderately achievable as it requires both substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition activities and a deed restriction/environmental covenant for impacted material left in place. Alternative 4 is also considered highly achievable and it would require a deed restriction/environmental covenant for impacted material left in place.

- Maintenance Requirements – Alternatives 2 and 5 have no maintenance requirements. Alternatives 3 and 4 have moderate maintenance requirements due to cap and epoxy encapsulation periodic inspections and maintenance, respectively.
- Cost Requirements – Alternative 5 has the lowest cost to implement. Alternatives 3 and 2 have a moderate cost to implement. Alternative 4 has an extremely high cost to implement. The elevated cost for implementation of Alternatives 2 and 3 are related to the costs associated with installing and maintaining the cover system and the costs associated with removing, replacing, transporting, and disposal of the impacted concrete slab.

5.2 Willco Plastics Building Removal Alternative Comparative Evaluation

After screening the alternatives, the alternatives selected for comparative evaluation in the Willco Plastics Building are:

1. No Action Alternative (USEPA requirement);
2. Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying);
3. Building Rehabilitation/Epoxy Encapsulation of Impacted Floor Slab ;
4. Partial Removal and Replacement of Impacted Building Materials;
5. Partial Demolition and Impermeable cap; and
6. Building Demolition.

All remedial options for the Willco Plastics Building, with the exception of the No Action Alternative, will need to begin with the remediation of ACM and the removal of asbestos impacted debris. In addition to the asbestos impacted debris, debris present within the building will need to be disposed of in accordance with applicable regulations.

5.2.1 Alternative 1 - No Action Alternative

PCB contamination is present on building columns, walls, and floor slabs at concentrations in excess of the USEPA required removal action goals. Currently, access to the Willco Plastics Building is partially restricted. ACF is not the owner of the building and is unable to guarantee continuously controlled access in the future. The No Action Alternative provides no changes in Site chemical levels. The No Action Alternative does not include administrative or physical controls that would control future land use or exposure to PCBs remaining at the Site.

5.2.1.1 Effectiveness

Because current PCB levels are in excess of the USEPA required removal action goals and access to the Site is not fully restricted, the No Action Alternative would not be effective in reaching the goal of overall protection of human health and the environment. It would not reduce the toxicity, mobility, or volume of contaminants, nor would it provide for short-term or long-term effectiveness. Additionally, the No Action Alternative would not comply with ARARs.

5.2.1.2 Implementability

The No Action Alternative is fully implementable.

5.2.1.3 Cost

The No Action Alternative includes no capital or operation and maintenance cost expenditures.

5.2.2 Alternative 2 - Mechanical Removal of Top Layer of Concrete (Scabbling/Scarifying)

After completion of asbestos abatement and removal of miscellaneous debris from the interior of the Willco Plastics Building, scabbling/scarifying to remove the upper ½ inch (+/-) could be accomplished, with the PCB impacted concrete removed from the Site and disposed of in accordance with TSCA regulations. Additional sampling to refine the areas to be treated and the removal depth would be required. The scabbling/scarification would reduce the PCB concentrations at the Site and transfer the PCBs to a permitted disposal facility.

In addition to removal of the impacted materials, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.2.2.1 Effectiveness

The scabbling/scarification of the top layer of concrete in the Willco Plastics Building would remove PCB contamination from the Site and prevent future exposure through treatment/disposal at a regulated disposal facility. It would be effective in reaching the goal of overall protection of human health and the environment. It would not reduce the overall toxicity or volume of contaminants. It would reduce the mobility of the contaminants and the remedy would, with proper dust and liquid containment equipment, be effective in both the short- and long-term at controlling exposure. Additionally, the Scabbling/Scarifying Alternative would comply with ARARs.

5.2.2.2 Implementability

The Scabbling/Scarifying Alternative is fully implementable. The Scabbling/Scarification Alternative is expected to take approximately four (4) months to complete.

5.2.2.3 Cost

The estimated capital cost for the Scabbling/Scarifying Alternative includes costs associated with the removal of debris from the Willco Plastics Building, performing the scabbling/scarification, confirmation sampling, and disposal of wastes generated during the scabbling/scarification process. Long term monitoring of the newly exposed surfaces will be required to ensure that PCBs at depth within the concrete do not migrate to and concentrate at the surface. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.2.3 Alternative 3 - Building Rehabilitation/Epoxy Encapsulation

After completion of asbestos abatement and removal of miscellaneous debris from the interior of the Willco Plastics Building, application of a protective epoxy coat could be accomplished, with the PCB impacted concrete sealed, preventing exposure from occurring. Two layers of epoxy would be required, with the first layer serving as an indicator of required maintenance and the second layer serving as a wearing surface. A maintenance plan would be required detailing inspection procedures, maintenance requirements, and other steps necessary to ensure the protective coating remains intact.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.2.3.1 Effectiveness

The application of a dual layer epoxy coating would be effective in preventing exposure to PCBs in the concrete within the Willco Plastics Building and would achieve the goal of protecting human health and the environment. The process would be effective in the short-term and the long-term, provided the coatings are applied and maintained correctly. It would not reduce the toxicity or volume of the PCBs, but would reduce the mobility of the PCBs by preventing the generation of PCB impacted concrete dust. Additionally, the Building Rehabilitation/Epoxy Encapsulation Alternative would comply with ARARs.

5.2.3.2 Implementability

The Building Rehabilitation/Epoxy Encapsulation Alternative is fully implementable and is expected to take approximately five (5) months to complete.

5.2.3.3 Cost

The estimated capital cost for the application of an epoxy coat includes costs associated with the removal of debris from the Willco Plastics Building, cleaning and prepping the surfaces to be coated, and applying two layers of epoxy. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.2.4 Alternative 4 - Partial Removal and Replacement Alternative

The Partial Removal alternative would provide for the removal of PCBs in excess of removal action goals and involves the removal and replacement of approximately 10 percent of the first floor slab and 2 percent of the second floor slab, based on the sampling conducted to date.

After completion of asbestos remediation, removal and replacement of impacted concrete slabs could begin. Shoring would be required for the removal of the second floor slab. Each section of floor slab to be removed and replaced would require shoring prior to and during saw cutting, during the removal of the slab, and during the placement and curing of the replacement slab. In addition, all water and dust generated during the saw cutting process would need to be captured, characterized, and disposed of in an appropriate manner.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls including changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying activity and use limitations (AULs) and required operation and maintenance plans (O&M plans), and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.2.4.1 Effectiveness

Removal and Replacement of the PCB impacted floor slab would reduce the toxicity and risk of exposure to PCBs by removing the PCBs from the Site. The alternative complies with ARARs because concrete with PCBs above the removal action goals would no longer be present, thereby achieving the long-term goal of overall protection of human health and the environment. Short-term exposures would need to be mitigated during the development of the work plan to ensure that concrete dust and dust laden water was not released to the environment and was contained to prevent exposure of workers performing the removal.

5.2.4.2 Implementability

The Partial Removal and Replacement Alternative is administratively feasible and is expected to take approximately five (5) months to complete. All needed goods and services are available to perform this alternative.

5.2.4.3 Cost

The estimated capital cost for the Partial Removal and Replacement alternative includes costs associated with the removal of debris from the Willco Plastics Building, shoring costs, removal and replacement of the impacted building materials, and disposal of wastes associated with the disposal of the building materials and wastes generated during the implementation of the alternative. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.2.5 Alternative 5 - Partial Building Demolition and Disposal Alternative

The Partial Building Demolition and Disposal Alternative provides for the Willco Plastics Building to be demolished to ground level, leaving the floor slab in place and covering the floor slab with an impermeable cap. After completing the remediation of asbestos impacts, the demolition of the Willco Plastics Building would begin.

The building would be demolished and the building materials would be segregated based on PCB concentrations. The building materials would be disposed of at an appropriate disposal facility, with any material not impacted by PCBs segregated for possible recycling. After removing the above grade portions of the building, the first floor slab would be covered with an impermeable cap. Appropriate activity and use limitations would be enacted to prevent excavation of or contact with PCB impacted soil and concrete. The cap will be maintained in compliance with TSCA requirements.

It is anticipated that the detailed work plan for the demolition of the building will contain the type of dust control and storm water runoff to be utilized during the process. Dust control may include misting, enclosure, etc. with appropriate testing to ensure fugitive dust emissions are prevented.

Dismantled building materials would be transported to an appropriate disposal facility. Based on existing analytical data, building materials could be disposed at either a TSCA or sanitary landfill, depending upon the PCB concentrations present in the materials.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls including changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

Although some soil and concrete in excess of removal action goals would remain on-site, the Partial Building Demolition and Disposal Alternative would satisfy ARARs for the site by eliminating exposure to the impacted materials.

5.2.5.1 Effectiveness

The Partial Building Demolition and Disposal Alternative would provide for overall protection of human health and the environment. However, the toxicity and volume of material would not be reduced, but the exposure risk to PCBs in concrete would be controlled. This alternative would be effective in the short term provided proper controls are in place during the demolition of the building and placement of the cap, and this alternative would be effective in the long term, provided the requirements of installing and maintaining an impermeable cap are met in perpetuity.

5.2.5.2 Implementability

The Partial Building Demolition and Disposal Alternative is technically feasible. The controlled building demolition and impermeable cap installation will use established procedures and will require approximately twelve months to complete.

Administratively, the application of activity and use limitations to control future activities at the site is challenging since the Willco Plastics Building is not owned by ACF. All needed goods and services are available to perform this alternative. The preparation and implementation of an operating and maintenance plan is also feasible.

5.2.5.3 Cost

The estimated capital cost for the Partial Building Demolition and Disposal Alternative is dependent upon several things, including the percent of demolition debris disposed of as TSCA waste and the percent disposed of as construction debris. In addition to the difference in tipping fees for the different disposal facilities, transportation cost fluctuations will also affect the capital cost. Based on the sampling results, none of the waste generated will be classified as TSCA waste. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

It should be noted that the disposal method for the building debris is dependent not only on the PCB concentration of the debris, but also on the willingness of local sanitary/construction/demolition debris landfills to accept the debris.

5.2.6 Alternative 6 - Building Demolition

After completing the remediation of asbestos impacts, the demolition of the Willco Plastics Building provides for the building to be demolished and building materials segregated based on PCB concentrations. Controlled demolition of the Willco Plastics Building, starting at the top floor and working down is feasible and, with suitable precautions and job site controls, fugitive dust emissions can be contained. After completion of the demolition and removal action, the lot would be regraded and seeded for future use. The Building Demolition and Disposal Alternative would achieve removal goals by removing the impacted building materials from the Site.

It is anticipated that the detailed work plan for the demolition of the building will contain the type of dust control and storm water runoff to be utilized during the process. Dust control may include misting, enclosure, etc. with appropriate testing to ensure fugitive dust emissions are prevented.

Dismantled building materials would be transported to an appropriate disposal facility. Based on existing analytical data, building materials could be disposed at either a construction landfill, a sanitary landfill, or recycled, depending upon the PCB concentrations present in the materials.

In addition to removal of the building, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The Building Demolition and Disposal Alternative would satisfy ARARs for the Site.

5.2.6.1 Effectiveness

The Building Demolition and Disposal Alternative would provide for overall protection of human health and the environment. Although the overall volume and toxicity of the material would not be reduced, the exposure to and mobility of the PCBs would be controlled.

The Building Demolition and Disposal Alternative would satisfy ARARs for the Site and provides for short and long-term effectiveness.

5.2.6.2 Implementability

The Building Demolition and Disposal Alternative is technically feasible. Although the controlled demolition of the building is more complex than traditional demolition methods, the dismantling process is feasible and technically proven for the building and will take approximately fifteen months to complete.

Administratively, there are challenges associated with the Building Demolition and Disposal Alternative. As noted previously, ACF does not own the Willco Plastics building. All needed goods and services are available to perform this alternative. There are no long term operation and maintenance requirements associated with this alternative.

5.2.6.3 Cost

The estimated capital cost for the Building Demolition and Disposal Alternative is dependent upon several things, including the percent of demolition debris disposed of as TSCA waste and the percent disposed of as construction debris. In addition to the difference in tipping fees for the different disposal facilities, transportation cost fluctuations will also affect the capital cost. Based on the sampling results, 90 percent of the demolition debris will be classified as non-hazardous waste and 10 percent will be classified as TSCA waste. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

It should be noted that the disposal method for the building debris is dependent not only on the PCB concentration of the debris, but also on the willingness of local sanitary/construction/demolition debris landfills to accept the debris.

5.2.7 Comparative Analysis

The six alternatives developed for the Willco Plastics Building were compared using the same ten review criteria utilized for the CBI building. The six alternatives selected for comparative analysis are:

Alternative 1 – No action

- Alternative 2 – Mechanical Removal of Top Layer of Concrete (Scabbling/scarifying)
- Alternative 3 – Building Rehabilitation/Epoxy Encapsulation

- Alternative 4 – Partial Removal and Replacement
- Alternative 5 – Partial Building Demolition and Disposal
- Alternative 6 – Building Demolition

Conclusions for the comparative analysis of the six CBI building alternatives are:
The no action alternative is included per USEPA requirements as a baseline. This alternative does not achieve ARARS or protection of human health and is not discussed further. Conclusions from this comparative analysis are as follows:

- Protectiveness – All remaining alternatives are protective of human health.
- Reduction of toxicity, mobility and volume – Alternatives 2, 4 and 6 provide complete reduction of the volume of impacted concrete and building material by transfer of this material to a landfill. Placement of the material in a landfill reduces mobility but not toxicity. Alternative 5 provides moderate reduction of volume as only a portion of the building is removed. A cap reduces mobility of residual material but no reduction in toxicity. Alternative 3 reduces the mobility of the impacted materials but no volume or toxicity reduction.
- Compliance with ARARs – All remaining alternatives provide compliance with ARARs.
- Short-term Implementation Risks – Alternative 3 will have little impact to the local community during implementation of encapsulation technology. Alternative 2 has a moderate short-term implementation risk because a much small quantity of material would require removal and transport to a landfill than alternatives requiring demolition, complete removal, capping or combinations of these technologies. Alternatives 4, 5 and 6 have relatively high short-term implementation risk as the local public will be subjected to increased construction traffic during implementation.
- Long-term Implementation Risks – Alternatives 4 and 6 have the lowest long-term implementation risk as impacted materials no longer remain on site. Alternative 2 has a moderate long-term risk as this technology is typically conducted based upon existing data and a predetermined scarifying depth. The potential exists for some residual PCB to remain with potential later wicking to the surface. Alternative 5 has moderate long-term risk as maintenance of the soil cap is required to protect the public from residuals in the slab foundation. Alternative 3 has moderate long-term risk as all impacted materials remain and epoxy encapsulated structures must be maintained.
- Technical Feasibility/Availability of Goods and Services – All five remaining alternatives provide a high level of technical feasibility. Alternatives 4, 5, and 6 can be implemented with readily available construction equipment. Alternative 3 is a proven technology for addressing PCB-impacted materials; the USEPA PCB “Mega Rule” (40 CFR part 761) supports the use of this technology. Specialty contractors for the application of epoxy encapsulation are readily available. Alternative 2 is also a proven technology with readily available equipment.
- Administrative Feasibility – All five remaining alternatives are administratively feasible. Alternative 6 is highly achievable only requiring substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition activities for implementation. Alternative 4 is also highly achievable but would require substantive compliance with Federal,

State, and local laws, regulations, and ordinances pertaining to both demolition and construction activities. Alternative 2 would also require substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the removal and replacement activities. A deed restriction/environmental covenant may be required if structural concerns limited the depth of scabbling and some PCB residuals were left in place. Alternative 5 is considered moderately achievable as it requires substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to both demolition and construction activities and a deed restriction/environmental covenant for impacted material left in place. Alternative 3 is also considered highly achievable and would require a deed restriction/environmental covenant for impacted material left in place.

- Maintenance Requirements – Alternatives 4 and 6 have no maintenance requirements. Alternative 2 may have some maintenance issues if PCB residuals must remain in place due to structural concerns. Alternatives 3 and 5 have moderate maintenance requirements due to epoxy encapsulation and cap periodic inspections and maintenance, respectively.
- Cost Requirements – Alternatives 4 has the lowest cost to implement. Alternatives 5 and 6 have moderate cost to implement. Alternatives 2 and 3 have the highest cost to implement.

5.3 Die Cast Area Soil Removal Alternative Comparative Evaluation

Based on risk assessment conclusions and the SRE data, removal alternatives were evaluated for the Site to address the future soil exposure concerns. After screening the alternatives, the alternatives selected for comparative evaluation in the Die Cast Area are:

1. No Action Alternative (USEPA requirement);
2. Excavation and Off-Site Disposal;
3. Partial Excavation, Off-Site Disposal, and Impermeable Cap;
4. ISTD/VE; and
5. Impermeable cap.

5.3.1 Alternative 1 - No Action Alternative

PCB contamination is present in surface and subsurface soils and concrete at levels in excess of the removal action goals. Currently, access to the contaminated soil in the Die Cast Area is not restricted, although the impacted soils and concrete are covered by a two-foot cover of granular fill. The No Action Alternative would provide no change in Site chemical levels or access controls. The No Action Alternative does not include administrative or physical controls that would control future land use changes or exposure to PCBs remaining at the Site. The No Action Alternative would not comply with ARARs.

5.3.1.1 Effectiveness

Because current PCB levels in soils are in excess of removal action goals and access to the Die Cast Area is unrestricted, the No Action Alternative would not be effective in reaching the goal of overall protection of human health and the environment.

5.3.1.2 Implementability

The No Action Alternative is fully implementable.

5.3.1.3 Cost

The No Action Alternative includes no capital or operation and maintenance costs.

5.3.2 Alternative 2 - Excavation and Off-Site Disposal Alternative

This alternative would include the stockpiling and testing of the granular material currently covering the impacted materials at the Die Cast Area in order to determine the PCB content of the granular material. The concrete floor of the former North and South Die Cast buildings would then be removed and sized for transport to an acceptable disposal facility. Since impacted soils are present within ten feet of existing structures (CBI Building and sidewalks bordering North Grand Boulevard), shoring would be required to maintain the structural integrity of the CBI Building and the sidewalk. Dust control measures would be required during excavation and concrete demolition activities. It is also possible that shallow groundwater will be encountered during excavation activities, requiring dewatering of the excavation and possible treatment of the groundwater prior to discharge to the Metropolitan St. Louis Sewer District (MSD) sanitary sewer system. In order to prevent the spread of contaminants, all vehicles leaving the site would require inspection and possible wheel washing prior to departure.

The removal action goal for this alternative is 1 mg/kg, although this level may not be practically achievable through excavation of soils overlying bedrock. If the bedrock is impacted above the 1 mg/kg level but below the SRE derived goal of 10.7 mg/kg, institutional controls (environmental covenants and/or deed restrictions) shall be put in place to ensure protection of human health and the environment. If PCBs are present within the bedrock between 25 mg/kg and 100 mg/kg, a protective cover combined with long term monitoring (including groundwater monitoring) along with institutional controls in accordance with the PCB cleanup regulations at 40 CFR Part 761(a) will be put in place.

Upon completion of the excavation of soils above removal action goals, the excavation would be backfilled with suitable fill material, compacted, graded level with surrounding parcels, and seeded with appropriate seed.

In addition to removal of the impacted soils and concrete, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.3.2.1 Effectiveness

The Excavation and Off-site Disposal Alternative would achieve the overall protection of human health and environment by removing the impacted material from the Site, eliminating exposure scenarios. The alternative would not reduce the volume or toxicity of the PCB impacted soils but would control the very limited potential mobility of PCBs from soils/concrete to the surrounding environment by placing the impacted materials into an engineered landfill. This alternative satisfies all ARARs, and is effective both in the short-term and the long-term.

5.3.2.2 Implementability

The Excavation and Off-site Disposal Alternative is technically feasible, although the presence of the existing structures/improvements will increase the cost and difficulty of the excavations. The main administrative issue is that the Site is not owned by ACF.

All needed goods and services are available to perform this alternative, which will take approximately fifteen months to complete. There are no long-term operation and maintenance requirements associated with this alternative.

5.3.2.3 Cost

The estimated capital cost for the Excavation and Disposal Alternative is dependent upon several things, including the total volume of material transported to TSCA disposal facilities, the total volume of material transported to sanitary landfills, and transportation cost fluctuations. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.3.3 Alternative 3 - Partial Excavation, Off-Site Disposal, and Cap Alternative

This alternative would include the stockpiling and testing of the granular material used to cover the floor slab of the former North and South Die Cast buildings in order to determine the PCB content of the granular material. The concrete floor of the former North and South Die Cast buildings would then be removed and sized for transport to an acceptable disposal facility. After the impacted concrete has been removed, impacted soils to a depth of ten feet below the existing ground surface would be excavated and transported to an off-site disposal facility. Suitable fill material, either from an off-site source or from the demolition of on-site structures, would be used to bring the excavation to the appropriate level, allowing for the construction of an impermeable cap over the impacted material left in place. Since impacted soils are present within ten feet of existing structures (CBI building and sidewalks bordering North Grand Boulevard), shoring may be required to maintain the structural integrity of the CBI building and the sidewalk. Dust control measures would be required during excavation and concrete demolition activities. It is also possible that shallow groundwater will be encountered during excavation activities, requiring dewatering of the excavation and possible treatment of the groundwater prior to discharge to the Metropolitan St. Louis Sewer District (MSD) sanitary sewer system. In order to prevent the spread of contaminants, all vehicles leaving the site would require inspection and possible wheel washing prior to departure.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be implemented include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

5.3.3.1 Effectiveness

The Partial Excavation, Off-site Disposal, and Cap Alternative would achieve the overall protection of human health and environment by removing the top ten feet of impacted soil and preventing future exposures to the impacted soils. The alternative would not reduce the volume or toxicity of the PCB impacted materials but would control the limited mobility of the PCBs through placement of excavated material into an engineered landfill and through the installation of an impermeable cap. This alternative satisfies all ARARs, and is effective both in the short-term and the long-term.

5.3.3.2 Implementability

The Partial Excavation, Off-Site Disposal, and Cap Alternative are technically feasible, although the presence of the existing structures/improvements may increase the cost and difficulty of the excavations.

All needed goods and services are available to perform this alternative, which will take approximately 16 months to complete. The installation of impermeable caps is fully implementable and technically feasible. Long term monitoring and operation and maintenance of the cap presents administrative challenges since ACF does not own the property, but the administrative issues are surmountable. The installation of the cap will not significantly hinder the possible future use of the site as either athletic fields or as auxiliary parking areas.

5.3.3.3 Cost

The estimated capital cost for the Excavation Partial Excavation, Off-Site Disposal, and Cap Alternative is dependent upon several things, including the total volume of material transported to TSCA disposal facilities, the total volume of material transported to sanitary landfills, and transportation cost fluctuations. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.3.4 Alternative 4 - ISTD/VE Alternative

The In-Situ Thermal Desorption and Vapor Extraction Alternative utilizes simultaneous application of thermal conduction heating and vacuum to treat contaminated soil and concrete without excavation. The applied heat volatilizes organic contaminants within the soil and concrete, enabling them to be carried in the vapor stream toward heater-vacuum wells. PCBs are destroyed, leaving behind inert materials. The vapors and gases extracted through the vacuum extraction wells are collected above ground and sampled to ensure no fugitive emissions occur. Confirmation sampling of system performance is conducted after the operation is complete.

The ISTD Alternative would satisfy ARARs for the Site. Provisions for control of vapor releases are designed into the system, including a vapor barrier constructed on the ground surface, allowing for the capture of all vapors generated during the application of heat to the impacted soils.

The removal action goal for this alternative is 1 mg/kg, although this level may not be practically achievable through ISDT/VE of soils overlying bedrock. If the bedrock is impacted above the 1 mg/kg level but below the SRE derived goal of 10.7 mg/kg, institutional controls (environmental covenants and/or deed restrictions) shall be put in place to ensure protection of human health and the environment. If PCBs are present within the bedrock between 25 mg/kg and 100 mg/kg, a protective cover combined with long term monitoring (including groundwater monitoring) along with institutional controls in accordance with the PCB cleanup regulations at 40 CFR Part 761(a) will be put in place. In addition to treatment of the impacted soils and concrete, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.3.4.1 Effectiveness

The ISTD Alternative would achieve the overall protection of human health and environment primarily by destroying the contaminants, with a fraction of the contaminants removed from the soil, collected at the surface, and disposed of at a permitted facility. This alternative satisfies all ARARs, and is effective both short-term and long-term.

5.3.4.2 Implementability

The ISTD Alternative is technically feasible, although a pilot test will be necessary to confirm the technology at the Site. The in-situ nature of the process eliminates most administrative complexities, since the soils remain on-site and no excavation is required.

All needed goods and services are available to perform this alternative, which will take approximately twenty-four months to complete. There are no maintenance requirements associated with the ISTD Alternative.

5.3.4.3 Cost

The estimated cost for the ISTD/VE Alternative for the Die Cast Area is based on a cost of $0.06 per kilowatt/hr, which is subject to change. No long term operation and maintenance costs are associated with this alternative. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.3.5 Alternative 5 - Impermeable Cap Alternative

PCB contamination is present in surface and subsurface soils at levels in excess of the removal action goals. In order to control exposure to surface and subsurface soils at the two areas, this alternative involves the installation of an impermeable cap at the Die Cast Area. This alternative will include the design of the cap to comply with the relevant regulations and standards, including the diversion of storm water to the current curb and gutter system and then to the MSD storm sewer system. Included in this alternative are maintenance requirements to prevent and/or repair damage to the cap, thereby limiting exposure to the impacted soils, and maintenance and repair of the storm water drainage system. In addition to the cap maintenance requirements, the cap and storm water drainage system will require periodic inspection to ensure that they remain effective. Institutional controls necessary to prevent excavation and inappropriate use of the Site would be implemented in conjunction with this alternative.

5.3.5.1 Effectiveness

The installation of an impermeable cap over the Die Cast Area would achieve overall protection of human health and environment by eliminating exposure to the impacted materials. The cap would also prevent the possible movement of any contaminants which adhere to the soil by preventing the infiltration of surface water, thereby removing the transport mechanism. In addition, the soil sample analytical results presented in the "Interim Data Submission Report for the Former Carter Carburetor Site, Round 2 Field Data-2007" (Figures 15, 16, 17, and 18) show that the PCBs present within the soil have not migrated. Two samples, collected from an area adjacent to a transformer release at the northeast corner of the former North Die Cast building, were found to contain PCBs associated with transformer use above 10.7 milligrams per kilogram, the risk-based standard for uncapped soil with an excess lifetime cancer risk greater than 1×10^{-5} for a recreational adolescent. No other soil samples collected from the perimeter of the footprint of the North and South Die Cast buildings were found to contain PCBs above 5.8 mg/kg, or one-half the risk based standard. Groundwater samples collected in 2005 from wells outside the perimeter of the North and South Die Cast buildings were not found to contain PCBs above the detection limit of 1.0 micrograms per liter. The addition of the shallow groundwater corrective action system would serve as an additional off-site migration prevention method. This alternative satisfies all ARARS, and is effective in both the short term and the long term.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be implemented include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

5.3.5.2 Implementability

The installation of an impermeable cap is fully implementable and technically feasible and is expected to take approximately nine months to complete. Long term monitoring and maintenance of the cap presents administrative issues since ACF does not own the Site. The installation of the cap will not significantly hinder the possible future use of the site as either athletic fields or as auxiliary parking areas. Currently, the area where a cap would be installed is approximately two feet lower in elevation than the area to the south. The addition of a cap will bring this area approximately level with the ground surface to the south, enhancing the use of the area as athletic fields or parking.

5.3.5.3 Cost

The impermeable cap for the Die Cast area includes both capital costs for the installation of the cap and annual maintenance costs. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.3.6 Comparative Analysis

The five alternatives developed for the Die Cast Area were compared using the same ten review criteria utilized for the Willco Plastics Building. The alternatives reviewed are:

Alternative 1 – No action
Alternative 2 – Excavation and Off-Site Disposal;
Alternative 3 – Partial Excavation, Off-site Disposal and Soil Cap;
Alternative 4 – ISTD/VE; and
Alternative 5 – Soil Cap.

Conclusions from this comparative analysis are as follows:

The no action alternative is included per USEPA requirements as a baseline. This alternative does not achieve ARARS or protection of human health and is not discussed further. Conclusions from this comparative analysis are as follows:

- Protectiveness – All remaining alternatives are protective of human health.
- Reduction of toxicity, mobility and volume – Alternative 4 provides high toxicity, mobility and volume reduction by the induced transfer and recovery of PCBs. Alternative 2 moderate reduction of the mobility of the PCBs by excavation and placement of impacted soil in a landfill. Toxicity or volume reduction is not achieved. Alternative 3 provides moderate reduction in mobility by excavation and placement of the most highly impacted soil in a landfill and construction of a soil cap over remaining impacted soil. Toxicity and volume reduction is not achieved. Alternative 5 provides a low to moderate reduction in mobility of PCBs by construction of a soil cap and surface water infiltration controls. Toxicity or volume reduction is not achieved.
- Compliance with ARARs – All remaining alternatives provide compliance with ARARs.
- Short-term Implementation Risks – Alternative 4 will have little impact to the local community during implementation. Alternatives 2, 3 and 5 have relatively high short-term implementation risk as the local public will be subjected to increased construction traffic during implementation.
- Long-term Implementation Risks – Alternatives 2 and 4 have the lowest long-term implementation risk as impacted materials no longer remain on site. Alternative 3 has moderate long-term risk as maintenance of the soil cap is required to protect the public from residuals in the soil. Alternative 5 has moderate long-term risk as all impacted materials remain and the cap and storm water improvements must be maintained.
- Technical Feasibility/Availability of Goods and Services – Three of the four remaining alternatives provide a high level of technical feasibility. Alternatives 2, 3, and 5 can be implemented with readily available construction equipment. Alternative 4 is a proven technology for addressing PCB-impacted materials but must be pilot testing to verify it is cost-effective in

local conditions. High-temperature thermal is proposed for which there is only one patented technology and vendor.

- Administrative Feasibility – All four remaining alternatives are administratively feasible. Alternatives 2, 3, and 5 require substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition or construction activities. Alternative 4 is a more specialized technology and may require additional supporting documentation to obtain approval prior to implementation. However, full-scale implementation of this technology for similar compounds has been conducted.
- Maintenance Requirements – Alternatives 2 and 4 have no maintenance requirements. Alternatives 3 and 5 have moderate maintenance requirements due to cap and storm water control maintenance.
- Cost Requirements – Alternative 5 has the lowest cost to implement. Alternatives 3 and 4 have moderate cost to implement. Alternative 2 has the highest cost to implement.

5.4 TCE AST Area Soil Removal Alternative Comparative Evaluation

After screening the alternatives, the alternatives selected for comparative evaluation are:

1. No Action Alternative (USEPA requirement);
2. Excavation and Off-Site Disposal;
3. Partial Excavation, Off-Site Disposal, and Impermeable Cap;
4. In-situ Thermal Desorption and Vapor Extraction; and
5. Impermeable Cap.

5.4.1 Alternative 1 - No Action Alternative

TCE contamination is present in surface and subsurface soils at levels in excess of the removal action goals. Currently, access to the contaminated soil in the TCE AST area is unrestricted. The No Action Alternative would provide no change in Site chemical levels or access controls. The No Action Alternative does not include administrative or physical controls that would control future land use changes or exposure to TCE remaining at the Site. The No Action Alternative would not comply with ARARs.

5.4.1.1 Effectiveness

Because current TCE levels in soils are in excess of removal action goals and access to the Site is unrestricted, the No Action Alternative would not be effective in reaching the goal of overall protection of human health and the environment.

5.4.1.2 Implementability

The No Action Alternative is fully implementable.

5.4.1.3 Cost

The No Action Alternative includes no capital or operation and maintenance costs.

5.4.2 Alternative 2 - Excavation and Off-Site Disposal Alternative

Excavation and off-site disposal of impacted soils in the TCE AST area would include the removal of TCE impacted soil from the TCE AST area, stockpiling and treatment of the TCE impacted soils to meet land ban requirements, and transport to an off-site disposal facility. Since impacted soils are present within ten feet of existing structures (sidewalks bordering North Spring Avenue and North Spring Avenue), shoring would be required to maintain the structural integrity of the sidewalk and North Spring Avenue. Dust control measures would be required during excavation and concrete demolition activities. It is also possible that shallow groundwater will be encountered during excavation activities, requiring dewatering of the excavation and possible treatment of the groundwater prior to discharge to the Metropolitan St. Louis Sewer District sanitary sewer system. In order to prevent the spread of contaminants, all vehicles leaving the site would require inspection and possible wheel washing prior to departure. Upon completion of the excavation of soils above removal action goals, the excavation would be backfilled with suitable fill, compacted, graded level with surrounding parcels, and seeded with appropriate seed.

In addition to removal of impacted soils from the site, institutional controls to be implemented include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.4.2.1 Effectiveness

The Excavation and Off-site Disposal Alternative would achieve the overall protection of human health and environment by removing the impacted soil from the Site, eliminating exposure scenarios. The alternative would reduce the volume and toxicity of the TCE impacted soils during the on-site treatment process. This alternative would control the mobility of the TCE impacted soils to the surrounding environment by placing the impacted soils into an engineered landfill. This alternative satisfies all ARARs, and is effective both in the short-term and the long-term.

5.4.2.2 Implementability

The Excavation and Off-site Disposal Alternative is technically feasible, although the presence of the existing structures/improvements will increase the cost and difficulty of the excavations. The on-site reduction of TCE concentrations is also technically feasible through several different methods, including thermal treatment, soil washing, and air stripping. The main administrative issue is that the Site is not owned by ACF.

All needed goods and services are available to perform this alternative, which may take up to twenty-four months to complete. There are no long-term operation and maintenance requirements associated with this alternative.

5.4.2.3 Cost

The estimated capital cost for the Excavation and Disposal Alternative is dependent upon several things, including the total volume of material treated on-site and transported to disposal facilities, and transportation cost fluctuations. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.4.3 Alternative 3 - Partial Excavation, Off-Site Disposal, and Cap Alternative

Excavation to a depth of ten feet below existing ground surface and off-site disposal of impacted soils in the TCE AST area would include the removal of TCE impacted soil from the TCE AST area, on-site treatment of the TCE impacted soils to meet land ban requirements, and transport to an off-site disposal facility. Since impacted soils are present within ten feet of existing structures (sidewalks bordering North Spring Avenue and North Spring Avenue), shoring may be required to maintain the structural integrity of the sidewalk and North Spring Avenue. It is also possible that shallow groundwater will be encountered during excavation activities, requiring dewatering of the excavation and possible treatment of the groundwater prior to discharge to the Metropolitan St. Louis Sewer District sanitary sewer system. In order to prevent the spread of contaminants, all vehicles leaving the site would require inspection and possible wheel washing prior to departure. Suitable fill material, either from an off-site source or from the demolition of on-site structures, would be used to bring the excavation to the appropriate level, allowing for the construction of an impermeable cap over the impacted material left in place. Upon completion of the cap, a ground water corrective action system would be designed and installed to prevent the off-site migration of impacted groundwater.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be implemented include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

5.4.3.1 Effectiveness

The Partial Excavation, Off-site Disposal, and Cap Alternative would achieve the overall protection of human health and the environment by removing the top ten feet of impacted soil and preventing future exposures to the impacted soils. The volume and toxicity of the TCE impacted soils would be reduced through the on-site treatment. This alternative would control the mobility of the TCE impacted soils to the surrounding environment by placing impacted soils into an engineered landfill, eliminating exposure to the impacted soils left in place, and controlling the off-site migration of impacted groundwater. This alternative satisfies all ARARs, and is effective both in the short-term and the long-term

5.4.3.2 Implementability

The Partial Excavation, Off-site Disposal, and Cap Alternative is technically feasible, although the presence of the existing structures/improvements will increase the cost and difficulty of the excavations. The on-site reduction of TCE concentrations is also technically feasible, through several different methods, including thermal treatment, soil washing, and air stripping. This alternative is expected to take approximately twenty-four months to complete.

5.4.3.3 Cost

All needed goods and services are available to perform this alternative. The installation of impermeable caps and attendant monitoring and treatment of groundwater (or in-situ control of plume migration) are fully implementable and technically feasible. Long term monitoring and operation and maintenance of the cap and the groundwater corrective action system present administrative issues since ACF does not own the property, but the administrative issues are surmountable. The installation of the caps and the groundwater corrective action system will not significantly hinder the possible future use of the site.

The estimated capital cost for the Partial Excavation, Off-site Disposal, and Cap Alternative is dependent upon several things, including the total volume impacted soils treated on-site, the total volume of material transported to disposal facilities, and transportation cost fluctuations. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.4.4 Alternative 4 - ISTD/VE Alternative

The ISTD/VE Alternative utilizes simultaneous application of thermal conduction heating and vacuum to treat contaminated soil without excavation. The applied heat volatilizes organic contaminants within the soil, enabling them to be carried in the vapor stream toward heater-vacuum wells. Gases emerging from the heated soil are collected under vacuum and conveyed to an Air Quality Control (AQC) system, consisting of a thermal oxidizer, a heat exchanger to cool the gases, and serial vessels of granular activated carbon, as necessary to meet substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the technology employed. The AQC system performance is gauged by a Continuous Emissions Monitoring (CEM) system, vapor sampling, and stack source testing of the final off-gas. Confirmation sampling of system performance is conducted after the operation is complete.

The ISTD/VE Alternative would satisfy ARARs for the Site. Provisions for control of vapor releases are designed into the system, including a vapor barrier constructed on the ground surface, allowing for the capture of all vapors generated during the application of heat to the impacted soils.

In addition to treatment of the impacted soils, institutional controls to be put in place include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site.

5.4.4.1 Effectiveness

The ISTD/VE Alternative would achieve the overall protection of human health and environment by removing the contaminants from the soil. Some reduction in toxicity of the chemicals may be achieved, although the granular activated carbon and any condensate collected will require characterization and disposal. This alternative satisfies all ARARs, and is effective both short-term and long-term.

5.4.4.2 Implementability

The ISTD/VE Alternative is technically feasible. The in-situ nature of the process eliminates most administrative complexities, since the soils remain on-site and no excavation is required.

All needed goods and services are available to perform this alternative, which is expected to take approximately 15 months to complete. There are no maintenance requirements associated with the ISTD/VE Alternative.

5.4.4.3 Cost

The estimated cost for the ISTD/VE Alternative for the TCE AST area is based on a cost of $0.06 per kilowatt/hr, which is subject to change. No long term operation and maintenance costs are associated with this alternative. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.4.5 Alternative 5 - Impermeable Cap Alternative

TCE contamination is present in surface and subsurface soils at levels in excess of the removal action goals. In order to control exposure to surface and subsurface soils at the TCE AST Area, this alternative involves the installation of an impermeable cap at the TCE AST area. This alternative will include the design of the impermeable cap to comply with the relevant regulations and standards, including the diversion of storm water to the current curb and gutter system and then to the MSD storm sewer system. Included in this alternative are maintenance requirements to prevent and/or repair damage to the cap, thereby limiting exposure to the impacted soils. In addition to the cap maintenance requirements, periodic inspection and repair of the cap will be required and a shallow groundwater corrective action system will be required in order to curtail off-site migration of TCE impacted groundwater.

In order to reduce potential exposure to contaminants managed in place at the site, institutional controls to be implemented include changing the zoning of the Site to prevent future use of the Site for residential or child day care/school purposes, filing of a deed restriction/environmental covenant with the recorder specifying AULs and O&M plans, and notifying the city of St. Louis Building Division of restrictions on development/environmental covenants in place at the Site. The AULs would include a restriction on excavation in the area of the cap.

5.4.5.1 Effectiveness

The installation of an impermeable cap over the TCE AST area would achieve overall protection of human health and environment by eliminating exposure to the impacted soils. The addition of the shallow groundwater corrective action system would prevent additional off-site migration of impacted groundwater. This alternative satisfies all ARARS, and is effective in both the short term and the long term.

5.4.5.2 Implementability

The installation of impermeable caps and attendant monitoring and treatment of groundwater are fully implementable and technically feasible and is expected to take approximately nine months to complete. Long term monitoring and operation and maintenance of the caps and the groundwater corrective action system present administrative issues since ACF does not own either property, but the administrative issues are surmountable. The installation of the cap and the groundwater corrective action system will not significantly hinder the possible future use of the site.

5.4.5.3 Cost

The Impermeable cap alternative for the TCE AST Area includes both capital costs for the installation and annual maintenance costs for the impermeable cap and the groundwater corrective action system. The cost for this alternative is summarized in Table 5-1. A detailed cost estimate is included in Attachment 2. The detailed cost estimate includes a breakdown of the total present worth cost as capital and operation and maintenance cost.

5.4.6 Comparative Analysis

The five alternatives developed for the TCE AST area were compared using the same ten review criteria utilized for the Willco Plastics Building. Conclusions from this comparative analysis are as follows:

- Alternative 1 – No action
- Alternative 2 – Excavation and Off-Site Disposal
- Alternative 3 – Partial Excavation, Off-Site Disposal, and Soil Cap
- Alternative 4 – In-Situ Thermal Desorption and Vapor Extraction
- Alternative 5 – Soil Cap

The no action alternative is included per USEPA requirements as a baseline. This alternative does not achieve ARARS or protection of human health and is not discussed further. Conclusions from this comparative analysis are as follows:

- Protectiveness – All remaining alternatives are protective of human health.
- Reduction of toxicity, mobility and volume – Alternative 4 provides high toxicity, mobility and volume reduction by the induced transfer and recovery of TCE. Alternative 2 moderate reduction of the mobility of the TCEs by excavation and placement of impacted soil in a landfill. Toxicity or volume reduction is not achieved. Alternative 3 provides moderate reduction in mobility by excavation and placement of the most highly impacted soil in a landfill and construction of a soil cap over remaining impacted soil. Toxicity and volume reduction is not achieved. Alternative 5

provides a low to moderate reduction in mobility of TCE by construction of a soil cap and groundwater migration controls (passive zero-valence iron curtain). Some groundwater toxicity or volume reduction may be achieved.

- Compliance with ARARs – All remaining alternatives provide compliance with ARARs.
- Short-term Implementation Risks – Alternative 4 will have little impact to the local community during implementation. Alternatives 2, 3 and 5 have relatively high short-term implementation risk as the local public will be subjected to increased construction traffic during implementation.
- Long-term Implementation Risks – Alternatives 2 and 4 have the lowest long-term implementation risk as impacted materials no longer remain on site. Alternative 3 has moderate long-term risk as maintenance of the soil cap is required to protect the public from residuals in the soil. Alternative 5 has moderate to high long-term risk as all impacted materials remain and the cap and groundwater controls must be maintained.
- Technical Feasibility/Availability of Goods and Services – Three of the four remaining alternatives provide a high level of technical feasibility. Alternatives 2, 3, and 5 can be implemented with readily available construction equipment. Alternative 4 is a proven technology for addressing TCE-impacted materials but must be pilot testing to verify it is cost-effective in local conditions. Low-temperature thermal is proposed for which there are numerous vendors available for implementation.
- Administrative Feasibility – All four remaining alternatives are administratively feasible. Alternatives 2, 3, and 5 require substantive compliance with Federal, State, and local laws, regulations, and ordinances pertaining to the demolition, construction, or treatment activities. Alternative 4 is a more specialized technology and may require additional supporting documentation to obtain approval prior to implementation. However, full-scale implementation of this technology for TCE has been conducted.
- Maintenance Requirements – Alternatives 2 and 4 have no maintenance requirements. Alternatives 3 and 5 have moderate maintenance requirements due to cap and groundwater control maintenance.
- Cost Requirements – Alternative 4 and 5 are the lowest cost to implement. Alternative 3 has moderate cost to implement. Alternative 2 has the highest cost to implement.

6.0 Recommended Alternatives

In summary, four separate areas of the Site with contamination above the removal action goals were addressed within this EE/CA report. These areas are the CBI Building, the Willco Plastics Building, the Die Cast Area, and the TCE AST Area. Within the CBI Building, PCBs above the removal action goals are present within concrete floor slabs on portions of all four floors and PCB impacted walls (brick/masonry) above the removal action goal are present on the first floor of the CBI building. Asbestos and lead-based paint are also present within the CBI Building. Within the Willco Plastics Building, PCBs were found within the concrete floor and ACM is present on the second floor of the building. PCB impacted soils and concrete above the removal action goal are present in the former Die Cast Area, with minor amount of impacted soils located at depth at the former location of substation #4 at the northeast corner of the former Die Cast buildings. TCE impacted soils above the removal action goal are present near the former location of the TCE AST.

As a result of the findings of the Site Evaluation, Streamlined Risk Evaluation and as required by the Settlement Order, removal technologies for the PCB and solvent contamination at the Site were identified and evaluated as part of the EE/CA process. The following ten (10) technologies were evaluated as potential removal actions for the contaminated Site building and surrounding soils. The technologies were considered separately and in combination with each other to develop the selected remedy.

- No Action (as required per the Settlement Order)
- Institutional Controls
- Building Rehabilitation/Epoxy Encapsulation
- Scabbing/Scarifying
- In-Situ Thermal Desorption/Vapor Extraction
- Excavation
- Impermeable Cap
- Groundwater Corrective Action System
- Partial Building Removal and Replacement
- Demolition and Disposal

The removal options of the Site building and soil were evaluated based on their potential effectiveness in achieving the Site specific PCB and solvent cleanup levels that are protective of human health and the environment as required by the USEPA under the Settlement Order, their implementability, and their cost.

The selected remedies for the Site are based on four (4) specific areas: the CBI Building; the Willco Plastics Building; the former Die Cast Area soil; and the former TCE AST Area soils. The associated costs for the selected remedies are presented in 2009 dollars. The final costs are dependent upon a variety of factors. Results of the comparative analysis are summarized in Table 4-1 (Technology Screening Summary) and the associated costs are summarized in Table 5-1 (Summary of Removal Action Costs) for both the building removal alternatives and the soil removal alternatives.

As it applies to all four selected remedial alternatives, the No Action alternatives were determined to be unacceptable in meeting the removal goals for both the Site buildings and Site soil because current PCB and solvent concentrations exceed the Site cleanup standards as required by the USEPA.

6.1 CBI Building Recommended Alternative

A comparative analysis of five alternatives was performed. The alternatives were No Action, Partial Removal and Replacement of Impacted Building Materials, Partial Building Demolition/ Impermeable Soil Cap/Institutional Controls, Building Rehabilitation/Epoxy Encapsulation and Building Demolition with offsite disposal. The Complete Building Demolition Alternative evaluated for use in the CBI building area was determined to be effective at meeting the removal goals as the recommended remedy. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is $12,890,000.

6.2 Willco Plastics Building Recommended Alternative

A comparative analysis of six alternatives was performed. The alternatives were No Action, Scabbing/Scarification, Partial Removal and Replacement of Impacted Building Materials, Partial Building Demolition/ Impermeable Soil Cap/Institutional Controls, Building Rehabilitation/Epoxy Encapsulation and Building Demolition with offsite disposal. Due to the low concentrations of PCBs detected in the Willco Plastics Building, the Partial Removal and Replacement of Impacted Building Materials evaluated for use in the Willco Plastics building were determined to be the effective remedy at meeting the removal goals. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The estimated total cost for implementing the selected remedy is $1,260,000.

6.3 Die Cast Area Recommended Alternative

A comparative analysis of five alternatives was performed. The alternatives were No Action, Excavation and Offsite Disposal, Partial Excavation/Offsite Disposal/Impermeable Soil Cap, In-situ Thermal Desorption/Vapor Extraction and Impermeable Soil Cap. The In-situ Thermal Desorption/Vapor Extraction (ISTD/VE) alternative evaluated for use in the Site Former Die Cast Buildings soil was determined to be effective at meeting the removal goals as the recommended remedy. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is $9,857,000.

6.4 TCE AST Area Recommended Alternative

A comparative analysis of five alternatives was performed. The alternatives were No Action, Excavation and Offsite Disposal, Partial Excavation/Offsite Disposal/Impermeable Soil Cap, In-situ Thermal Desorption/Vapor Extraction and Impermeable Soil Cap. Due to the nature of chlorinated solvents in soils, the In-Situ Thermal Desorption and Vapor Extraction evaluated for use in the Site TCE AST soil was determined to be effective at meeting the removal goals as the recommended remedy. The remedy is protective of human health and the environment and is technically and administratively feasible for the Site. The total cost for implementing the selected remedy is $2,529,000.

6.5 Summary

All of the selected remedies are protective of public health and the environment. The total cost for implementing the selected remedies is $26,536,000.

(2009 Dollars).The final costs are dependent upon a variety of factors, including but not limited to the amount of material required to be disposed of at a TSCA disposal facility, energy costs, and transportation costs.

7.0 Declaration of Certification

Under penalty of law, I certify that to the best of my knowledge, after appropriate inquires of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Richard A. Hyink
Director of Environment, Health and Safety
ACF Industries LLC

9-22-10
Date

8.0 References

Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov/substances/toxsubstance.asp

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). Atlanta, Ga. www.atsdr.cdc.gov/toxprofiles/tp17.pdf

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Minimum Risk Levels. December, 2005. www.atsdr.cdc.gov/mrls.htm

Bonaparte, Rudolph of GeoSyntec Consultants; Gross, Beth A. of GeoSyntec Consultants; Daniel, David E. of University of Illinois; Koerner, Robert M. of Drexel University/Geosynthetic Research Institute; and Dwyer, Steve of Stephen F. Dwyer Engineering. *Draft Technical Guidance for RCRA/CERCLA Final Covers*. April 2004.

California Environmental Protection Agency (Cal EPA). 2005a. *Reference Exposure Levels.* February, 2005. www.oehha.ca.gov/risk/ChemicalDB/

California Environmental Protection Agency (Cal EPA). 2005b. *Cancer Slope Factors.* August, 2005. www.oehha.ca.gov/risk/ChemicalDB/

Carter Carburetor Historical Documents. 1980 - 1985.

City of St. Louis. 2005. *St. Louis City Revised Code 11.81 – Groundwater*. St. Louis, Missouri.

Crystal Environment Group, Inc. *Lead-Based Paint Inspection at the Former Carter Carburetor Facility*. July 24, 2006.

Crystal Environmental Group, Inc. *Asbestos Survey Report, Former Carter Carburetor Building, St. Louis, Missouri*. August 3, 2006.

Driver, J.H., J.J. Konz, and G.K. Whitmyre, 1989. "*Soil Adherence to Human Skin.*" Bull. Environ. Contam. Toxicol. Vol 43, pp. 814-820.

Ecology and Environment, Inc. 1996. *Phase-I Integrated Site Assessment, Preliminary Assessment. Site Inspection for the Carter Carburetor Site*. April 26, 1996.

Ecology and Environment, Inc. 1998. *Draft Engineering Evaluation/Cost Analysis for the Carter Carburetor Site*. November 1998.

Ecology and Environment, Inc. 1999. *Sampling Results for the Carter Carburetor Site*. Memorandum. January 27, 1999.

Ecology and Environment, Inc. 2000. "*Revised Draft Engineering Evaluation/Cost Analysis for the Carter Carburetor Site*". St. Louis, Missouri. July, 2000.

Hawley, J.K. 1985. *"Assessment of Health Risk from Exposure to Contaminated Soil"*; Risk Analysis; Vol. 5, No. 4, pp. 289-302.

Kelso, Gary L. and Cox, David C. of Midwest Research Institute and Washington Consulting Group. *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*. May 1986.

Kim, N.K and J. Hawley. 1985. *"Re-entry Guidelines: Binghamton State Office Building"*. New York State Department of Health, Bureau of Toxic Substances Assessment, Division of Health Risk Control. Albany, NY. August, 1985. Document 0549P.

Kissel, J.C., K.Y. Richter, and R.A. Fenske. 1996. *"Field Measurement of Dermal Loading Attributable to Various Activities: Implications for Exposure Assessment."* Risk Analysis, Vol. 16, No. 1.

Lepow, M.L., L. Bruckman, M. Gilette, S. Markowitz, R. Rubino, and J. Kapish. 1975. *"Investigations into Sources of Lead in the Environment of Urban Children."* Environ. Res., Vol. 10, pp. 415-426.

Lutsen, E. and J. Rockway, 1971. *"Engineering Geology of St. Louis County, Missouri"*. Engineering Geology Series No. 4.

MACTEC Engineering and Consulting, Inc. 2003. *"Final Environmental Field Investigation Report for Former Carter Carburetor Site"*. St. Louis, Missouri, August 2003.

MACTEC Engineering and Consulting, Inc. 2005. *"Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site – PCB Delineation of the North and South Diecast Buildings"*. St. Louis, Missouri, October 2005.

MACTEC Engineering and Consulting, Inc. 2005. *"Limited Groundwater Investigation Report for the Former Carter Carburetor Site"*. St. Louis, Missouri, October 2005.

MACTEC Engineering and Consulting, Inc. 2006. *Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data*. St. Louis, Missouri. November, 2006.

MACTEC Engineering and Consulting, Inc. 2007. *Interim Data Submission Report for the Former Carter Carburetor Site, Round 2 Field Data*. St. Louis, Missouri. December, 2007.

MACTEC Engineering and Consulting, Inc. 2008. *"UST Areas Characterization Results: CBI Building/LRA Property, Former Carter Carburetor Site"*. St. Louis, Missouri. March, 2008.

Michaud, J.M., S.L. Huntley, M.M. Sherer, and D.J. Paustenbach. 1994. *"PCB and Dioxin Re-entry Criteria for Building Surfaces and Air"*. Journal of Exposure Analysis and Environmental Epidemiology, 4(2):197-227.

Michigan Department of Environmental Quality (MDEQ). 1998. *"Part 201 Generic Groundwater and Soil Volatilization to Indoor Air Inhalation Criteria Technical Support Document."* August, 1998.

Miller, D., et al., 1974. *"Water Resources of the St. Louis Area, Missouri"*. USGS and Missouri Geological Survey and Water Resources.

Miller, D., and Vandike, J., 1997. *"Groundwater Resources of Missouri (Missouri State Water Plan Series Volume II)"* USGS and Missouri Geological Survey and Water Resources.

Que Hee, S.S., B. Peace, C.S. Clark, J.R. Boyle, R.L. Bornschein, and P.B. Hammond. 1985. *"Evolution of efficient methods to sample lead sources, such as house dust and hand dust, in the homes of children." Environ. Res.*, Vol. 38, pp. 77-95.

Roels, H.A., J.P. Buchet, R.R. Lauwenys, P. Branx, F. Claeys-Thoreau, A. Lafontaine, and G. Verduyn. 1980. *"Exposure to Lead by Oral and Pulmonary Routes of Children Living in the Vicinity of a Primary Lead Smelter."* Environ. Res., Vol. 22, pp. 81-94.

RS Means Company. RS Means – Assemblies Cost Data, 2008.

RS Means Company. RS Means – Building Construction Cost Data, 2008.

RS Means Company. RS Means – Labor Rates for the Construction Industry, 2008.

RS Means Company. RS Means – Heavy Construction Cost Data, 2009.

RS Means Company. RS Means – Site work and Landscape Cost Data, 2009.

Shannon & Wilson Construction Services, Inc., 1998a. "*Final Report, Carter Carburetor Site*." October 22, 1998.

Shannon & Wilson Construction Services, Inc., 1998b. "*Final Report, Carter Carburetor Site*." Appendices A-E, October 22, 1998.

Shannon & Wilson Construction Services, Inc., 1998c. *"Final Report, Carter Carburetor Site."* Appendices F-K. October 22, 1998.

Tetra Tech EM Inc., 2004. *"Removal Site Evaluation Report, Carter Carburetor Site"*. St. Louis, Missouri. Superfund Technical Assessment and Response Team (START). May 28, 2004.

United States Environmental Protection Agency (USEPA). 1989a. *"Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)"*. Office of Solid Waste and Emergency Response. EPA/540/1-89/002. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1989b. *"Risk Assessment Guidance for Superfund Volume II, Environmental Evaluation Manual"*. EPA/540/1-89/001. Office of Solid Waste and Emergency Response. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1990. *"National Oil and Hazardous Substances Pollution Contingency Plan"*. Code of Federal Regulations, Title 40, Part 300, Federal Register, March 8.

United States Environmental Protection Agency (USEPA). 1991. *"Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual (Part B Development of Risk-based Preliminary Remediation Goals"*. Office of Emergency and Remedial Response. EPA/540/R-92/003, Publication 9285.7-01B. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1992. *"Dermal Exposure Assessment: Principles and Applications"*. Office of Research and Development. EPA/600/8-91/011B. Washington, D.C.

United States Environmental Protection Agency, Office of Emergency and Remedial Response, 1993. *"Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA"*. August 1993.

United States Environmental Protection Agency (USEPA). 1996. *"Soil Screening Guidance: User's Guide"*. Office of Solid Waste and Emergency Response. Publication 9355-4-23. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1997a. *"Health Effects Summary Tables (HEAST), Annual Update"*. Office of Solid Waste and Emergency Response. NCEA-W-0364. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1997b. *"Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments"*. EPA 540-R-97-006. OSWER Directive 9285.7-25. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 1997c. *"Standard Default Exposure Factors. Human Health Evaluation Manual, Supplemental Guidance"*. Office of Emergency and Remedial Response. OSWER Directive 9285.6-03. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1998. *"TSCA MegaRule – Technical Support Documentation (Support Document for the PCB Disposal Amendments), Final Rule"*. April 16, 1998.

United States Environmental Protection Agency (USEPA). 1999. *"Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites."* OSWER Directive 9285.7-28 P. Office of Solid Waste and Emergency Response. Washington, DC. October, 1999.

United States Environmental Protection Agency (USEPA). 2002a. *"Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites"*. Office of Emergency Response, OSWER 9285.6-10. Washington, DC.

United States Environmental Protection Agency (USEPA). 2002b. *"Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites"*. OSWER 9355.4-24. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 2002c. *"OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance"*. EPA 530-D-02-004. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 2003. *"Human Health Toxicity Values in Superfund Risk Assessments"*. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-53. Washington, D.C.

United States Environmental Protection Agency (USEPA). 2004a. Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings.

United States Environmental Protection Agency (USEPA) www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

United States Environmental Protection Agency (USEPA). 2004b. "Risk Assessment Guidance *for Superfund, Volume 1, Human Health Evaluation Manual (Part E Supplemental Guidance for Dermal Risk Assessment, Interim Guidance").* Office of Emergency and Remedial Response. NCEA-W-0364. Washington, D.C.

United States Environmental Protection Agency (USEPA), Region 9. 2004c. *"Preliminary Remediation Goal Tables"*. Technical Support Section. San Francisco, CA.

United States Environmental Protection Agency (USEPA), Region 7. 2005a. *"Administrative Settlement Agreement and Order on Consent for Removal Action"*, in the matter of: Carter Carburetor Site, St. Louis, Missouri, September 29, 2005.

United States Environmental Protection Agency (USEPA). 2005b. *"Guidelines for Carcinogen Risk Assessment"*. EPA/630/P-03/001F. Risk Assessment Forum. Washington, D.C.

United States Environmental Protection Agency (USEPA). 2007. *ProUCL Version 4.0 User Guide*. Office of Research and Development, EPA Technical Support Center. EPA/600/R-07/038. Las Vegas, NV.

United States Environmental Protection Agency (USEPA). 2008. *"Integrated Risk Information System"*. National Center for Environmental Assessment. Cincinnati, Ohio. Available as an on-line data-base at www.epa.gov/iris. Data search, March, 2008.

Tables

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
Volatile Organic Compounds (VOCs)					
1,1,1,2-Tetrachloroethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1,1-Trichloroethane	**267**	ug/kg	8	Die Cast Building	SB-29-05
	7.4	ug/kg	8	Die Cast Building	SB-20-05
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1,2,2-Tetrachloroethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1,2-Trichloroethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1-Dichloroethane	**676**	ug/kg	8	Die Cast Building	SB-29-05
	6.7		8	Die Cast Building	SB-12-08
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1-Dichloroethene	**12.7**	ug/kg	8	Die Cast Building	SB-29-05
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,1-Dichloropropene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2,3-Trichlorobenzene	**1,140**	ug/kg	8	Die Cast Building	SB-25-08
	389	ug/kg	8	Die Cast Building	SB-24-07
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2,3-Trichloropropane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2,4-Trichlorobenzene	**2,220**	ug/kg	8	Die Cast Building	SB-25-08
	80	ug/kg	8	Die Cast Building	SB-29-05
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2,4-Trimethylbenzene	**99,100**	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	4.5	ug/kg	14	UST - Other	UST-2-04-2
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2-Dibromo-3-Chloropropane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2-Dibromoethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2-Dichlorobenzene	**135**	ug/kg	8	Die Cast Building	SB-25-08
	9	ug/kg	8	Die Cast Building	SB-30-06
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2-Dichloroethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,2-Dichloroethene (Total)	**2,250,000**	ug/kg	4	TCE UST	TCE-G-13-22
	5.7	ug/kg	1	Main Building 1st floor	1SS-A1-AA2-01-05
	< 0.55	ug/kg	4	TCE UST	TCE-T-15-1
1,2-Dichloropropane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,3,5-Trimethylbenzene	**32,700**	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	86.2	ug/kg	8	Die Cast Building	SB-29-05
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,3-Dichlorobenzene	**706**	ug/kg	8	Die Cast Building	SB-25-08
	178	ug/kg	8	Die Cast Building	SB-24-07
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,3-Dichloropropane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
1,4-Dichlorobenzene	**284**	ug/kg	8	Die Cast Building	SB-24-07
	8.5	ug/kg	8	Die Cast Building	SB-11-08
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
2,2-Dichloropropane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
2-Chlorotoluene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
2-Hexanone (MBK)	< 16.7	ug/kg	14	UST - Other	UST-2-02-21
4-Chlorotoluene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Acetone	**1,510**	ug/kg	8	Die Cast Building	SB-29-05
	35.7	ug/kg	13	Pump Room	0SS-F4-E5-01-05
	< 16.7	ug/kg	14	UST - Other	UST-2-02-21
Benzene	**1,790**	ug/kg	14	UST - Other	UST-3-3-15
	5.2	ug/kg	14	UST - Other	UST-5-01-19
	< 3.6	ug/kg	14	UST - Other	UST-7-3-2 DUP
Bromobenzene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Bromochloromethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
Bromoform	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Bromomethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Carbon Disulfide	**9.4**	ug/kg	13	Pump Room	0SS-F7-E8-01-3.5
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Carbon Tetrachloride	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Chlorobenzene	**41.5**	ug/kg	8	Die Cast Building	SB-25-08
	25.6	ug/kg	8	Die Cast Building	SB-24-07
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Chlorodibromomethane	< 5.1	ug/kg	8	Die Cast Building	SB-18-06
Chloroethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Chloroform	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Chloromethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Cis-1,2-Dichloroethene	**2,250,000**	ug/kg	4	TCE UST	TCE-G-13-22
	5.2	ug/kg	4	TCE UST	TCE-T-13-30
	< 0.55	ug/kg	4	TCE UST	TCE-T-15-1
Cis-1,3-Dichloropropene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Dibromochloromethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Dibromomethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Dichlorodifluoromethane	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Ethylbenzene	**13,800**	ug/kg	14	UST - Other	UST-4-1-20
	5.9	ug/kg	14	UST - Other	UST-6-03-12
	< 3.6	ug/kg	14	UST - Other	UST-7-3-2 DUP
Hexachlorobutadiene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Isopropyl alcohol	**703**	ug/m3	18	Herbert Hoover Boys & Girls Club	MR 5
	123	ug/m3	18	Herbert Hoover Boys & Girls Club	WSVR
Isopropyl Benzene	**8,080**	ug/kg	1	Main Building 1st floor	1SS-D6-C7-01-14.5
	6.6	ug/kg	8	Die Cast Building	SB-11-08
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Methyl Ethyl Ketone (MEK)	**12.5**	ug/kg	14	UST - Other	UST-2-02-14
	< 8.3	ug/kg	14	UST - Other	UST-2-02-21
Methyl Isobutyl Ketone	< 8.3	ug/kg	14	UST - Other	UST-2-02-21
Methyl Tert-Butyl Ether	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Methylene Chloride	**90**	ug/kg	8	Die Cast Building	SB-29-05
	6.5	ug/kg	1	Main Building 1st floor	1SS-DD8-EE9-01-14
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Naphthalene	**10,900**	ug/kg	14	UST - Other	UST-3-3-15
	5.3	ug/kg	1	Main Building 1st floor	1SS-K9-J10-01-13
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
N-Butylbenzene	**29,700**	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	8.8	ug/kg	14	UST - Other	UST-2-04-2
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
N-Propylbenzene	**24,500**	ug/kg	1	Main Building 1st floor	1SS-D6-C7-01-14.5
	15.6	ug/kg	1	Main Building 1st floor	1SS-C12-B13-01-14
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
P-Isopropyltoluene	**12,300**	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	13.3	ug/kg	1	Main Building 1st floor	1SS-JJ8-KK9-01-14-DUP
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Sec-Butylbenzene	**17,600**	ug/kg	1	Main Building 1st floor	1SS-D6-C7-01-14.5
	24.0	ug/kg	13	Pump Room	0SS-F4-E5-01-05
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Styrene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Tert-Butylbenzene	**1,330**	ug/kg	1	Main Building 1st floor	1SS-D6-C7-01-14.5
	11.0	ug/kg	4	UST - Other	SB-02-12
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
Tetrachloroethene	**3,460**	ug/kg	8	Die Cast Building	SB-29-05
	13.5	ug/kg	17	Vapor Intrusion	SS-MW-C-1-14
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Tetrachloroethene	**12.8**	ug/m3	18	Herbert Hoover Boys & Girls Club	MR 5
	< 7.9	ug/m3	18	Herbert Hoover Boys & Girls Club	ESVR
Toluene	**4,260**	ug/kg	14	UST - Other	UST-4-1-20
	8.6	ug/kg	8	Die Cast Building	SB-29-05
	< 3.6	ug/kg	14	UST - Other	UST-7-3-2 DUP
Trans-1,2-Dichloroethene	**27,700**	ug/kg	4	TCE UST	TCE-L-8-12
	17.6	ug/kg	8	Die Cast Building	SB-29-05
	< 0.55	ug/kg	4	TCE UST	TCE-T-15-1
Trans-1,2-Dichloroethene	< 1.7	mg/m3	18	Herbert Hoover Boys & Girls Club	MR 5
Trans-1,3-Dichloropropene	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Trichloroethene	**62,000,000**	ug/kg	4	TCE UST	TCE-G-13-22
	4.8	ug/kg	17	Vapor Intrusion	SS-MW-DD-19-03
	< 0.55	ug/kg	4	TCE UST	TCE-T-15-1
Trichloroethene	**16.3**	ug/m3	18	Herbert Hoover Boys & Girls Club	WSVR
	< 2.4	ug/m3	18	Herbert Hoover Boys & Girls Club	MR 5
Trichloroethylene	**1,050**	ug/kg	8	Die Cast Building	SB-29-05
	7	ug/kg	8	Die Cast Building	SB-16-08
	< 5.1	ug/kg	8	Die Cast Building	SB-18-06
Trichlorofluoromethane	**13.7**	ug/kg	1	Main Building 1st floor	1SS-O9-N10-01-13
	10.4	ug/kg	1	Main Building 1st floor	1SS-JJ8-KK9-01-14-DUP
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Vinyl Chloride	**261,000**	ug/kg	4	TCE UST	TCE-M-5-13
	5.4	ug/kg	4	TCE UST	TCE-EE-1-34
	5.4	ug/kg	14	UST - Other	UST-2-02-14
	< 0.55	ug/kg	4	TCE UST	TCE-T-15-1
Vinyl Chloride	< 1.1	mg/m3	18	Herbert Hoover Boys & Girls Club	MR 5
Xylenes, Total	**30,300**	ug/kg	14	UST - Other	UST-4-1-20
	10.4	ug/kg	14	UST - Other	UST-5-01-19
	< 4.2	ug/kg	14	UST - Other	UST-2-02-21
Total Petroleum Hydrocarbons (TPHS)					
Fuel Oil	< 5,000,000	ug/kg	8	Die Cast Building	G-04-09-23
Total Extractable Hydrocarbons	**18,100,000**	ug/kg	8	Die Cast Building	SB-15-04
	15,000	ug/kg	8	Die Cast Building	SB-10-05
	< 10,000	ug/kg	8	Die Cast Building	SB-07-08
	< 10,000	ug/kg	8	Die Cast Building	SB-08-16
	< 10,000	ug/kg	8	Die Cast Building	SB-17-05
	< 10,000	ug/kg	8	Die Cast Building	SB-18-06
	< 10,000	ug/kg	8	Die Cast Building	SB-20-05
	< 10,000	ug/kg	8	Die Cast Building	SB-21-05
	< 10,000	ug/kg	8	Die Cast Building	SB-22-05
	< 10,000	ug/kg	8	Die Cast Building	SB-23-06
	< 10,000	ug/kg	8	Die Cast Building	SB-24-07
	< 10,000	ug/kg	8	Die Cast Building	SB-26-05
	< 10,000	ug/kg	9	Warehouse building	SB-05-12
	< 10,000	ug/kg	9	Warehouse building	SB-06-04
	< 10,000	ug/kg	10	South Parking Lot	SB-13-08
	< 10,000	ug/kg	10	South Parking Lot	SB-14-04
	< 10,000	ug/kg	10	South Parking Lot	SB-31-05
Total Petroleum Hydrocarbons	**830,000,000**	ug/kg	8	Die Cast Building	G-04-09-23
TPH - Diesel Range Organics	**10,600,000**	ug/kg	14	UST - Other	UST-3-3-15
	10,500	ug/kg	8	Die Cast Building	SB-25-08
	< 10,000	ug/kg	8	Die Cast Building	SB-07-08
	< 10,000	ug/kg	8	Die Cast Building	SB-08-16

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
TPH - Diesel Range Organics	< 10,000	ug/kg	8	Die Cast Building	SB-10-05
	< 10,000	ug/kg	8	Die Cast Building	SB-17-05
	< 10,000	ug/kg	8	Die Cast Building	SB-18-06
	< 10,000	ug/kg	8	Die Cast Building	SB-20-05
	< 10,000	ug/kg	8	Die Cast Building	SB-21-05
	< 10,000	ug/kg	8	Die Cast Building	SB-22-05
	< 10,000	ug/kg	8	Die Cast Building	SB-23-06
	< 10,000	ug/kg	8	Die Cast Building	SB-24-07
	< 10,000	ug/kg	8	Die Cast Building	SB-26-05
	< 10,000	ug/kg	8	Die Cast Building	SB-30-06
	< 10,000	ug/kg	9	Warehouse building	SB-05-12
	< 10,000	ug/kg	9	Warehouse building	SB-06-04
	< 10,000	ug/kg	10	South Parking Lot	SB-13-08
	< 10,000	ug/kg	10	South Parking Lot	SB-14-04
	< 10,000	ug/kg	10	South Parking Lot	SB-19-04
	< 10,000	ug/kg	10	South Parking Lot	SB-31-05
TPH - Gasoline Range Organics	**6,100,000**	ug/kg	14	UST - Other	UST-4-1-20
	590	ug/kg	14	UST - Other	UST-8-1-23
	< 420	ug/kg	14	UST - Other	UST-9-04-24
TPH - Jet Fuel	< 5,000,000	ug/kg	8	Die Cast Building	G-04-09-23
TPH - Kerosene	< 5,000,000	ug/kg	8	Die Cast Building	G-04-09-23
TPH - Mineral Spirits	< 5,000,000	ug/kg	8	Die Cast Building	G-04-09-23
TPH - Motor Oil	**7,570,000**	ug/kg	8	Die Cast Building	SB-15-04
	12,700	ug/kg	8	Die Cast Building	SB-25-08
	< 10,000	ug/kg	8	Die Cast Building	SB-07-08
	< 10,000	ug/kg	8	Die Cast Building	SB-08-16
	< 10,000	ug/kg	8	Die Cast Building	SB-17-05
	< 10,000	ug/kg	8	Die Cast Building	SB-18-06
	< 10,000	ug/kg	8	Die Cast Building	SB-20-05
	< 10,000	ug/kg	8	Die Cast Building	SB-21-05
	< 10,000	ug/kg	8	Die Cast Building	SB-22-05
	< 10,000	ug/kg	8	Die Cast Building	SB-23-06
	< 10,000	ug/kg	8	Die Cast Building	SB-24-07
	< 10,000	ug/kg	8	Die Cast Building	SB-24-20
	< 10,000	ug/kg	8	Die Cast Building	SB-26-05
	< 10,000	ug/kg	9	Warehouse building	SB-05-12
	< 10,000	ug/kg	9	Warehouse building	SB-06-04
	< 10,000	ug/kg	10	South Parking Lot	SB-13-08
	< 10,000	ug/kg	10	South Parking Lot	SB-14-04
	< 10,000	ug/kg	10	South Parking Lot	SB-31-05
Semi-Volatile Organic Compounds (SVOCs)					
Acenaphthene	**1,410**	ug/kg	14	UST - Other	UST-5-02-2
	6.4	ug/kg	1	Main Building 1st floor	1SS-FF5-GG6-01-12
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Acenaphthylene	**188**	ug/kg	14	UST - Other	UST-1-1-2
	5.2	ug/kg	14	UST - Other	UST-7-3-2
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Anthracene	**2,030**	ug/kg	1	Main Building 1st floor	1SS-K6-J7-01-14.5
	4.4	ug/kg	1	Main Building 1st floor	1SS-E8-D9-01-13
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Benzo(a)Anthracene	**5,020**	ug/kg	14	UST - Other	UST-1-1-2
	4.0	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Benzo(a)Pyrene	**3,630**	ug/kg	14	UST - Other	UST-1-1-2
	4.6	ug/kg	14	UST - Other	UST-2-01-2
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
Benzo(b)Fluoranthene	**7,120**	ug/kg	14	UST - Other	UST-1-1-2
	3.9	ug/kg	14	UST - Other	UST-7-1-20
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Benzo(g,h,i)Perylene	**778**	ug/kg	14	UST - Other	UST-1-1-2
	4.2	ug/kg	14	UST - Other	UST-2-01-2
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Benzo(k)Fluoranthene	**1,150**	ug/kg	14	UST - Other	UST-1-1-2
	23.6	ug/kg	1	Main Building 1st floor	1SS-G10-F11-01-10
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Chrysene	**4,520**	ug/kg	14	UST - Other	UST-1-1-2
	4.1	ug/kg	1	Main Building 1st floor	1SS-E5-D6-01-13
	4.1	ug/kg	13	Pump Room	0SS-F4-E5-01-09
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Dibenzo(a,h)Anthracene	**349**	ug/kg	14	UST - Other	UST-1-1-2
	7.3	ug/kg	13	Pump Room	0SS-F4-E5-01-01
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Fluoranthene	**8,490**	ug/kg	14	UST - Other	UST-1-1-2
	4.4	ug/kg	1	Main Building 1st floor	1SS-K9-J10-01-13
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Fluorene	**1,270**	ug/kg	1	Main Building 1st floor	1SS-K6-J7-01-14.5
	5.6	ug/kg	14	UST - Other	UST-7-3-2
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Indeno(1,2,3-cd)Pyrene	**895**	ug/kg	14	UST - Other	UST-1-1-2
	4.3	ug/kg	14	UST - Other	UST-5-02-18
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Phenanthrene	**7,690**	ug/kg	1	Main Building 1st floor	1SS-K6-J7-01-14.5
	4.0	ug/kg	14	UST - Other	UST-7-1-20
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Pyrene	**6,250**	ug/kg	1	Main Building 1st floor	1SS-K6-J7-01-14.5
	5.3	ug/kg	14	UST - Other	UST-9-01-12
	< 0.85	ug/kg	14	UST - Other	UST-1-2-18
Polychlorinated biphenols (PCBs)					
PCB-1016	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1221	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1232	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1242	**270,000,000**	ug/kg	8	Die Cast Building	G-09-09-03
	570	ug/kg	8	Die Cast Building	G-04-02-04D
	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1248	**200,000,000**	ug/kg	8	Die Cast Building	G-05-01-08
	43	ug/kg	1	Main Building 1st floor	1SS-L12-J13-01-01
	< 310	ug/kg	8	Die Cast Building	SB-21-05
	< 310	ug/kg	8	Die Cast Building	SB-21-21
	< 310	ug/kg	8	Die Cast Building	SB-23-21
	< 310	ug/kg	8	Die Cast Building	SB-24-20
	< 310	ug/kg	8	Die Cast Building	SB-25-14
	< 310	ug/kg	10	South Parking Lot	SB-14-04
	< 310	ug/kg	10	South Parking Lot	SB-31-05
PCB-1254	**10,000**	ug/kg	8	Die Cast Building	G-03-05-08
PCB-1254	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1260	**1,400,000**	ug/kg	11	North Parking Lot	SS4-02-16
	454	ug/kg	13	Pump Room	0SS-G4-F5-01-01
	< 250	ug/kg	8	Die Cast Building	SB-18-06
PCB-1268	< 250	ug/kg	8	Die Cast Building	SB-18-06

Table 2.1 Carter Carburetor Overall Parameter Maximum and Minimum Results

Parameter	Results	Units	Area #	Area Name	Sample ID
Metals					
Arsenic	**23,000**	ug/kg	10	South Parking Lot	SB-13-08
	2,500	ug/kg	1	Main Building 1st floor	1SS-A1-AA2-01-05
	< 4,100	ug/kg	8	Die Cast Building	SB-18-06
Barium	**201,000**	ug/kg	10	South Parking Lot	SB-31-05
	14,700	ug/kg	1	Main Building 1st floor	1SS-A1-AA2-01-05
Cadmium	**3,600**	ug/kg	4	TCE UST	SB-02-12
	620	ug/kg	13	Pump Room	0SS-H9-G10-01-3.5
	< 360	ug/kg	1	Main Building 1st floor	1SS-K9-J10-01-13
Chromium	**37,000**	ug/kg	8	Die Cast Building	SB-12-08
	3,700	ug/kg	8	Die Cast Building	SB-18-06
Lead	**151,000**	ug/kg	14	UST - Other	UST-7-3-2
	2,300	ug/kg	1	Main Building 1st floor	1SS-A1-AA2-01-05
	< 5,100	ug/kg	8	Die Cast Building	SB-18-06
Mercury	**910**	ug/kg	13	Pump Room	0SS-F7-E8-01-3.5
	27	ug/kg	8	Die Cast Building	SB-08-16
	27	ug/kg	8	Die Cast Building	SB-25-08
	27	ug/kg	8	Die Cast Building	SB-30-06
	< 20	ug/kg	8	Die Cast Building	SB-18-06
Selenium	< 1,000	ug/kg	8	Die Cast Building	SB-18-06
Silver	< 500	ug/kg	1	Main Building 1st floor	1SS-K9-J10-01-13

Notes:

ug/kg - micrograms per kilogram

ug/m3 - micrograms per cubic meter

< 20 - parameter not detected above this detection limit

Bold - Maximum Detection and/or Minimum Detection

Created by: Lana Smith

Reviewed by: Gene Watson

Table 2-2 Carter Carburetor Summary of Concrete Samples by Aroclors

Parameter	Area #	Area Name	Sample ID	Result in ug/kg	Sample Type
PCB-1016	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-P12-O13-1-3	< 341	Concrete
	1	Main Building 1st floor	1CR-N10-M13-02-01	< 474,000	Concrete
	1	Main Building 1st floor	1CR-O10-N13-02-01	< 474,000	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-EE4-HH7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-G1-D4-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M1-J4-01-01	< 19,400	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	< 474	Concrete
	5	Plastics Building 1st floor	1CR-QQ14-SS18-01-01	< 495	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	< 520	Concrete
	8	Die Cast Building	SDC-04	< 57,000,000	Concrete
	12	Main Building 4th floor	4CR-A2-DD5-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-DD10-HH13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-HH10-NN13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	< 97,500	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F5-E6-01-01	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-01	**1,800**	Concrete
PCB-1221	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-P12-O13-1-3	< 341	Concrete
	1	Main Building 1st floor	1PTC-M12-L13-2-3	**47,300**	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-EE4-HH7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-G1-D4-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M1-J4-01-01	< 19,400	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	< 474	Concrete
	5	Plastics Building 1st floor	1CR-QQ14-SS18-01-01	< 495	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	< 520	Concrete
	8	Die Cast Building	SDC-04	< 57,000,000	Concrete
	12	Main Building 4th floor	4CR-A2-DD5-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-DD10-HH13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-HH10-NN13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	< 97,500	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F5-E6-01-01	< 478	Concrete
	13	Pump Room	0CR-F9-E10-01-01	< 9,850	Concrete

Table 2-2 Carter Carburetor Summary of Concrete Samples by Aroclors

Parameter	Area #	Area Name	Sample ID	Result in ug/kg	Sample Type
PCB-1232	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-P12-O13-1-3	< 341	Concrete
	1	Main Building 1st floor	1CR-N10-M13-02-01	< 474,000	Concrete
	1	Main Building 1st floor	1CR-O10-N13-02-01	< 474,000	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-EE4-HH7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-G1-D4-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M1-J4-01-01	< 19,400	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	< 474	Concrete
	5	Plastics Building 1st floor	1CR-QQ14-SS18-01-01	< 495	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	< 520	Concrete
	8	Die Cast Building	SDC-04	< 57,000,000	Concrete
	12	Main Building 4th floor	4CR-A2-DD5-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-DD10-HH13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-HH10-NN13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	< 97,500	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F5-E6-01-01	< 478	Concrete
	13	Pump Room	0CR-F9-E10-01-01	< 9,850	Concrete
PCB-1242	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-M12-L13-2-2	**269,000**	Concrete
	1	Main Building 1st floor	1PTC-M12-L13-2-1	**436,000**	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-EE4-HH7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-G1-D4-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M1-J4-01-01	< 19,400	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	< 474	Concrete
	5	Plastics Building 1st floor	1CR-QQ14-SS18-01-01	< 495	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	**B 1,200**	Concrete
	8	Die Cast Building	SDC-04	**B 120,000,000**	Concrete
	12	Main Building 4th floor	4CR-A2-DD5-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-DD10-HH13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-HH10-NN13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	< 97,500	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F5-E6-01-01	< 478	Concrete
	13	Pump Room	0CR-F9-E10-01-01	< 9,850	Concrete

Table 2-2 Carter Carburetor Summary of Concrete Samples by Aroclors

Parameter	Area #	Area Name	Sample ID	Result in ug/kg	Sample Type
PCB-1248	0	2003 Area Unknown	CORE-01 1.5-3.5	**7,500**	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	**168,400**	Concrete
	1	Main Building 1st floor	1CR-FF6-GG9-01-02	**567**	Concrete
	1	Main Building 1st floor	1CR-O10-N13-02-01	**4,140,000**	Concrete
	2	Main Building 2nd floor	2CR-M1-J4-01-01	**789**	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	**10,600**	Concrete
	3	Main Building 3rd floor	3CR-KK7-NN10-01-02	**844**	Concrete
	3	Main Building 3rd floor	3CR-MM3-SS5-01-01	**230,000**	Concrete
	5	Plastics Building 1st floor	1CR-LL14-PP16-01-01	**730**	Concrete
	5	Plastics Building 1st floor	1CR-LL16-PP18-01-01	**7,350**	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	**736**	Concrete
	7	Plastics Building 2nd floor	2CR-NN13-QQ15-01-01	**1,210**	Concrete
	8	Die Cast Building	SDC-01	< 520	Concrete
	8	Die Cast Building	SDC-04	< 57,000,000	Concrete
	12	Main Building 4th floor	4CR-EE5-HH10-01-01	**881**	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	**1,740,000**	Concrete
	13	Pump Room	0CR-G8-F9-02-01	**1,010**	Concrete
	13	Pump Room	0CR-H9-G10-01-01	**18,900**	Concrete
PCB-1254	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-P12-O13-1-3	< 341	Concrete
	1	Main Building 1st floor	1CR-N10-M13-02-01	< 474,000	Concrete
	1	Main Building 1st floor	1CR-O10-N13-02-01	< 474,000	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-EE4-HH7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-G1-D4-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	< 471	Concrete
	3	Main Building 3rd floor	3CR-AA7-DD10-01-01	**137,000**	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	< 474	Concrete
	5	Plastics Building 1st floor	1CR-QQ14-SS18-01-01	< 495	Concrete
	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	< 520	Concrete
	8	Die Cast Building	SDC-04	< 57,000,000	Concrete
	12	Main Building 4th floor	4CR-OO6-SS10-01-01	**790**	Concrete
	12	Main Building 4th floor	4CR-H2-E7-01-01-DUP	**1,530**	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F4-E5-01-02	< 478	Concrete
	13	Pump Room	0CR-F5-E6-01-01	< 478	Concrete
	13	Pump Room	0CR-F9-E10-01-01	< 9,850	Concrete
PCB-1260	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	1PTC-B11-A12-1-3	**4,950**	Concrete
	1	Main Building 1st floor	1CR-E7-D10-02-01	**719,000**	Concrete
	2	Main Building 2nd floor	2CR-H4-E6-01-01	< 471	Concrete
	2	Main Building 2nd floor	2CR-AA5-DD9-01-01	< 2,380	Concrete
	3	Main Building 3rd floor	3CR-M4-J7-01-01	**3,340**	Concrete
	3	Main Building 3rd floor	3CR-P7-N10-01-1/2	**52,600**	Concrete
	5	Plastics Building 1st floor	1CR-LL14-PP16-01-01	**512**	Concrete
	5	Plastics Building 1st floor	1CR-HH13-LL16-01-01	**4,530**	Concrete

Table 2-2 Carter Carburetor Summary of Concrete Samples by Aroclors

Parameter	Area #	Area Name	Sample ID	Result in ug/kg	Sample Type
PCB-1260	7	Plastics Building 2nd floor	2CR-HH13-NN15-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-OO15-QQ19-01-01	< 478	Concrete
	7	Plastics Building 2nd floor	2CR-QQ14-SS19-01-01	< 488	Concrete
	8	Die Cast Building	SDC-01	**1,100**	Concrete
	8	Die Cast Building	SDC-04	**21,000,000**	Concrete
	12	Main Building 4th floor	4CR-A2-DD5-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-DD10-HH13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-HH10-NN13-01-01	< 476	Concrete
	12	Main Building 4th floor	4CR-E2-A8-01-01	< 97,500	Concrete
	13	Pump Room	0CR-F8-E9-01-01	**1,280**	Concrete
	13	Pump Room	0CR-F4-E5-01-1/2	**90,800**	Concrete
	13	Pump Room	0CR-F4-E5-01-1/2	**90,800**	Concrete
	13	Pump Room	0CR-F4-E5-01-1/2	**90,800**	Concrete
PCB-1268	0	2003 Area Unknown	CORE-01 1.5-3.5	< 5,200	Concrete
	0	2003 Area Unknown	CORE-02 1.5-4	< 52,000	Concrete
	1	Main Building 1st floor	CORE-04-0-1.5	< 120,000	Concrete
	1	Main Building 1st floor	CORE-06-0-1.5	< 120,000	Concrete
	1	Main Building 1st floor	CORE-02-0-1.5	< 260,000	Concrete

Notes:

ug/kg - microgram per kilogram

Bold - detection

Created by: Lana Smith

Reviewed by: Gene Watson

Table 2-3 Carter Carburetor PCB Sample and Detection Frequency for Concrete Samples

Parameter	Area #	Area Name	Number of Samples	Number of Detections	Sample Type
PCB-1016	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	0	Concrete
	12	Main Building 4th floor	18	0	Concrete
	13	Pump Room	17	**1**	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	0	Concrete
	5	Plastics Building 1st floor	5	0	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	0	Concrete
PCB-1221	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	**1**	Concrete
	12	Main Building 4th floor	18	0	Concrete
	13	Pump Room	17	0	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	0	Concrete
	5	Plastics Building 1st floor	5	0	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	0	Concrete
PCB-1232	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	0	Concrete
	12	Main Building 4th floor	18	0	Concrete
	13	Pump Room	17	0	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	0	Concrete
	5	Plastics Building 1st floor	5	0	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	0	Concrete
PCB-1242	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	**2**	Concrete
	12	Main Building 4th floor	18	0	Concrete
	13	Pump Room	17	0	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	0	Concrete
	5	Plastics Building 1st floor	5	0	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	**25**	Concrete
PCB-1248	0	2003 Area Unknown	3	**3**	Concrete
	1	Main Building 1st floor	228	**220**	Concrete
	12	Main Building 4th floor	18	**9**	Concrete
	13	Pump Room	17	**11**	Concrete
	2	Main Building 2nd floor	27	**19**	Concrete
	3	Main Building 3rd floor	59	**57**	Concrete
	5	Plastics Building 1st floor	5	**4**	Concrete
	7	Plastics Building 2nd floor	6	**3**	Concrete
	8	Die Cast Building	25	0	Concrete
PCB-1254	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	0	Concrete
	12	Main Building 4th floor	18	**3**	Concrete
	13	Pump Room	17	0	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	**1**	Concrete
	5	Plastics Building 1st floor	5	0	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	0	Concrete
PCB-1260	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	228	**9**	Concrete
	12	Main Building 4th floor	18	0	Concrete
	13	Pump Room	17	**6**	Concrete
	2	Main Building 2nd floor	27	0	Concrete
	3	Main Building 3rd floor	59	**3**	Concrete
	5	Plastics Building 1st floor	5	**3**	Concrete
	7	Plastics Building 2nd floor	6	0	Concrete
	8	Die Cast Building	25	**8**	Concrete
PCB-1268	0	2003 Area Unknown	3	0	Concrete
	1	Main Building 1st floor	6	0	Concrete

Notes:

Highlight and **Bold** - Detections

Created by: Lana Smith

Reviewed by: Gene Watson

Table 2-4 Carter Carburetor PCB Sample and Detection Frequency for Brick Chip Samples

Parameter	Area #	Area Name	Number of Samples	Number of Detections	Sample Type
PCB-1016	1	Main Building 1st floor	38	0	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip
PCB-1221	1	Main Building 1st floor	38	0	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip
PCB-1232	1	Main Building 1st floor	38	0	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip
PCB-1242	1	Main Building 1st floor	38	0	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip
PCB-1248	1	Main Building 1st floor	38	**36**	Brick Chip
	2	Main Building 2nd floor	5	**3**	Brick Chip
	3	Main Building 3rd floor	10	**9**	Brick Chip
PCB-1254	1	Main Building 1st floor	38	0	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip
PCB-1260	1	Main Building 1st floor	38	**3**	Brick Chip
	2	Main Building 2nd floor	5	0	Brick Chip
	3	Main Building 3rd floor	10	0	Brick Chip

Notes:

Highlight and **Bold** - Detections

Created by: Lana Smith

Reviewed by: Gene Watson

Table 2-5 Carter Carburetor PCB Sample and Detection Frequency for Soil Samples

Parameter	Area #	Area Name	Number of Samples	Number of Detects	Sample Type
PCB-1016	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	0	Soil
	13	Pump Room	11	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	0	Soil
	9	Warehouse building	2	0	Soil
PCB-1221	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	0	Soil
	13	Pump Room	11	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	0	Soil
	9	Warehouse building	2	0	Soil
PCB-1232	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	0	Soil
	13	Pump Room	11	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	0	Soil
	9	Warehouse building	2	0	Soil
PCB-1242	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	**2**	Soil
	13	Pump Room	11	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	**127**	Soil
	9	Warehouse building	2	0	Soil
PCB-1248	1	Main Building 1st floor	34	**15**	Soil
	10	South Parking Lot	34	0	Soil
	13	Pump Room	11	**3**	Soil
	4	TCE UST	1	**1**	Soil
	8	Die Cast Building	402	**52**	Soil
	9	Warehouse building	2	0	Soil
PCB-1254	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	0	Soil
	13	Pump Room	11	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	**1**	Soil
	9	Warehouse building	2	0	Soil
PCB-1260	1	Main Building 1st floor	34	0	Soil
	10	South Parking Lot	34	**5**	Soil
	13	Pump Room	11	**2**	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	402	**15**	Soil
	9	Warehouse building	2	0	Soil
PCB-1268	10	South Parking Lot	6	0	Soil
	4	TCE UST	1	0	Soil
	8	Die Cast Building	37	0	Soil
	9	Warehouse building	2	0	Soil

Notes:

Highlight and **Bold** - Detections

Created by: Lana Smith

Reviewed by: Gene Watson

Table 2-6 Carter Carburetor PCB Sample and Detection Frequency for Sediment (Sewer) Samples

Parameter	Area #	Area Name	Number of Samples	Number of Detections	Sample Type
PCB-1016	16	Sewers	5	0	Sediment
PCB-1221	16	Sewers	5	0	Sediment
PCB-1232	16	Sewers	5	0	Sediment
PCB-1242	16	Sewers	5	0	Sediment
PCB-1248	16	Sewers	5	**5**	Sediment
PCB-1254	16	Sewers	5	0	Sediment
PCB-1260	16	Sewers	5	**3**	Sediment

Notes:

Highlight and **Bold** - Detections

Created by: Lana Smith

Reviewed by: Gene Watson

Table 3-1
Action and Chemical Specific Requirements
Federal Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
National Primary Drinking Water Standards (SDWA 40 CFR 141)	Establishes maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) that are health-based standards for public drinking water systems.	Chemical-specific ARAR. Since the shallow aquifer is not utilized as a public drinking water source the MCLs for organic and inorganic contaminants would not be applicable. However, MCL standards may be considered relevant and appropriate for establishing groundwater remediation goals.
State Secondary Drinking Water Standards (SWDA 40 CFR 143)	Establishes state guidelines, secondary maximum contaminant levels (SMCLs) for public water systems.	Chemical-specific ARAR. Secondary standards are not applicable but may be considered relevant and appropriate for groundwater remediation goals.
National Pollution Discharge Elimination System (NPDES) Requirements (CWA 40 CFR 122)	Regulates discharges of pollutants from any point source into waters of the U.S.	Action-specific ARAR. Applicable to releases from site during and after implementation of the removal action.
General Pretreatment Regulations for Existing and New Sources of Pollution for Publicly Owned Treatment Works (POTW) (WPCA 40 CFR 401 and 403)	Provides effluent limitations guidelines for existing sources, standards of performance for new sources, and pre-treatment standards for new and existing sources.	Action-specific ARAR. Applicable if wastewater collected during the removal from the site is discharged to a POTW.
DOT Rules for Transportation of Hazardous Materials (DOT 49 CFR 107)	Provides regulations for transport of hazardous waste on the highway system, rail system, by water or, by air.	Action-specific ARAR. Applicable to excavation and off-site treatment and disposal options requiring waste transport using public transportation system.
Standards for Identification and Listing of Hazardous Waste (RCRA 40 CFR 261)	Identifies those wastes subject to regulation.	Chemical-specific ARAR. Applicable if soils are determined t contain a hazardous characteristic. RCRA requirements are applicable to hazardous wastes generated from removal actions that are stored, treated, or disposed of and/or transported.

Table 3-1
Action and Chemical Specific Requirements
Federal Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Standards Applicable to Generators of Hazardous Waste (RCRA 40 CFR 262)	Regulates manifesting, pre-transport requirements, and recordkeeping and reporting for hazardous waste generators.	Action-specific ARAR. Applicable if soil removed from site is determined to exhibit hazardous characteristic.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (RCRA 40 CFR264, 265)	Regulations apply to owners and operators of facilities that treat, store, or dispose of hazardous waste.	Action-specific ARAR. Applicable if soil removed from site is determined to exhibit hazardous characteristic.
RCRA Land Disposal Restrictions (RCRA 40 CFR 268)	Identifies hazardous wastes that are restricted from land disposal and defines the limited circumstances under which otherwise prohibited waste may continue to be land disposed.	Chemical- and action specific ARAR. Applicable if soils are determined to be characteristic hazardous. Soils failing toxicity characteristic testing need to comply with Universal Treatment Standards prior to land disposal.
PCB Manufacturing, Processing, Distribution in Commerce and Prohibitions (TSCA 40 CFR 761)	Regulates the storage and disposal, recordkeeping and reporting, and waste disposal recordkeeping and reporting for PCB contaminated wastes.	Chemical- and action specific ARAR. Will be applicable if waste from the site is transported and stored or disposed.
Mega Rule (63 FR 35384 – 35474)	USEPA revisions to 40 CFR 761 regarding PCB contaminated waste.	Chemical- and action specific ARAR. Will be applicable if waste from the site is transported and stored or disposed.

Table 3-2
Action Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Demolition Landfill Design and Operation (10 CSR 80-4.010(3))	Regulate demolition landfill waste streams.	Action Specific ARAR. Disposal issues may arise from demolition activities
Disposal of hazardous waste at Sanitary Landfills (10 CSR 80-3.010(3))	Regulated quantities of hazardous waste are excluded from disposal at permitted solid waste landfills. The excavated soil must be tested prior to disposal and determination made as to whether or not it is considered hazardous and handled accordingly. Excavated soil that is not hazardous may be disposed of at a sanitary landfill, but may be considered special waste and require special handling. Prior approval must be obtained from the facility.	Action Specific ARAR. Disposal issues may arise due to hazard determination of wastes generated during removal activities.
Clean Fill Provision (260.210.9(1) RSMo)	Missouri Solid Waste Management Law that regulates clean fill	Action Specific ARAR. Ensures use of clean fill in excavations.
Definition of Solid Waste (260.200(34) RSMo)	Missouri Solid Waste Management Law definitions	Action Specific ARAR. Defines solid waste.
Definition of Clean Fill (260.200(4) RSMo)	Missouri Solid Waste Management Law definitions	Action Specific ARAR. Defines clean fill.
Permit Exemptions (10 CSR 80-2.020(9))	Allows for permit exemptions, including those for beneficial use of solid waste.	Action Specific ARAR. Allows for the use of some materials for fill on site.
Illegal Dumping Provisions (260.210.1(1)RSMo)	Missouri Solid Waste Management Law that restricts illegal dumping activities.	Action Specific ARAR. Restricts illegal dumping as a method of disposal.
Hazardous Waste Determination for Off-site Disposal (40 CFR part 261, as incorporated by reference in 10 CSR 25-4.261)	Requires containerized or bulked wastes that are removed fro off-site disposal shall be subject to hazardous waste determination requirements.	Action Specific ARAR. Containerized or bulked wastes that are removed for off-site disposal are subject to this requirement.
Hazardous Waste Transportation Requirements for Generators (40 CFR part 262, as incorporated by reference in 10 CSR 25-5.262)	Requires that hazardous waste removed and/or containerized for shipment off-site should be handled in accordance with the applicable generator regulations.	Action Specific ARAR. Hazardous waste shipped off-site is subject to these generator requirements.

Table 3-2
Action Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Hazardous Waste Transportation Requirements (40 CFR Part 263, as incorporated by reference in 10 CSR 25-6.263)	Hazardous wastes that are removed for off-site disposal shall be handled in accordance with the applicable transportation regulations.	Action Specific ARAR. Hazardous wastes that are removed for off-site disposal shall be handled in accordance with the applicable transportation regulations.
Monitoring and Management of Contaminated Groundwater Releases (40 CFR Part 264 Subpart F, as incorporated by reference in 10 CSR 25-7.264(2)(F))	Regulations governing the monitoring and management of contaminated groundwater that originated from releases from solid waste management units.	Action Specific ARAR. Releases of contaminated groundwater from solid waste management units would be subject to this rule.
Closure and Post-Closure (40 CFR Part 264 Subpart G, Closure and Post-Closure, as incorporated in 10 CSR 25-7.264(2)(G))	Regulations governing the closure and pos-closure care of all hazardous waste management facilities.	Action Specific ARAR - Hazardous waste management facilities would be subject to these closure and post-closure requirements.
Use and Management of Containers (40 CFR Part 264 Subpart I, as incorporated by reference in 10 CSR 25-7.264(2)(I))	These regulations govern the use and management of containers for hazardous waste.	Action Specific ARAR - These regulations govern the use and management of containers for hazardous waste.
Tank Use, Management, and Closure for Hazardous Wastes (40 CFR 264 Subpart J, as incorporated by reference in 10 CSR 25-7.264(2)(J))	Hazardous waste in tanks shall be handled in accordance with the tank use, management, and closure requirements.	Action Specific ARAR – Hazardous waste in tanks shall be handled in accordance with the tank use, management, and closure requirements.
Land Disposal and/or Capping of Past Disposal Areas (40 CFR 264 Subpart N, as incorporated by reference in 10 CSR 25-7.264(2)(N))	Regulations that govern land disposal and/or capping of past disposal areas.	Action Specific ARAR – Regulations that govern land disposal and/or capping of past disposal areas.
Air Emission Standards for tanks and Containers containing Hazardous Waste (40 CFR 264 Subpart CC, as incorporated by reference in 10 CSR 25-7.264(2)(CC))	Air Emissions standards for tanks and containers may apply to hazardous waste stored tanks or containers.	Action Specific ARAR – Air Emissions standards for tanks and containers may apply to hazardous waste stored tanks or containers.
Geology in regards to human health and safety (4 CSR 145-1.010)	This rule regulations the practice of geology, as it affects human health and safety, in the state.	Action Specific ARAR – This rule regulations the practice of geology, as it affects human health and safety, in the state.

Table 3-2
Action Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Abandonment of Unused Domestic Supply Wells (10 CSR 23-3.110)	This rule regulates the abandonment of unused domestic supply wells. The Missouri Department of Natural Resources' Public Drinking Well Branch of Water Protection Program regulates the construction and abandonment of public supply wells.	Action Specific ARAR – This rule governs the abandonment of unused domestic supply wells.
Construction, Regulation and Abandonment of Monitoring Wells (10 CSR 23-4.010)	This rule governs the construction, registration and abandonment of monitoring wells in the state.	Action Specific ARAR – Provides requirements for the construction, registration and abandonment of monitoring wells in the state.
Protection of caves from vandalism and pollution (L. 1981 H.S.H.B. 1192)	This act regulates the protection of caves (including sinkholes) and cave life from vandalism and pollution.	Action Specific ARAR – Geological conditions make encountering caves (including sink holes) and cave life a real possibility.
Surface and Groundwater tracing (L. 1991 S.B. 221, RSMo256.621)	This act and associated revised statue relate to surface and groundwater tracing. It requires that all persons engaging in water tracing to register with and report the results of the tracing to the Missouri Department of Natural Resources' Geological Survey and Resource assessment Division.	Action Specific ARAR – This act and associated revised statue relate to surface and groundwater tracing. It requires that all persons engaging in water tracing to register with and report the results of the tracing to the Missouri Department of Natural Resources' Geological Survey and Resource assessment Division.
Restriction of Emission of Visible Air Contaminants (10 CFR 10-5.090)	Restrict emissions of visible air contaminants	Action Specific ARAR – Restrict emissions of visible air contaminants.
Restriction of Particulate Matter (10 CFR 10-6.170)	Restriction of particulate matter to the ambient air beyond the premise of origin.	Action Specific ARAR –Restriction of particulate matter in the ambient air beyond the premise of origin.
Emission of Visible Air Contaminants (10 CFR 10-5.180)	Air Quality Standards and Air Pollution Control Regulations for the St. Louis Metropolitan Area.	The site is located in St. Louis Missouri.

Table 3-2
Action Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Asbestos Abatement Projects (10 CFR 10-6.250)	Regulates asbestos abatement projects – Certification, Accreditation, and business Exemption Requirements	Action Specific ARAR – Based on site history, asbestos containing material is present.
Asbestos Abatement Projects (10 CFR 10-6.240)	Regulates asbestos abatement project – Registration, Notification and Performance Requirements	Action Specific ARAR – Based on site history, asbestos containing material is present.

Table 3-2
Chemical Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Land Disposal of Hazardous Waste (40 CFR 268, as incorporated by reference in 10 CSR 25-7.268)	The land disposal restrictions will apply to the disposal of containerized waste, bulked waste, or any hazardous waste generated during the removal activities.	The land disposal restrictions will apply to the disposal of containerized waste, bulked waste, or any hazardous waste generated during the removal activities.
Remediation Goals/Cleanup Levels (United States Environmental Protection Agency (USEPA) Region III Risk-Based Concentrations; USEPA Region IX Preliminary Remediation Goals tables; Missouri Department of Natural Resources' document entitled Cleanup Levels for Missouri)	Chemical specific, health- based "point-of-departure" concentrations in tap water are routinely evaluated and/or determined from regulatory guidance documents.	Guidance established in these documents appears applicable within the context of the activities detailed within the proposed removal activities.
Emission of Visible Air Contaminants (10 CSR 10-5.180)	Air Quality Standards and Air Pollution Control Regulations for the St. Louis Metropolitan Area	The site is located in St. Louis, Missouri
Asbestos Abatement Projects (10 CSR 10-6.250)	Regulates asbestos abatement projects – Certification, Accreditation, and Business Exemption Requirements.	Based on site history, asbestos containing material is likely present.
Asbestos Abatement Projects (10 CSR 10-6.240)	Regulates asbestos abatement projects – Registration, Notification, and Performance Requirements.	Based on site history, asbestos containing material is likely present.

Table 3-2
Location Specific Requirements
State Applicable or Relevant and Appropriate Requirements (ARARs)
Former Carter Carburetor Site
St. Louis, Missouri

ARAR	Description	Comment
Discharge to losing streams (10 CSR 20-7.010)	This rule regulates discharges to losing streams.	Drainage areas in the vicinity of the site have been determined to be losing.
Protection of caves from vandalism and pollution (L. 1981 H.S.H.B. 1192)	This act relates to the protection of caves (including) sinkholes) and cave life from vandalism and pollution.	Geological conditions make encountering caves (including sinkholes) and cave life a real possibility.
Emission of Visible Air Contaminants (10 CFR 10-5.180)	Air Quality Standards and Air Pollution Control Regulations for the St. Louis Metropolitan Area	The site is located in St. Louis, Missouri

TABLE 3-3
REMOVAL ACTION GOALS FOR SOIL - SUMMARY
FORMER CARTER CARBURETOR SITE
ST. LOUIS, MISSOURI

Constituent of Concern	EPC (mg/kg)	Construction Worker				Outdoor Groundskeeper			
		Risk-Based RAGS ELCR $= 10^{-6}$ (mg/kg)	Risk-Based RAGS ELCR = 10^{-5} (mg/kg)	Risk-Based RAGS ELCR $= 10^{-4}$ (mg/kg)	Risk-Based RAGS HI=1 (mg/kg)	Risk-Based RAGS ELCR $= 10^{-6}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-5}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-4}$ (mg/kg)	Risk-Based RAGS HI=1 (mg/kg)
TCE	370	1088	10881	108810	52.9				
PCBs *	4,610	21.5	215	2151	10.5	0.98	9.8	98	14

Constituent of Concern	EPC (mg/kg)	Recreational Adolescent				Adult Staff Worker			
		Risk-Based RAGS ELCR $= 10^{-6}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-5}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-4}$ (mg/kg)	Risk-Based RAGS HI=1 (mg/kg)	Risk-Based RAGS ELCR $= 10^{-6}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-5}$ (mg/kg)	Risk-Based RAGS ELCR $= 10^{-4}$ (mg/kg)	Risk-Based RAGS HI=1 (mg/kg)
PCBs *	4,610	1.1	10.7	107	7.4	1.6	15.9	159	23

Notes:

mg/kg = milligrams per kilogram
EPC=Exposure Point Concentration
ELCR=Excess Lifetime Cancer Risk
HI=Hazard Index
RAG= Removal Action Goal
Shading indicates the compound is not a chemical of concern for that receptor.
* Aroclor 1248 values used for EPC and Risk-Based RAG calculations for Die Cast area exposure unit. RAG should be applied to total PCB concentrations.

TCE - Trichloroethylene
PCB - Polychlorinated biphenols

Created by: CLT
Reviewed by: EMW

TABLE 3-4
REMOVAL ACTION GOALS FOR GROUNDWATER - SUMMARY
FORMER CARTER CARBURETOR SITE
ST. LOUIS, MISSOURI

		Construction Worker			
Conctituent of Concern	EPC (mg/L)	Risk-Based RAGS ELCR = 10^{-6} (mg/L)	Risk-Based RAGS ELCR = 10^{-5} (mg/L)	Risk-Based RAGS ELCR = 10^{-4} (mg/L)	Risk-Based RAGS HI=1 (mg/L)
TCE	3.43	0.26	2.6	26.2	0.033
1,2,4-Trimethylbenzene	0.0706	NA	NA	NA	0.018
VC	1.11	0.081	0.81	8.1	0.18

Notes:

mg/kg = milligrams per kilogram
EPC=Exposure Point Concentration
ELCR=Excess Lifetime Cancer Risk
HI=Hazard Index
RAG= Removal Action Goal

NA - Not Available
TCE - Trichloroethylene
VC - Vinyl Chloride

Created by: CLT
Reviewed by: EMW

TABLE 4-1
TECHNOLOGY SCREENING SUMMARY
FORMER CARTER CARBURETOR SITE
ST. LOUIS, MISSOURI

Identified Remedial Technologies	Relevant Screening Criteria: Relative Effectiveness	Relevant Screening Criteria: Ease of Implementation	Relevant Screening Criteria: Relative Cost	Comments	Technology Retained: CBI	Technology Retained: WILLCO	Technology Retained: DIE CAST AREA	Technology Retained: TCE AREA
				COCs	PCBs, Asbestos, Lead Paint	PCBs, Asbestos, Lead Paint	PCBs	TCE, VC
				Media	Concrete, Brick	Concrete, Brick	Soil	Soil, Groundwater
No Action								
No Action	Low	High	Low	Technology retained for comparison with other technologies.	Yes	Yes	Yes	Yes
Institutional Controls								
Deed Restrictions	Moderate	High	Low	Potentially implementable without impairing future land use.	Yes	Yes	Yes	Yes
Access/Security Restrictions	Moderate	High	Low	Site is currently fenced but tresspass/vandalism has occurred	Yes	Yes	Yes	Yes
Engineering Controls								
Soil or Gravel Cover	Moderate	Moderate	Moderate	In source area, may only be applicable in conjunction with treatment.	No	No	Yes	Yes
Asphalt/Concrete Cap	Moderate	Moderate	High	In source area, may only be applicable in conjunction with treatment; may not be suitable for future site use	No	No	No	No
Epoxy Encapsulation	High	Moderate	Low	Epoxy covering of concrete to prevent exposure to PCBs is an accepted technology; inspection and maintenance is required	Yes	Yes	No	No
Removal								
Mechanical Excavation	High	Moderate	Moderate	Assuming standard construction practices can be employed.	No	No	Yes	Yes
Scabbling/Scarifying	Moderate	Moderate	High	Not effective where COC has permeated concrete to depth greater than 1/2 inch.	Yes	Yes	No	No
Chemical Treatment	Low	Moderate	High	Not effective where COC has permeated concrete to depth greater than 1/2 inch, may mobilize COCs at depth.	Yes	Yes	No	No
Asbestos/Lead Abatement	High	Moderate	Moderate	Standard practices are well established.	Yes	Yes	No	No
Partial Demolition	High	Moderate	High	Assuming standard construction practices can be employed, will require impermeable cap.	Yes	Yes	No	No
Demolition	High	Moderate	Moderate	Assuming standard construction practices can be employed.	Yes	Yes	No	No
Disposal								
Off-Site Disposal	High	Moderate	Moderate-High	Treatment may be needed in conjunction with disposal for hot spot area.	Yes	Yes	Yes	Yes
On-Site Disposal	High	Moderate-High	Moderate-High	No apparent advantage over other technologies.	No	No	No	No
In Situ Treatment								
Bioremediation	Low-Moderate	Moderate	Moderate	Very limited effectiveness for PCBs, soil-type dependent for VOCs; takes a relatively long time to implement.	No	No	Yes	Yes
Vapor Extraction	Moderate	Moderate	Moderate	Commonly used technology for VOCs; may be used as a vapor control measure in conjuntion with other treatment technology	No	No	Yes	Yes
Thermal Desorption	High	Moderate	High	Applicability dependent on site hydrogeological conditions but successful full-scale success exists.	No	No	Yes	Yes
Chemical Oxidation	Moderate	Moderate	Moderate	Limited successful full-scale demonstration of effectiveness; soil mixing likely required	No	No	No	No
Fixation/Stabilization	Low	Moderate	Moderate	Applicability dependent on site hydrogeological conditions.	No	No	No	No
Off-Site Treatment								
Soil Washing/Acid Extraction	Moderate	Low	High	Availability uncertain	No	No	No	No
Fixation/Stabilization	High	Low	Moderate	Likely used in conjuntion with other treatment or disposal.	Yes	Yes	Yes	Yes
Pyrometallurgical Recovery	Low	Low	High	Generally suitable for high-metal content materials. Availability uncertain.	No	No	No	No
Ex Situ Vitrification	Moderate	Low	High	Availability uncertain	No	No	No	No

Notes:
COCs - Constituents of Concern
PCBs - Polychlorinated byphenols
TCE - trichloroethene
VC - vinyl chloride
VOCs - Volitle Organic Compounds
High -
Moderate -
Low -

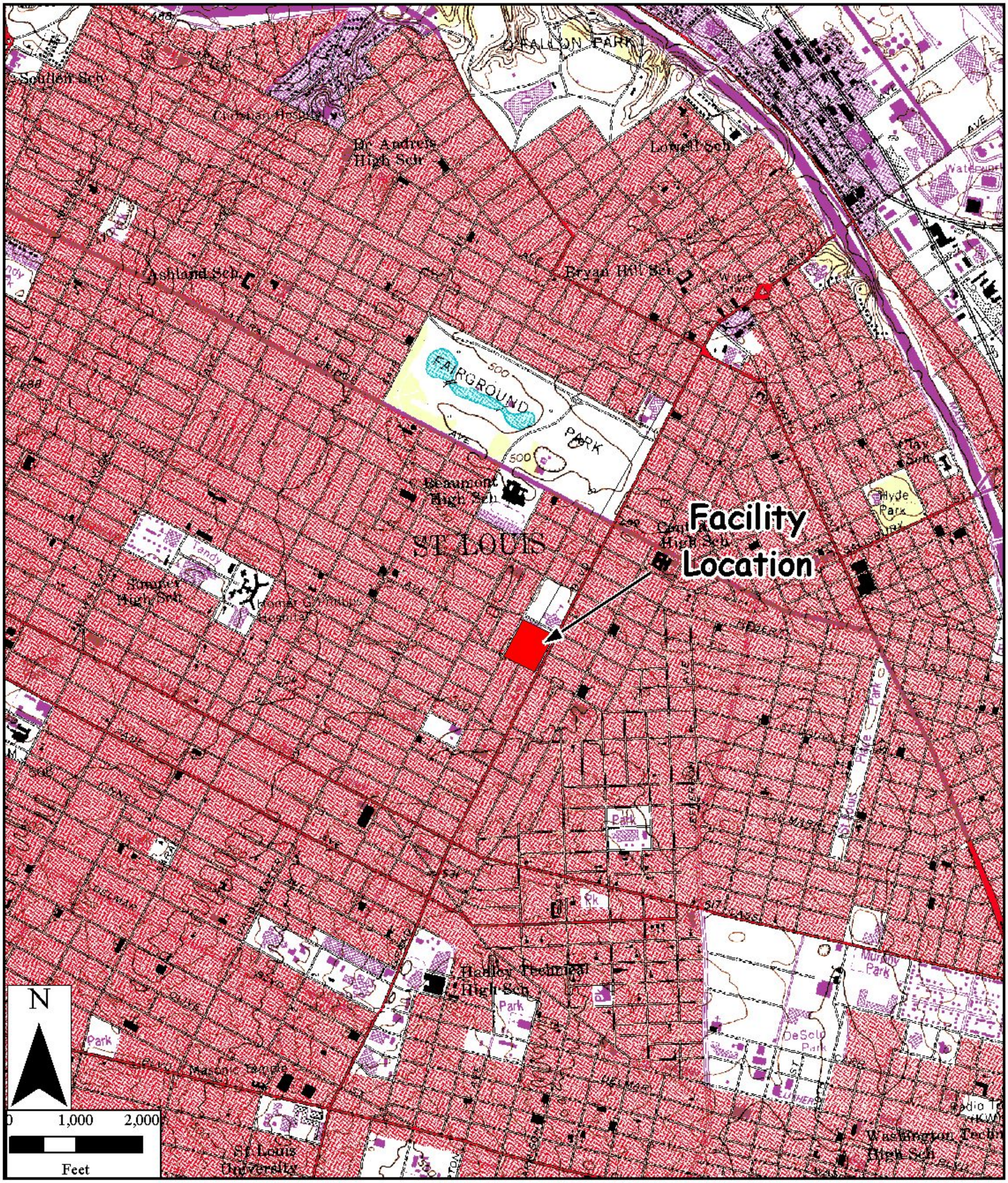
Created by: CLT
Reviewed by: EMW

Table 5-1
Summary of Removal Action Costs
Former Carter Carburetor Facility
St. Louis, Missouri

Location	Capital Cost	Average Annual O&M	O & M at 7% discount rate, 30 years	Capital and O & M Costs without Contingency and PM	Percent Contingency and PM	Added Contingency and PM	ALTERNATIVE TOTAL (rounded up)
CBI Building Alternatives							
1. No Action Alternative	$0	$0	$0	$0	NA	NA	$0
2. Partial Removal and Replacement	$12,239,484	$0	$0	$12,239,484	25%	$3,059,871	$15,300,000
3. Partial Demolition and Impermeable Cap	$10,432,284	$84,070	$711,000	$11,143,284	25%	$2,785,821	$13,930,000
4. Epoxy Encapsulation	$24,170,969	$152,800	$1,661,000	$25,831,969	25%	$6,457,992	$32,290,000
5. Building Demolition	**$10,311,677**	**$0**	**$0**	**$10,311,677**	**25%**	**$2,577,919**	**$12,890,000**
Willco Plastics Building Alternatives							
1. No Action Alternative	$0	$0	$0	$0	NA	NA	$0
2. Mechanical Removal (Scabbling/Scarifying)	$2,169,937	$25,467	$316,000	$2,485,937	25%	$621,484	$3,108,000
3. Epoxy Encapsulation	$3,161,608	$22,033	$300,000	$3,461,608	25%	$865,402	$4,328,000
4. Partial Removal and Replacement	**$1,007,491**	**$0**	**$0**	**$1,007,491**	**25%**	**$251,873**	**$1,260,000**
5. Partial Demolition and Impermeable Cap	$1,980,891	$14,433	$180,000	$2,160,891	25%	$540,223	$2,702,000
6. Building Demolition	$1,741,531	$0	$0	$1,741,531	25%	$435,383	$2,177,000
Die Cast Area Alternatives							
1. No Action Alternative	$0	$0	$0	$0	NA	NA	$0
2. Excavation and Off-Site Disposal	$9,707,536	$0	$0	$9,707,536	25%	$2,426,884	$12,135,000
3. 10' Excavation, Cap, and Off-Site Disposal	$4,905,587	$14,433	$180,000	$5,085,587	25%	$1,271,397	$6,357,000
4. ISTD/VE	**$7,885,575**	**$0**	**$0**	**$7,885,575**	**25%**	**$1,971,394**	**$9,857,000**
5. Impermeable Soil Cap	$900,112	$14,433	$180,000	$1,080,112	25%	$270,028	$1,351,000
TCE AST Area Alternatives							
1. No Action Alternative	$0	$0	$0	$0	NA	NA	$0
2. Excavation and Off-Site Disposal	$3,540,060	$0	$0	$3,540,060	25%	$885,015	$4,426,000
3. 10' Excavation, Cap, and Off-Site Disposal -- add GWCA A or Passive Barrier B	$1,692,338	$9,233	$115,000	$1,807,338	25%	$451,835	$2,260,000
4. ISTD/VE	**$2,022,871**	**$0**	**$0**	**$2,022,871**	**25%**	**$505,718**	**$2,529,000**
5. Impermeable Soil Cap -- add GWCA A or Passive Barrier B	$218,736	$9,233	$115,000	$333,736	15%	$50,060	$384,000
Groundwater costs associated with TCE Alternatives 3 and 5							
Option A - GWCA pump and treat	$231,724	$84,367	$1,046,000	$1,277,724	25%	$319,431	$1,598,000
Option B - Passive Barrier ISCO)	$450,000	$60,333	$704,000	$1,154,000	25%	$288,500	$1,443,000

Notes:
PM - Project Management
* - Includes 60 year Present Value Demolition and Disposal Cost
ISTD/VE - In-situ Thermal Desorption/Vapor Extraction
ISCO - In-situ Chemical Oxidation
updated: 8/9/10
GWCA - Groundwater Corrective Action
Created By: CLT
Reviewed By: EMW

Figures



Legend

Facility Location

Drawn By: BSM

Approved by: EMW

Checked By: CLT

Date: January 14, 2007

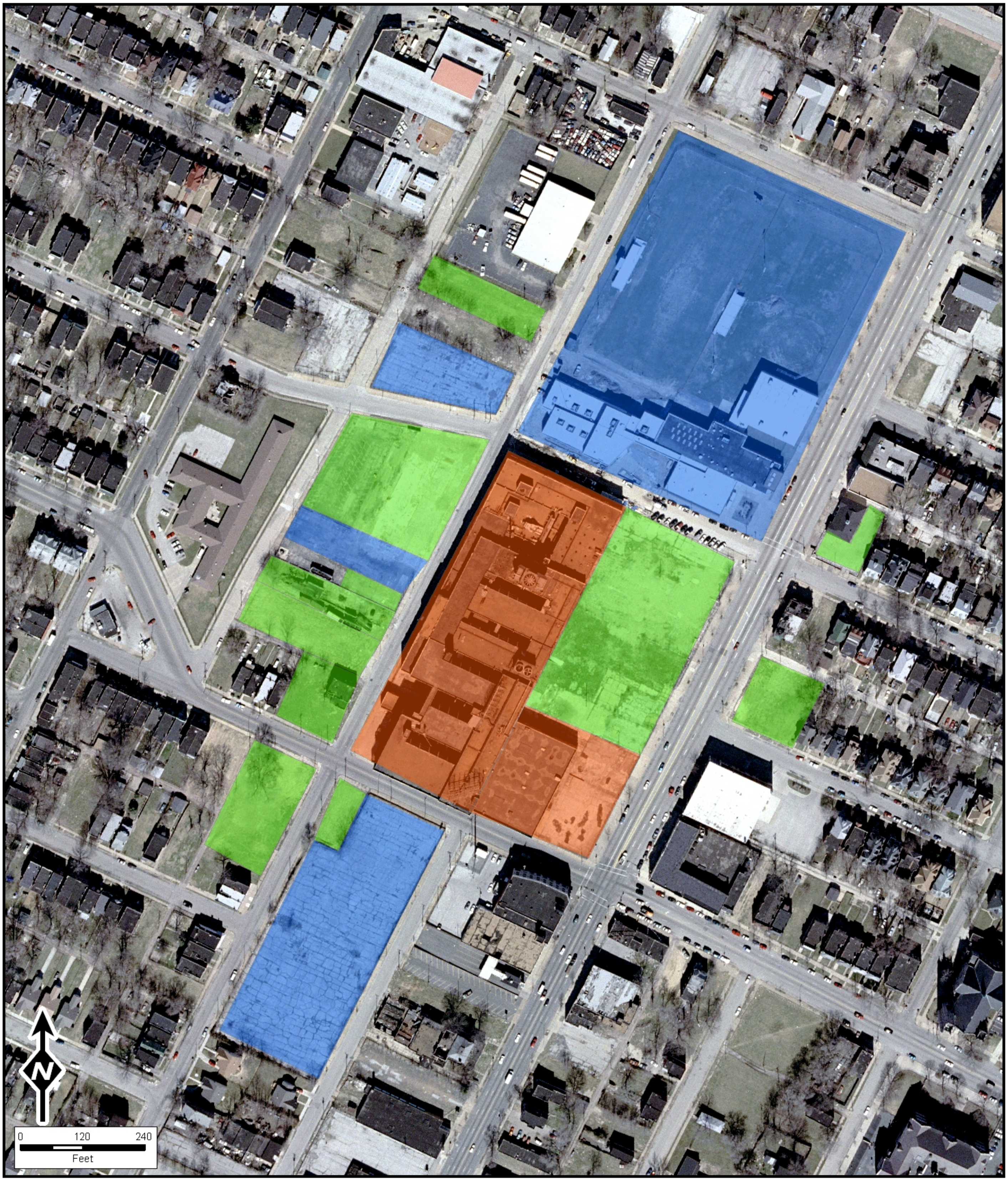
MACTEC

Figure 1-1
Site Location Map
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\080114\fig1-1 location map.mxd

Drawn By: CGS	Approved by: EMW	**Figure 1-2**
Checked By: CLT	April 21, 2009	**Site Layout Map**
MACTEC		**Former Carter Carburetor Site**
		St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\EE_CA_Report\090409_fig1_2_2004_aerial.mxd



Legend

- CARTER BUILDING INC
- HERBERT HOOVER BOYS AND GIRLS CLUB
- LRA

Drawn By: CCC
Approved by: EMW
Checked By: CLT
Date: April, 22, 2009

MACTEC

Figure 1- 3:
Ownership Map
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\EA_CC_reportApril2009\090421_fig1_2and3.mxd

Legend

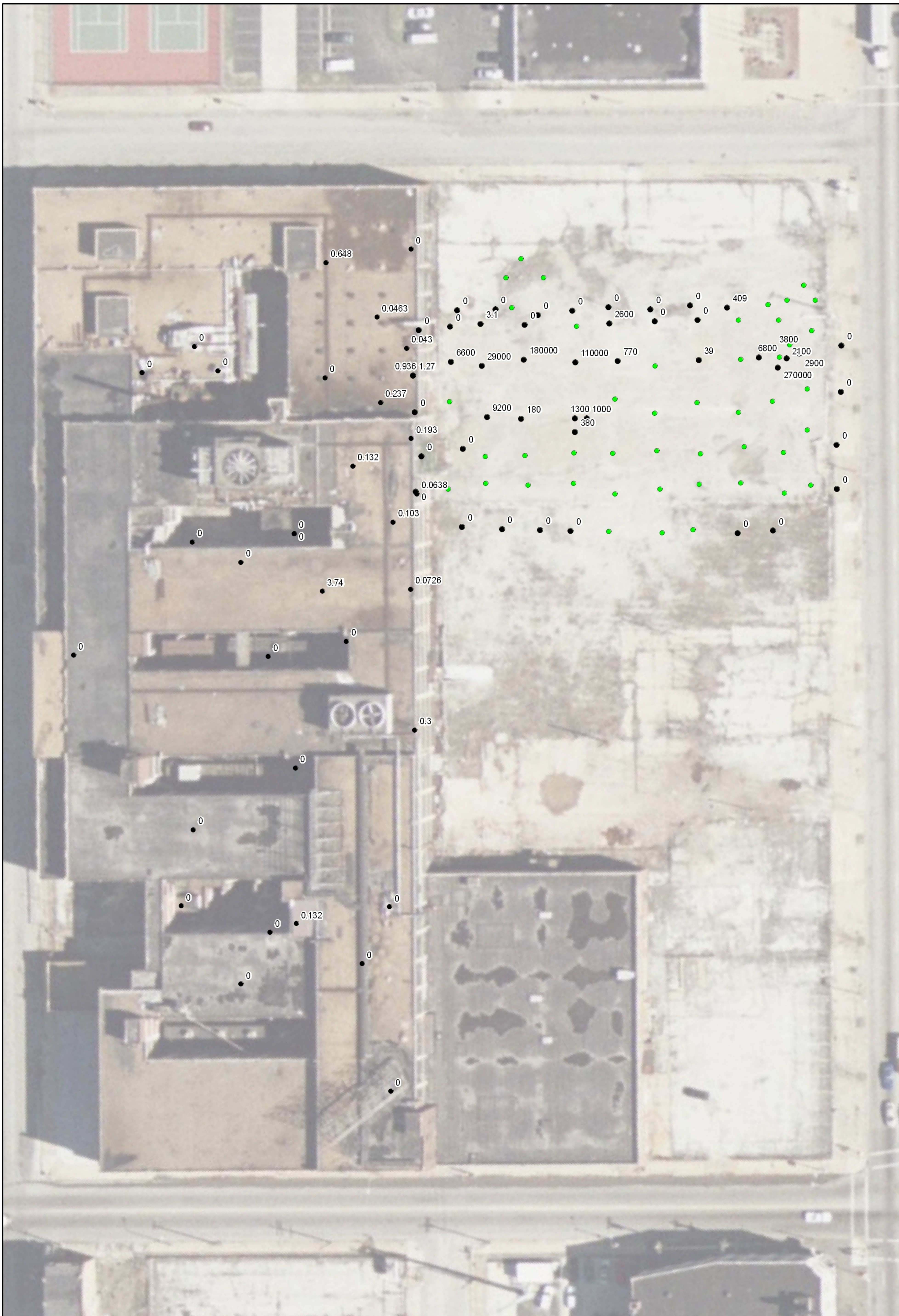
- Recreational
- Commercial
- Residential
- Vacant

Drawn By: CCC
Approved by: EMW
Checked By: CLT
Date: April, 22, 2009

MACTEC

Figure 1- 4:
Surrounding Property Use
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\EA_CC_reportApril2009\090421_fig1_2and3.mxd



Legend

● PCB Soil Boring Location (mg/kg)

0 25 50
Feet

Drawn By: CGS Approved by: EMW

Checked By: CLT April 21, 2009

MACTEC

Figure 2-1
PCBs in Shallow Soil
(Less than 3-feet)
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\EE_CA_Report_April2009\090302_2_1_shallowPCB.mxd

Legend

Soil Samples (mg/kg)

- Below 52.9 mg/kg
- Above 52.9 mg/kg

0 12.5 25
Feet

Drawn By: CGS Approved by: EMW

Checked By: CLT April 21, 2009

MACTEC

Figure 2-2
TCE in Shallow Soil
(Less than 3-feet)
TCE AST Area
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\EE_CA_Report_April2009\090302_2_2_shallowTCE.mxd

Legend

● PCB Soil Boring Location (mg/kg)

0 25 50
Feet

Drawn By: CGS Approved by: EMW

Checked By: CLT April 21, 2009

MACTEC

Figure 2-3
PCBs in Subsurface Soil
(Greater than 3-feet)
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\EE_CA_Report_April2009\090302_2_3_subsurfacePCB.mxd

Legend

Soil Samples (mg/kg)

- Below 52.9 mg/kg
- Above 52.9 mg/kg

0 12.5 25

Feet

Drawn By: CGS Approved by: EMW

Checked By: CLT April 21, 2009

MACTEC

Figure 2-4

TCE in Subsurface Soil

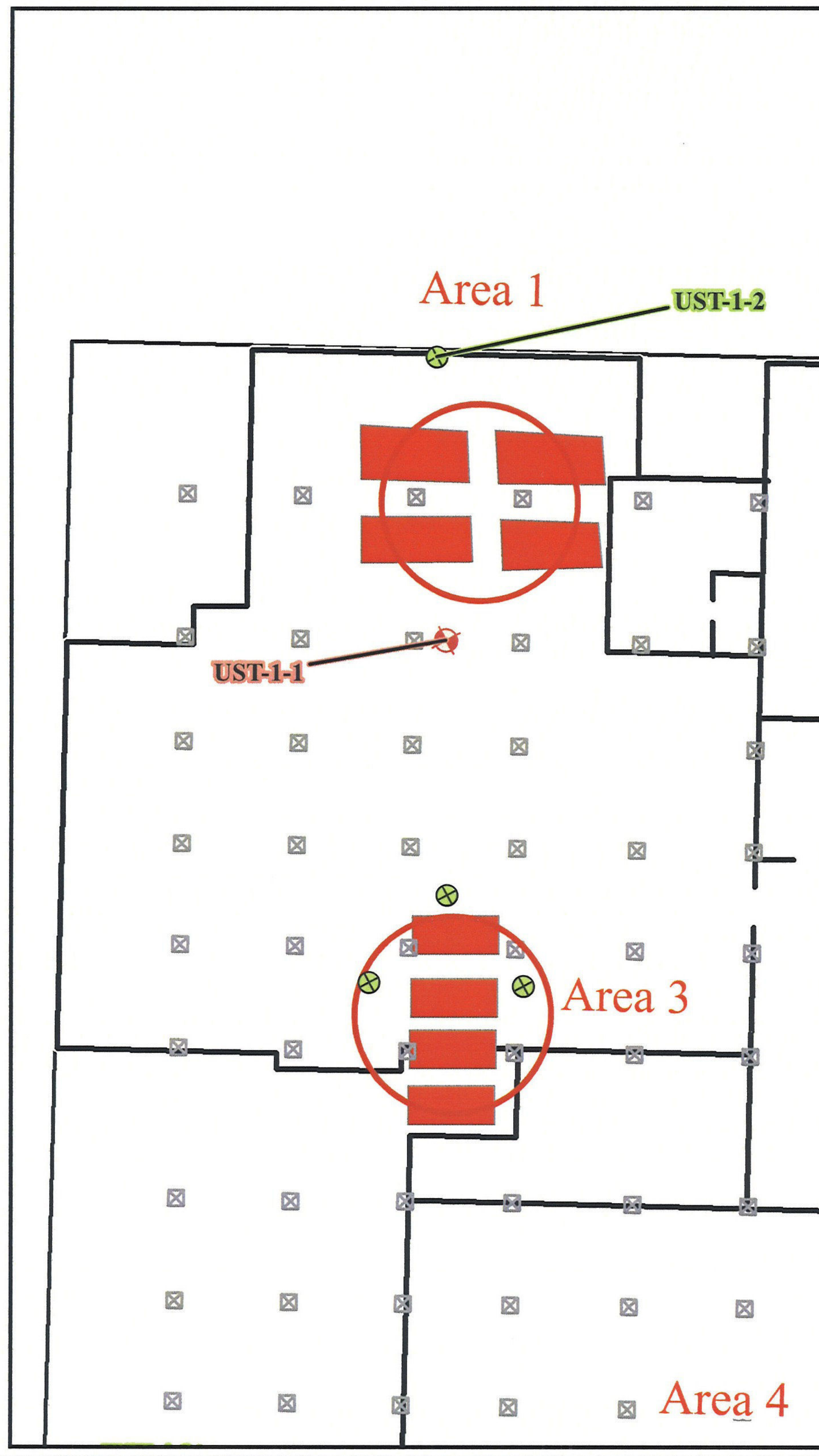
(Greater than 3-feet)

TCE AST Area

Former Carter Carburetor Site

St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\EE_CA_Report_April2009\090302_2_4_subsurfaceTCE.mxd



Parameter	Units	UST-1-1-15	UST-1-1-19	UST-1-1-2	UST-1-1-24	UST-1-2-18	UST-1-2-18 DUP
Volatile Organic Compounds							
Benzene	ug/kg	< 5.5	< 5.8	< 5.2	< 5.1	< 5.4	< 5.2
Ethylbenzene	ug/kg	< 5.5	< 5.8	< 5.2	< 5.1	< 5.4	< 5.2
Naphthalene	ug/kg	< 8.4	< 8.6	< 20.7	< 7.9	< 21.8	< 9.1
Toluene	ug/kg	< 5.5	< 5.8	< 5.2	< 5.1	< 5.4	< 5.2
Xylenes, Total	ug/kg	< 10.9	< 11.6	< 10.3	< 10.2	< 10.9	< 10.5
Total Petroleum Hydrocarbons (TPH)							
TPH - Diesel Range Organics	mg/kg	< 19.1	< 19.5	**86.1**	< 17.9	< 19.3	< 20.7
TPH - Gasoline Range Organics	mg/kg	< 0.55	< 0.58	< 0.52	**0.66**	< 0.54	< 0.52
TPH - Oil Range Organics	mg/kg	**35.2**	< 19.5	**652**	< 17.9	< 19.3	< 20.7
Semi-Volatile Compounds							
Acenaphthene	ug/kg	< 8.4	< 8.6	**34**	< 7.9	< 0.85	< 9.1
Acenaphthylene	ug/kg	< 8.4	< 8.6	**188**	< 7.9	< 0.85	< 9.1
Anthracene	ug/kg	< 8.4	< 8.6	**597**	< 7.9	< 0.85	< 9.1
Benzo(a)Anthracene	ug/kg	< 8.4	< 8.6	**5,020**	< 7.9	< 0.85	< 9.1
Benzo(a)Pyrene	ug/kg	**8.8**	< 8.6	**3,630**	< 7.9	< 0.85	< 9.1
Benzo(b)Fluoranthene	ug/kg	< 8.4	< 8.6	**7,120**	< 7.9	< 0.85	< 9.1
Benzo(g,h,i)Perylene	ug/kg	< 8.4	< 8.6	**778**	< 7.9	< 0.85	< 9.1
Benzo(k)Fluoranthene	ug/kg	< 8.4	< 8.6	**1,150**	< 7.9	< 0.85	< 9.1
Chrysene	ug/kg	< 8.4	< 8.6	**4,520**	< 7.9	< 0.85	< 9.1
Dibenzo(a,h)Anthracene	ug/kg	< 8.4	< 8.6	**349**	< 7.9	< 0.85	< 9.1
Fluoranthene	ug/kg	**9.2**	< 8.6	**8,490**	< 7.9	< 0.85	< 9.1
Fluorene	ug/kg	< 8.4	< 8.6	**51.3**	< 7.9	< 0.85	< 9.1
Indeno(1,2,3-cd)Pyrene	ug/kg	< 8.4	< 8.6	**895**	< 7.9	< 0.85	< 9.1
Phenanthrene	ug/kg	< 8.4	< 8.6	**1,220**	< 7.9	< 0.85	< 9.1
Pyrene	ug/kg	< 8.4	< 8.6	**6,240**	< 7.9	< 0.85	< 9.1

Legend

- Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Storage Tank
- Column

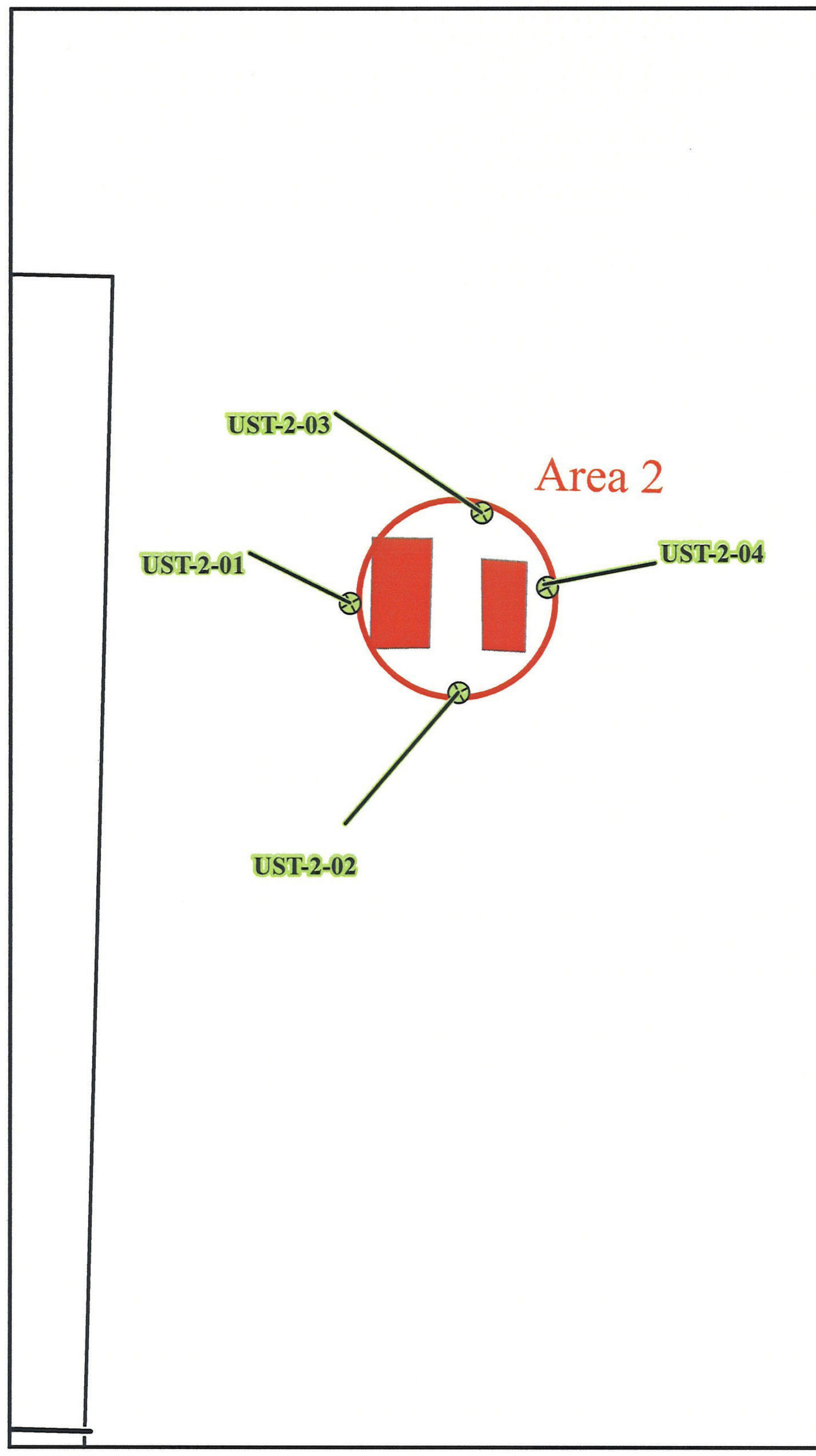
Drawn By: CCC Approved by: EMW

Checked By: CLT Date: December 10, 2007

MACTEC

Figure 2-5:
UST Area #1
Soil Sample Analytical Results
Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_1.mxd



Parameter	Units	UST-2-01-10	UST-2-01-18	UST-2-01-2	UST-2-01-22	UST-2-02-14	UST-2-02-18	UST-2-02-21	UST-2-02-6	UST-2-03-10	UST-2-03-16	UST-2-03-22	UST-2-04-10	UST-2-04-10 DUP	UST-2-04-15	UST-2-04-2	UST-2-04-22
Volatile Organic Compounds																	
1,2,4-Trimethylbenzene	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	< 5	< 4.6	< 4.2	< 5.1	< 4.5	< 5	< 5	< 5.1	< 5.1	< 4.7	**4.5**	< 5.2
1,2-Dichloroethene (Total)	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	< 5	< 4.6	< 4.2	**50.7**	< 4.5	< 5	**5.9**	< 5.1	< 5.1	< 4.7	< 4.4	< 5.2
Acetone	ug/kg	< 20.5	< 19.7	< 21.7	< 18.2	**78.7**	< 18.3	< 16.7	< 20.3	< 18	< 19.8	< 20.2	< 20.5	< 20.3	< 18.7	< 17.6	< 20.6
Cis-1,2-Dichloroethene	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	< 5	< 4.6	< 4.2	**50.7**	< 4.5	< 5	**5.9**	< 5.1	< 5.1	< 4.7	< 4.4	< 5.2
Methyl Ethyl Ketone (MEK)	ug/kg	< 10.3	< 9.8	< 10.9	< 9.1	**12.5**	< 9.1	< 8.3	< 10.2	< 9	< 9.9	< 10.1	< 10.2	< 10.1	< 9.3	< 8.8	< 10.3
Naphthalene	ug/kg	< 4.1	< 9.8	< 4	< 9.1	< 4.1	< 9.1	< 8.3	< 4	< 9	< 9.9	< 4.2	< 4.1	< 4	< 9.3	**8**	< 4.2
N-Butylbenzene	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	< 5	< 4.6	< 4.2	< 5.1	< 4.5	< 5	< 5	< 5.1	< 5.1	< 4.7	**8.8**	< 5.2
Trichloroethene	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	< 5	< 4.6	< 4.2	**105**	< 4.5	< 5	< 5	< 5.1	< 5.1	< 4.7	< 4.4	< 5.2
Vinyl Chloride	ug/kg	< 5.1	< 4.9	< 5.4	< 4.5	**5.4**	< 4.6	< 4.2	< 5.1	< 4.5	< 5	< 5	< 5.1	< 5.1	< 4.7	< 4.4	< 5.2
Semi-Volatile Compounds																	
Acenaphthene	ug/kg	< 4.1	< 4.1	< 4	**19.6**	< 4.1	< 4.1	< 4	< 4	< 4.1	< 4.1	< 4.2	< 4.1	< 4	< 3.6	< 4.2	< 4.2
Acenaphthylene	ug/kg	< 4.1	< 4.1	< 4	< 4.1	< 4.1	< 4.1	< 4	< 4	< 4.1	< 4.1	< 4.2	< 4.1	< 4	< 3.6	**6.1**	< 4.2
Anthracene	ug/kg	< 4.1	< 4.1	< 4	**43**	< 4.1	< 4.1	< 4	< 4	< 4.1	**6.3**	< 4.2	< 4.1	< 4	< 3.6	**12.4**	< 4.2
Benzo(a)Anthracene	ug/kg	**6.4**	< 4.1	**5.6**	**203**	< 4.1	< 4.1	< 4	**7.6**	< 4.1	**16.2**	**4.9**	< 4.1	< 4	< 3.6	**54.1**	< 4.2
Benzo(a)Pyrene	ug/kg	**5.1**	< 4.1	**4.6**	**183**	< 4.1	< 4.1	< 4	**6.7**	< 4.1	**11**	< 4.2	< 4.1	< 4	< 3.6	**48.6**	< 4.2
Benzo(b)Fluoranthene	ug/kg	**18**	< 4.1	**16.3**	**473**	**9.1**	< 4.1	< 4	**23.2**	< 4.1	**30.8**	**13.2**	< 4.1	< 4	< 3.6	**126**	< 4.2
Benzo(g,h,i)Perylene	ug/kg	**5**	< 4.1	**4.2**	**74.9**	< 4.1	< 4.1	< 4	< 4	< 4.1	**4.5**	< 4.2	< 4.1	< 4	< 3.6	**21.7**	< 4.2
Chrysene	ug/kg	**5.6**	< 4.1	**5.1**	**231**	< 4.1	< 4.1	< 4	**7.8**	< 4.1	**10.8**	< 4.2	< 4.1	< 4	< 3.6	**61.8**	< 4.2
Fluoranthene	ug/kg	**14.3**	< 4.1	**10.6**	**515**	**4.5**	< 4.1	< 4	**21.5**	< 4.1	**41.1**	**11.1**	< 4.1	< 4	< 3.6	**122**	< 4.2
Fluorene	ug/kg	< 4.1	< 4.1	< 4	**17.6**	< 4.1	< 4.1	< 4	< 4	< 4.1	< 4.1	< 4.2	< 4.1	< 4	< 3.6	< 4.2	< 4.2
Indeno(1,2,3-cd)Pyrene	ug/kg	**10.4**	< 4.1	**9.4**	**86.9**	< 4.1	< 4.1	< 4	**10.4**	< 4.1	**11**	**8.3**	< 4.1	< 4	< 3.6	**27.2**	< 4.2
Phenanthrene	ug/kg	**9.3**	< 4.1	**6.7**	**254**	< 4.1	< 4.1	< 4	**10.4**	< 4.1	**30.4**	**7.1**	< 4.1	< 4	< 3.6	**63.4**	< 4.2
Pyrene	ug/kg	**12.1**	< 4.1	**10.8**	**379**	< 4.1	< 4.1	< 4	**17.1**	< 4.1	**30.4**	**8.2**	< 4.1	< 4	< 3.6	**114**	< 4.2

Legend

⊕ Boring Location

Column

Storage Tank

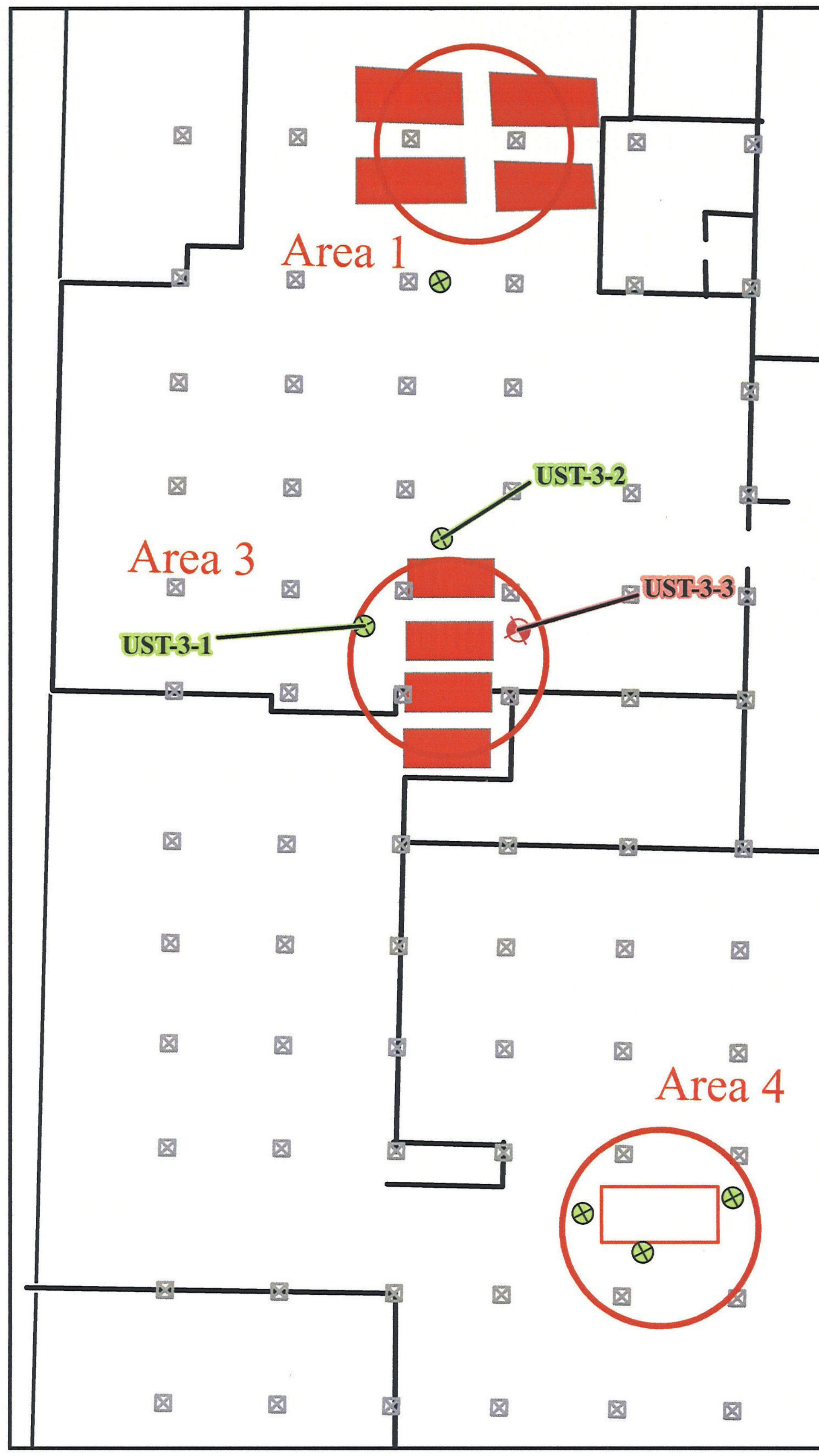
Drawn By: CCC   Approved by: EMW

Checked By: CLT   Date: December 10, 2007

MACTEC

Figure 2-6: UST Area #2 Soil Sample Analytical Results Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_2.mxd



Parameter	Units	UST-3-1-15	UST-3-1-2	UST-3-1-21	UST-3-1-21 DUP	UST-3-1-23	UST-3-2-15	UST-3-2-2	UST-3-2-22	UST-3-2-24	UST-3-3-15	UST-3-3-25	UST-3-3-25 DUP	UST-3-3-3
Volatile Organic Compounds														
Benzene	ug/kg	< 879	< 5.9	< 1010	< 847	< 4.4	< 1110	< 5.1	< 213	< 5.5	**1,790**	< 5.4	< 5.9	< 6.1
Ethylbenzene	ug/kg	< 879	< 5.9	< 1010	< 847	< 4.4	< 1110	< 5.1	**J 119**	< 5.5	< 1190	< 5.4	< 5.9	< 6.1
Naphthalene	ug/kg	**7,320**	< 23.5	**5,140**	< 3390	**54.8**	**5,760**	< 20.5	**1,070**	< 22.1	**10,900**	< 21.7	< 23.4	< 24.6
Toluene	ug/kg	< 879	< 5.9	< 1010	< 847	< 4.4	< 1110	< 5.1	< 213	< 5.5	< 1190	< 5.4	< 5.9	< 6.1
Xylenes, Total	ug/kg	< 1760	< 11.7	< 2020	< 1690	< 8.8	< 2210	< 10.3	**J 92.9**	< 11.1	< 2380	< 10.9	< 11.7	< 12.3
Total Petroleum Hydrocarbons (TPH)														
TPH - Diesel Range Organics	mg/kg	**3,780**	**19.3**	**361**	**287**	**30.1**	**705**	**32.6**	**407**	< 18.2	**10,600**	**23.6**	< 18.5	**31.8**
TPH - Gasoline Range Organics	mg/kg	**2,140**	< 0.59	**2,640**	**1,650**	**7.4**	**2,400**	< 0.51	**541**	**0.73**	**1,690**	**1.5**	**1.2**	< 0.61
TPH - Oil Range Organics	mg/kg	**1,060**	**110**	**102**	**114**	**41.1**	**267**	**88.6**	**162**	< 18.2	**6,480**	**195**	**89.6**	**92.4**

Legend

- ⊕ Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Storage Tank
- Column

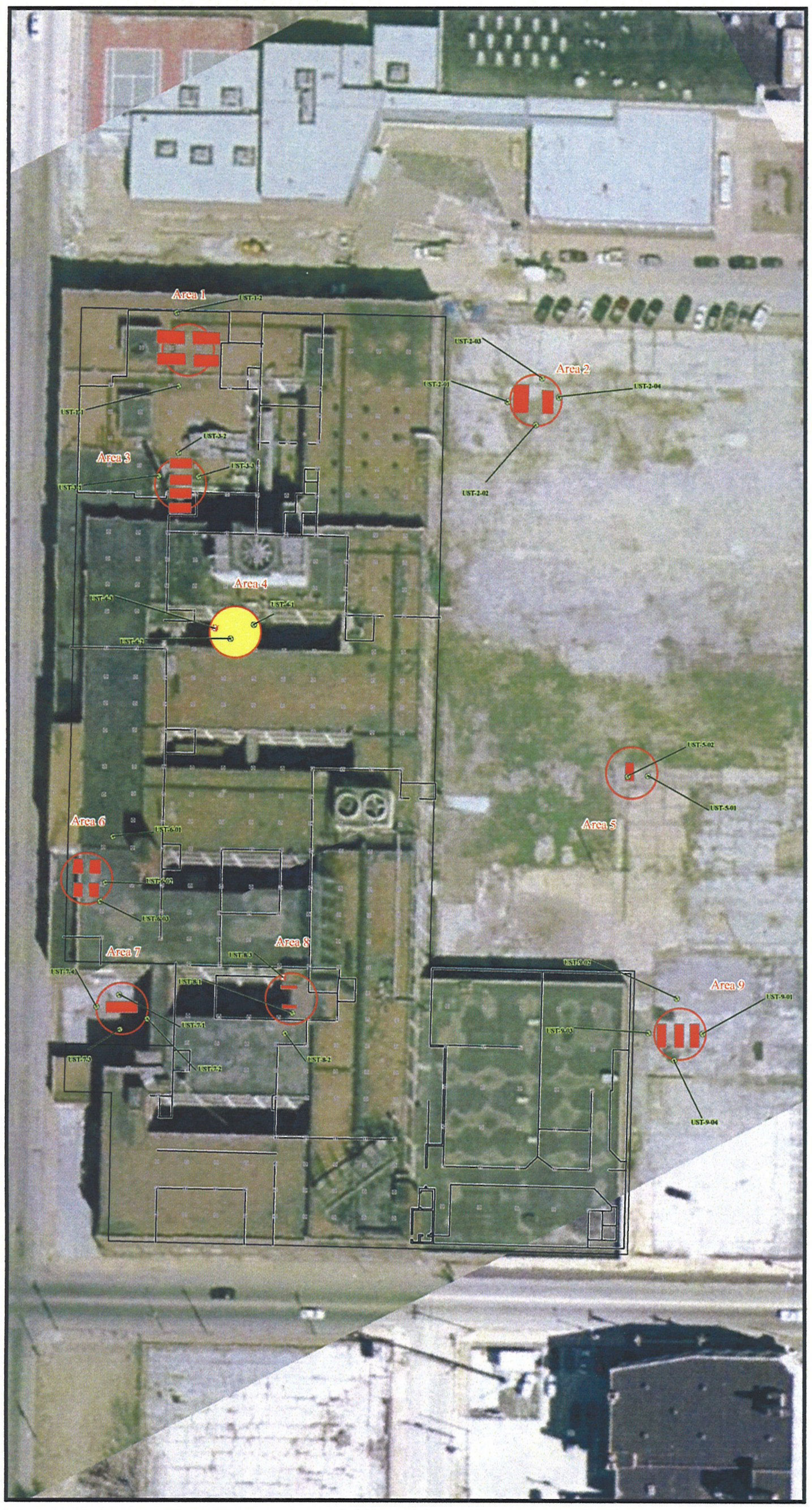
Drawn By: CCC Approved by: EMW

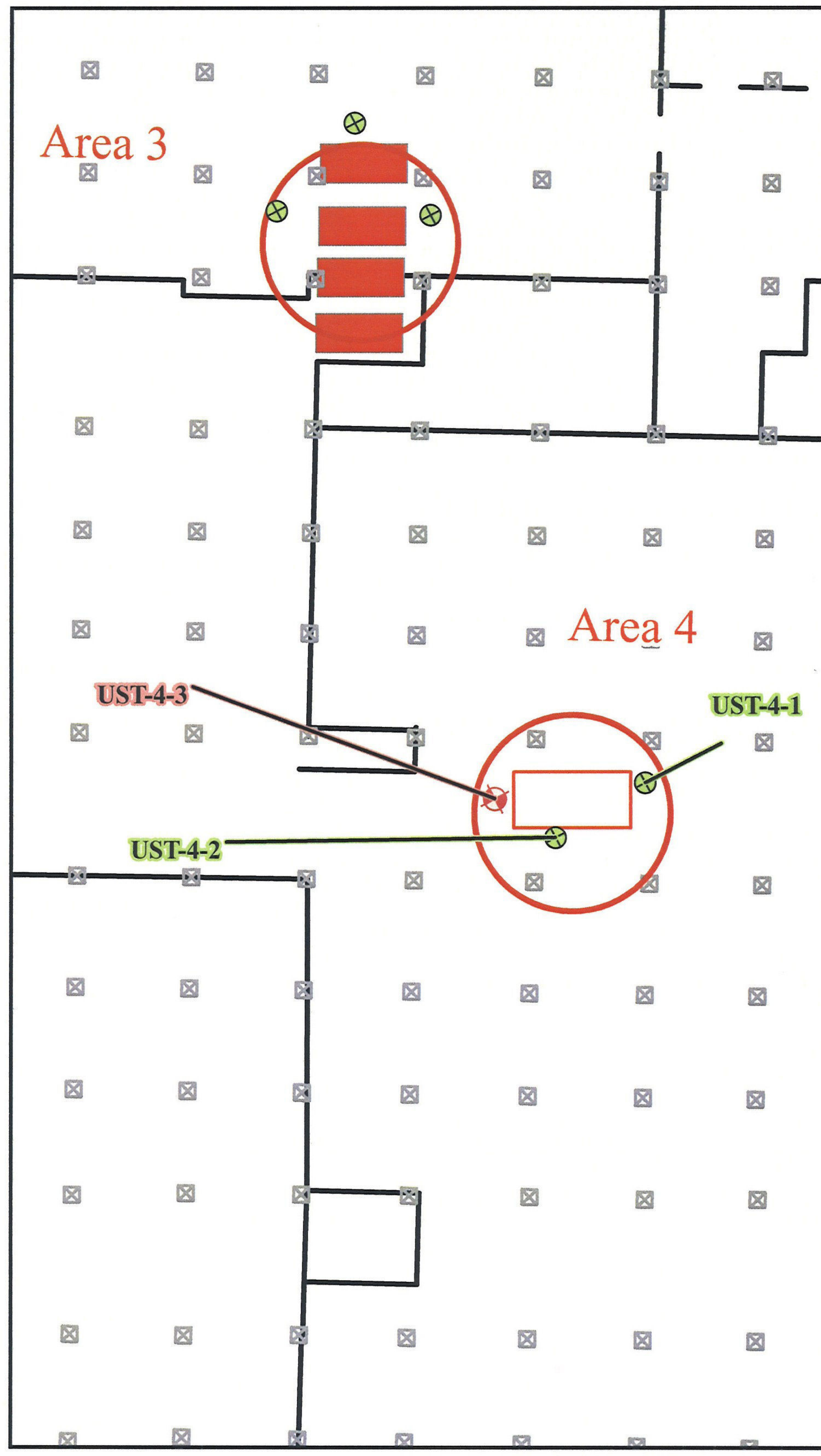
Checked By: CLT Date: December 10, 2007

MACTEC

Figure 2-7:
UST Area #3
Soil Sample Analytical Results
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_3.mxd





Parameter	Units	UST-4-1-15	UST-4-1-2	UST-4-1-20	UST-4-1-22	UST-4-2-13	UST-4-2-19	UST-4-2-19 DUP	UST-4-2-2	UST-4-3-14	UST-4-3-18	UST-4-3-18 DUP	UST-4-3-2	UST-4-3-20
Volatile Organic Compounds														
Benzene	ug/kg	J 805	< 5.1	J 932	J 158	6.9	J 261	J 144	< 5.4	< 524	< 281	< 240	< 4.9	< 217
Ethylbenzene	ug/kg	J 601	< 5.1	13,800	386	< 4.3	J 262	J 159	< 5.4	960	3,480	2,980	< 4.9	J 72.4
Naphthalene	ug/kg	J 540	< 20.3	< 11500	< 1080	< 17.2	2,030	1,910	< 21.5	< 2100	< 1120	< 959	< 19.8	< 868
Toluene	ug/kg	J 329	< 5.1	4,260	J 235	< 4.3	J 143	J 91.4	< 5.4	J 153	325	324	< 4.9	J 44.3
Xylenes, Total	ug/kg	J 1,330	< 10.2	30,300	815	< 8.6	3,500	2,120	< 10.8	1130	3,350	2,960	< 9.9	J 96.7
Total Petroleum Hydrocarbons (TPH)														
TPH - Diesel Range Organics	mg/kg	1,380	< 18.6	1,010	58	98.5	809	289	< 18.9	371	821	715	< 18.4	75.4
TPH - Gasoline Range Organics	mg/kg	3,880	< 0.51	6,100	68.8	14.1	4,180	3,440	< 0.54	1,130	2,800	241	1	245
TPH - Oil Range Organics	mg/kg	307	102	136	24.2	< 18.8	29.6	< 18.7	31.3	37.8	79.4	56	32	< 18.2

Legend

- ⊕ Boring Location
- ⌖ Boring Location/Small Diameter Monitoring Well
- —— Column
- ■ Storage Tank

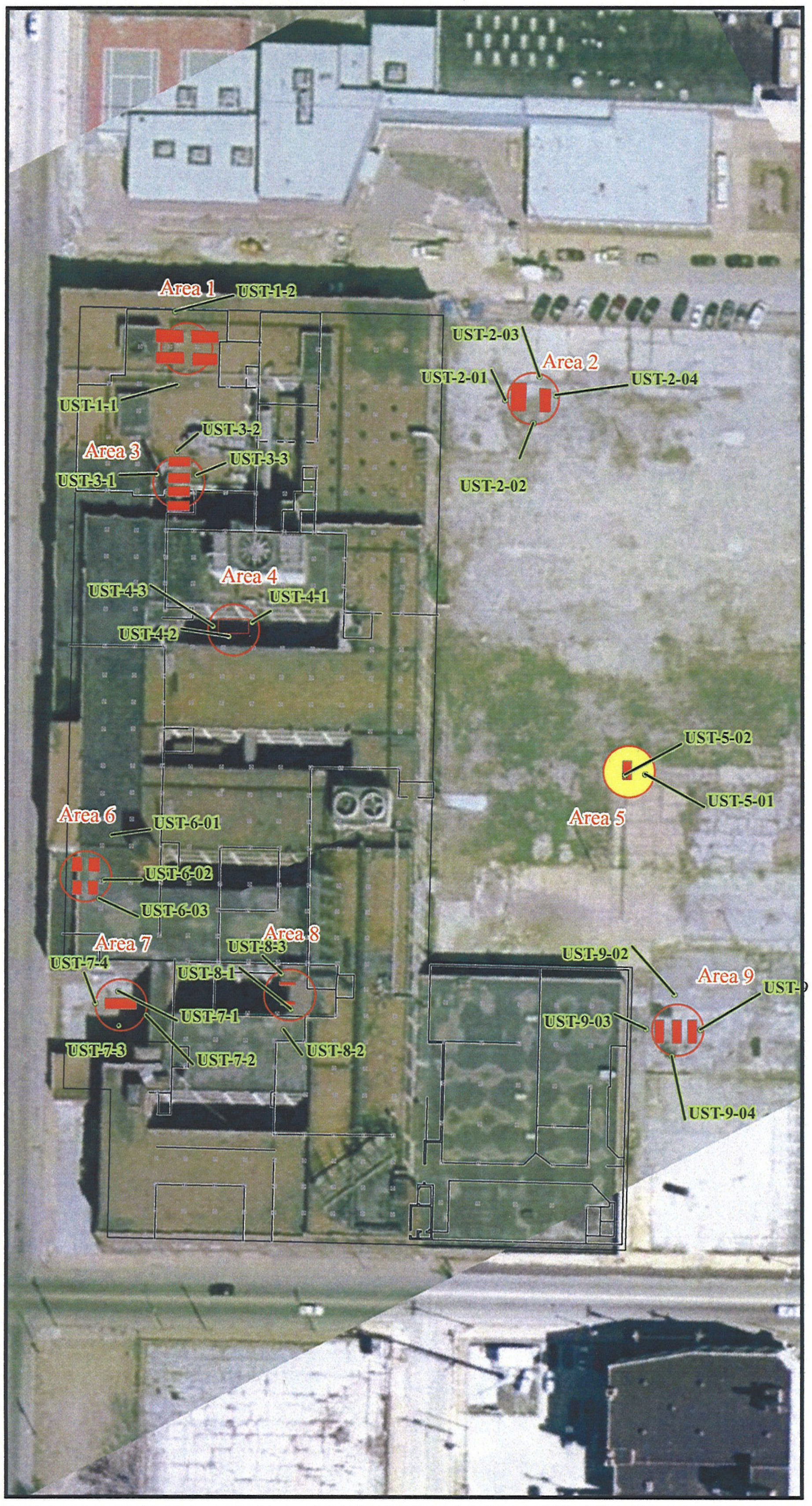
Drawn By: CCC Approved by: EMW

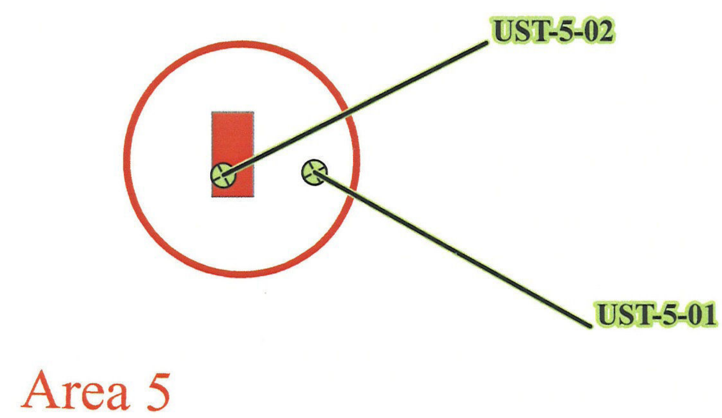
Checked By: CLT Date: December 10, 2007

MACTEC

Figure 2-8:
UST Area #4
Soil Sample Analytical Results
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_4.mxd





Parameter	Units	UST-5-01-15	UST-5-01-19	UST-5-01-19 DUP	UST-5-01-2	UST-5-01-23	UST-5-02-13	UST-5-02-18	UST-5-02-2	UST-5-02-22
Volatile Organic Compounds										
Benzene	ug/kg	< 4.5	**5.2**	< 5.4	< 5.6	**42.1**	< 4.8	< 5.3	< 5.1	< 4.8
Ethylbenzene	ug/kg	< 4.5	< 5.1	< 5.4	< 5.6	**29.6**	< 4.8	< 5.3	< 5.1	< 4.8
Naphthalene	ug/kg	< 4.1	< 20.6	< 21.5	< 4.1	< 15.6	< 4.2	< 4.1	< 20.4	< 19.2
Toluene	ug/kg	< 4.5	< 5.1	< 5.4	< 5.6	< 3.9	< 4.8	< 5.3	< 5.1	< 4.8
Xylenes, Total	ug/kg	< 9.1	**10.4**	< 10.8	< 11.2	**50.2**	< 9.5	< 10.7	< 10.2	< 9.6
Total Petroleum Hydrocarbons (TPH)										
TPH - Gasoline Range Organics	mg/kg	< 0.45	**74.1**	**J 16.4**	< 0.56	**75.2**	< 0.48	< 0.53	< 0.51	< 0.48
Semi-Volatile Compounds										
Acenaphthene	ug/kg	< 4.1	**89**	**690**	< 4.1	**892**	< 4.2	< 4.1	**1,410**	**9.1**
Acenaphthylene	ug/kg	< 4.1	**17.3**	< 40.6	< 4.1	< 40.7	< 4.2	< 4.1	< 40.1	**5.7**
Anthracene	ug/kg	< 4.1	**46.9**	**378**	< 4.1	< 40.7	< 4.2	< 4.1	< 40.1	**57.1**
Benzo(a)Anthracene	ug/kg	< 4.1	**8.4**	**59.6**	< 4.1	**111**	< 4.2	**4.9**	**137**	**135**
Benzo(a)Pyrene	ug/kg	< 4.1	**5**	**J 34.4**	< 4.1	**64.1**	< 4.2	**5.2**	**85**	**120**
Benzo(b)Fluoranthene	ug/kg	< 4.1	< 4.1	< 40.6	< 4.1	**J 38.6**	< 4.2	**13.5**	**52**	**312**
Benzo(g,h,i)Perylene	ug/kg	< 4.1	< 4.1	< 40.6	< 4.1	< 40.7	< 4.2	< 4.1	**42.9**	**63.5**
Chrysene	ug/kg	< 4.1	**10.1**	**73.6**	< 4.1	**137**	< 4.2	**6.2**	**179**	**136**
Fluoranthene	ug/kg	< 4.1	< 4.1	< 40.6	< 4.1	< 40.7	< 4.2	**16.2**	< 40.1	**275**
Fluorene	ug/kg	< 4.1	**105**	**642**	< 4.1	**992**	< 4.2	< 4.1	**1,140**	**9.3**
Indeno(1,2,3-cd)Pyrene	ug/kg	< 4.1	< 4.1	< 40.6	< 4.1	**< 40.7**	< 4.2	**4.3**	< 40.1	**69**
Phenanthrene	ug/kg	< 4.1	**200**	**2,940**	< 4.1	**7,110**	**18.7**	**12**	**7,220**	**196**
Pyrene	ug/kg	< 4.1	**49.5**	**298**	< 4.1	**589**	< 4.2	**12.7**	**823**	**263**

Legend

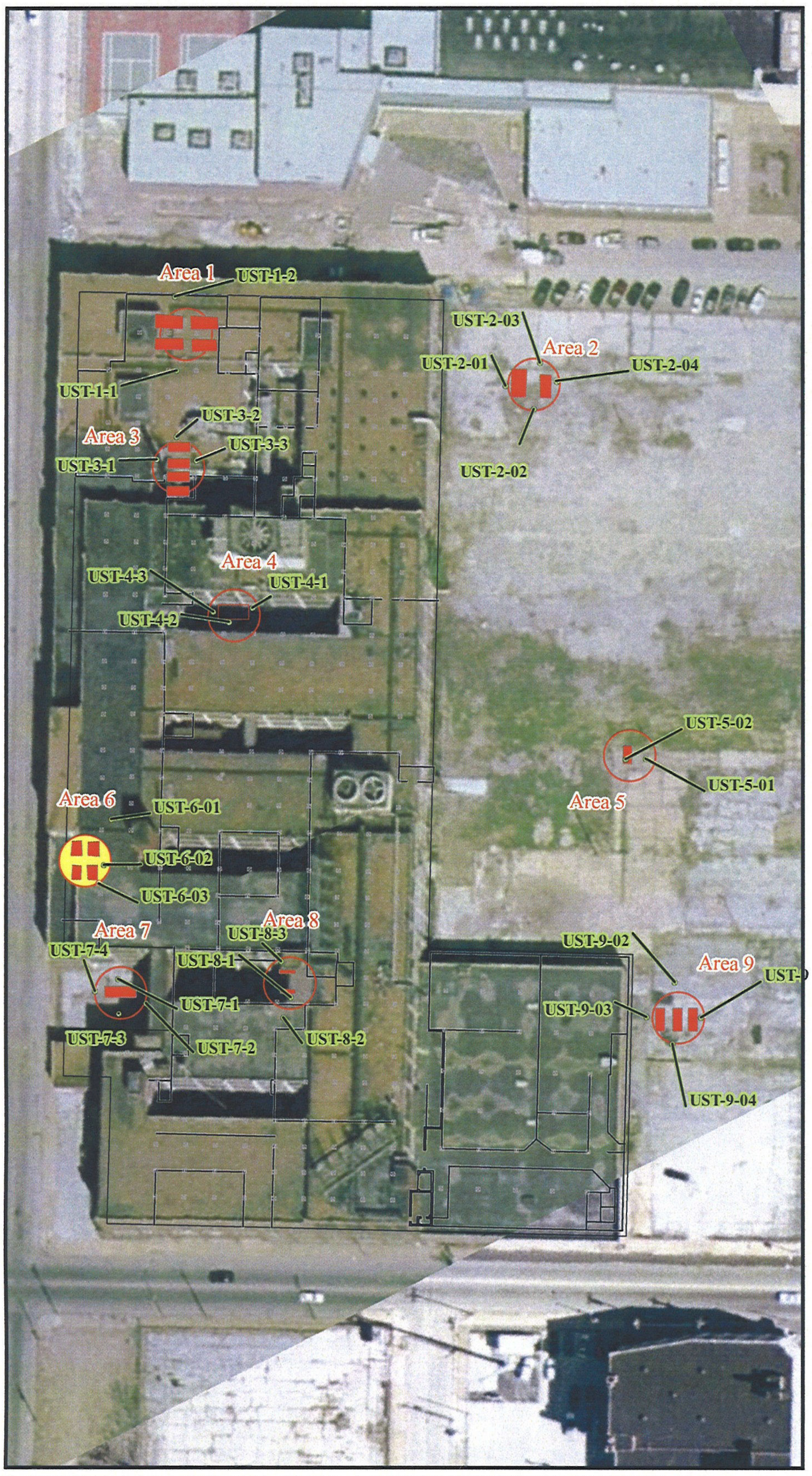
- Boring Location
- Column
- Storage Tank

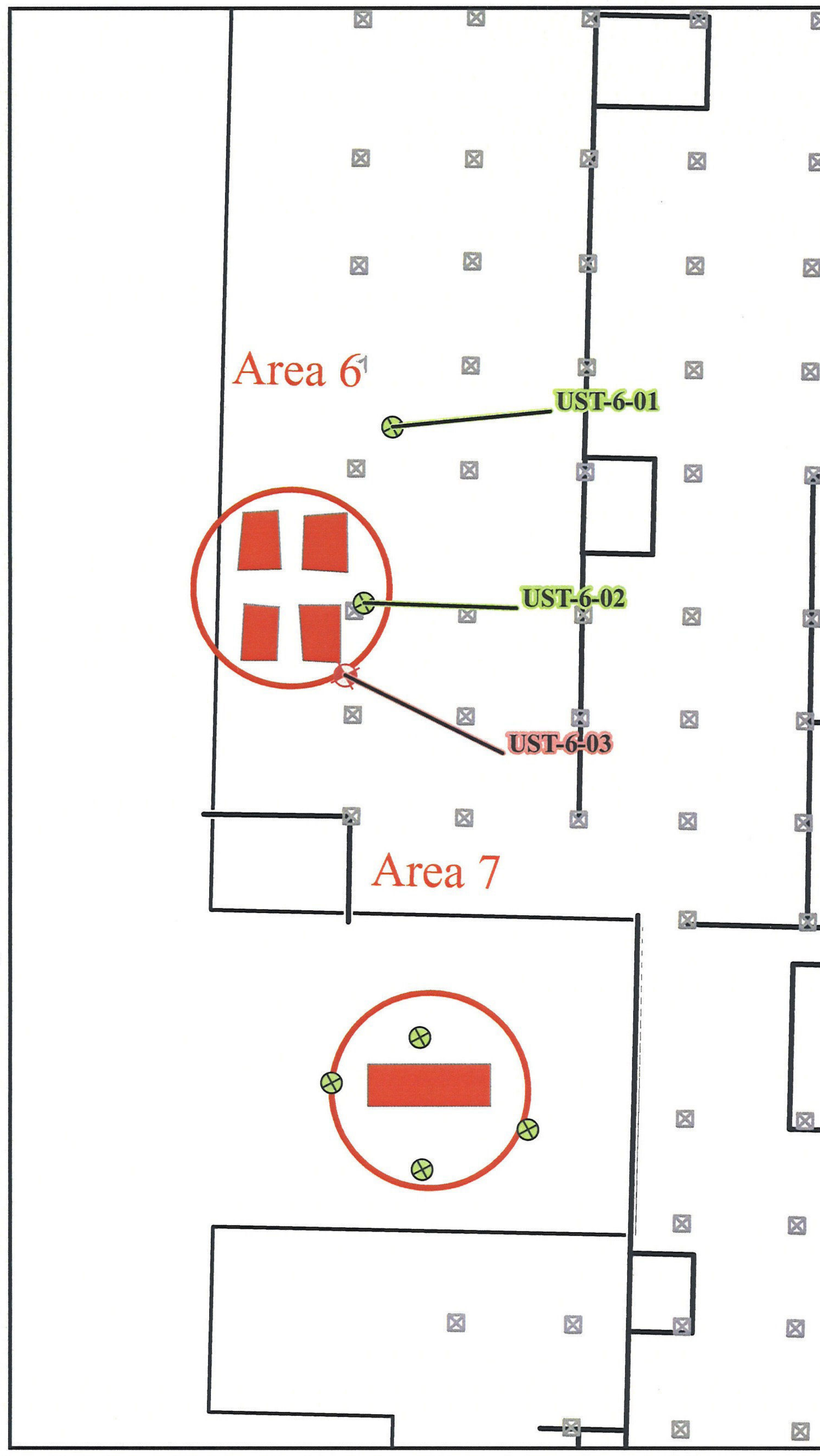
Drawn By: CCC
Approved by: EMW
Checked By: CLT
Date: December 10, 2007

MACTEC

Figure 2-9:
UST Area #5
Soil Sample Analytical Results
Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_5.mxd





Parameter	Units	UST-6-01-1	UST-6-01-14	UST-6-01-18	UST-6-01-26	UST-6-02-12	UST-6-02-18	UST-6-02-24	UST-6-02-29	UST-6-03-12	UST-6-03-18	UST-6-03-18 DUP	UST-6-03-24	UST-6-03-28
Volatile Organic Compounds														
Benzene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	< 4.8	< 5.4	< 5.1	< 5.3	< 6.9
Ethylbenzene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	**5.9**	< 5.4	< 5.1	< 5.3	< 6.9
Naphthalene	ug/kg	< 22.1	< 21.5	< 36.5	< 23.1	< 22.7	< 18.8	< 22.5	< 29.6	< 19.2	< 21.6	< 20.5	< 21.1	< 27.7
Toluene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	< 4.8	< 5.4	< 5.1	< 5.3	< 6.9
Xylenes, Total	ug/kg	< 11.1	< 10.8	< 18.2	< 11.6	< 11.3	< 9.4	< 11.2	< 14.8	< 9.6	< 10.8	< 10.2	< 10.6	< 13.9
Total Petroleum Hydrocarbons (TPH)														
TPH - Diesel Range Organics	mg/kg	**45.9**	< 19	< 19.4	< 20	**22.3**	< 18.9	< 19.2	< 19.4	**24.6**	< 18.7	< 19.3	< 19.4	**26.2**
TPH - Gasoline Range Organics	mg/kg	**1.2**	< 0.54	**8.7**	< 0.58	**2.6**	< 0.47	< 0.56	< 0.74	**7.2**	< 0.54	< 0.51	< 0.53	< 0.69
TPH - Oil Range Organics	mg/kg	**76.7**	< 19	< 19.4	< 20	< 22	< 18.9	< 19.2	< 19.4	< 20.2	< 18.7	< 19.3	< 19.4	< 20.6

Legend

- ⊕ Boring Location
- ⌖ Boring Location/ Small Diameter Boring Well
- —— Column
- ▬ Storage Tank

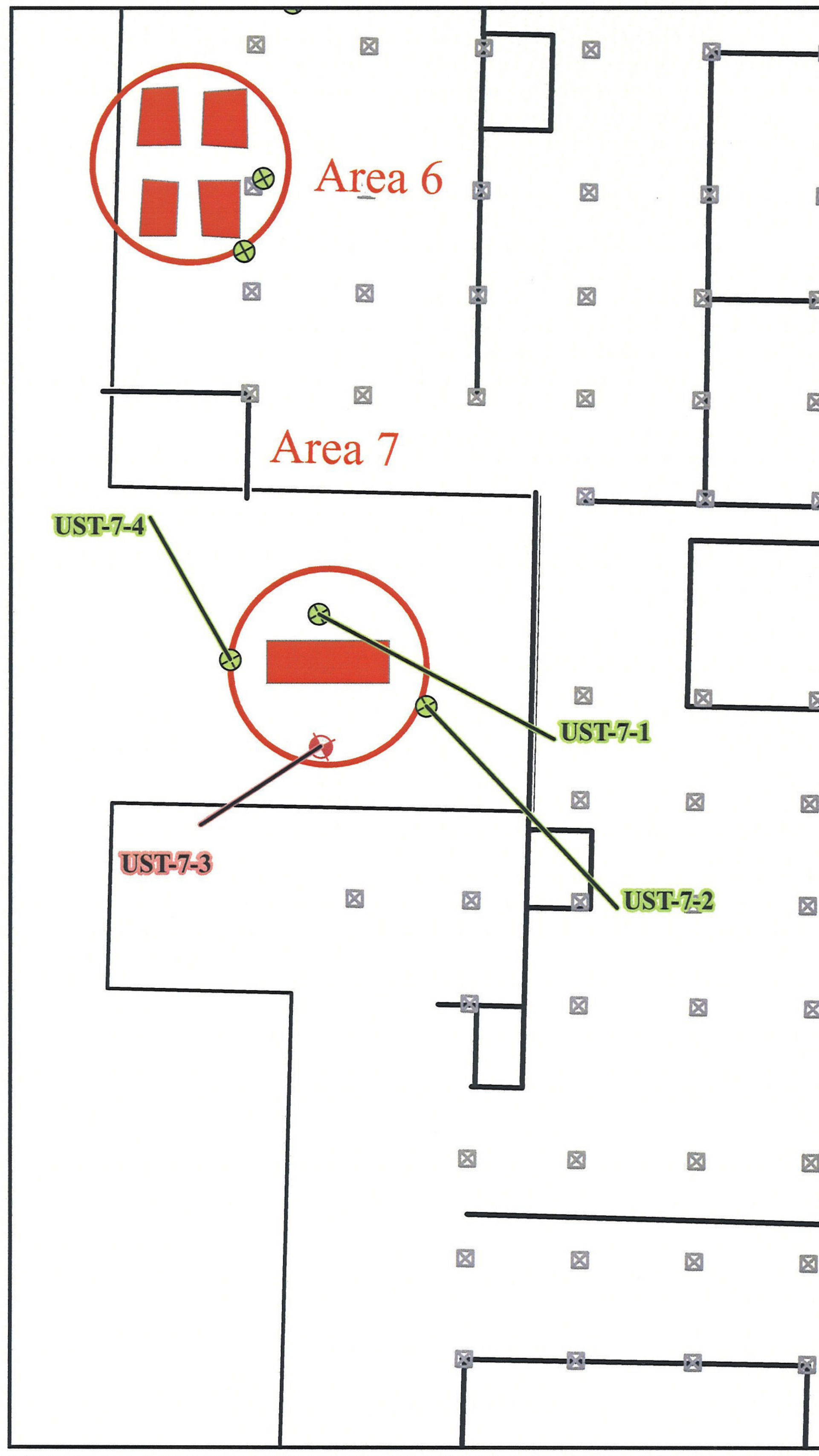
Drawn By: CCC | Approved by: EMW

Checked By: CLT | Date: January 14, 2008

MACTEC

Figure 2-10:
UST Area #6
Soil Sample Analytical Results
Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_6.mxd



Parameter	Units	UST-6-01-1	ST-6-01-14	ST-6-01-18	ST-6-01-26	ST-6-02-12	ST-6-02-18	UST-6-02-24	ST-6-02-29	UST-6-03-12	ST-6-03-18	ST-6-03-18 DUP	ST-6-03-24	ST-6-03-28
Volatile Organic Compounds														
Benzene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	< 4.8	< 5.4	< 5.1	< 5.3	< 6.9
Ethylbenzene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	**5.9**	< 5.4	< 5.1	< 5.3	< 6.9
Naphthalene	ug/kg	< 22.1	< 21.5	< 36.5	< 23.1	< 22.7	< 18.8	< 22.5	< 29.6	< 19.2	< 21.6	< 20.5	< 21.1	< 27.7
Toluene	ug/kg	< 5.5	< 5.4	< 9.1	< 5.8	< 5.7	< 4.7	< 5.6	< 7.4	< 4.8	< 5.4	< 5.1	< 5.3	< 6.9
Xylenes, Total	ug/kg	< 11.1	< 10.8	< 18.2	< 11.6	< 11.3	< 9.4	< 11.2	< 14.8	< 9.6	< 10.8	< 10.2	< 10.6	< 13.9
Total Petroleum Hydrocarbons (TPH)														
TPH - Diesel Range Organics	mg/kg	**45.9**	< 19	< 19.4	< 20	**22.3**	< 18.9	< 19.2	< 19.4	**24.6**	< 18.7	< 19.3	< 19.4	**26.2**
TPH - Gasoline Range Organics	mg/kg	**1.2**	< 0.54	**8.7**	< 0.58	**2.6**	< 0.47	< 0.56	< 0.74	**7.2**	< 0.54	< 0.51	< 0.53	< 0.69
TPH - Oil Range Organics	mg/kg	**76.7**	< 19	< 19.4	< 20	< 22	< 18.9	< 19.2	< 19.4	< 20.2	< 18.7	< 19.3	< 19.4	< 20.6
Semi-Volatile Compounds														
Acenaphthene	ug/kg	< 3.9	**12**	< 4	**46.5**	< 4.7	< 4.1	< 4.1	**7.3**	--	< 4	--	< 4.2	< 4.1
Acenaphthylene	ug/kg	< 3.9	**13.3**	< 4	**7.2**	< 4.7	< 4.1	< 4.1	**5.2**	--	< 4	--	< 4.2	< 4.1
Anthracene	ug/kg	< 3.9	**53.2**	< 4	**131**	< 4.7	< 4.1	< 4.1	**18**	--	< 4	--	< 4.2	< 4.1
Benzo(a)Anthracene	ug/kg	< 3.9	**134**	**4.7**	**341**	< 4.7	< 4.1	< 4.1	**54.6**	--	< 4	--	< 4.2	< 4.1
Benzo(a)Pyrene	ug/kg	< 3.9	**110**	< 4	**269**	< 4.7	< 4.1	< 4.1	**51**	--	< 4	--	< 4.2	< 4.1
Benzo(b)Fluoranthene	ug/kg	**3.9**	**148**	**7.3**	**495**	< 4.7	< 4.1	< 4.1	**96.7**	--	< 4	--	< 4.2	< 4.1
Benzo(g,h,i)Perylene	ug/kg	< 3.9	**65.3**	< 4	**121**	< 4.7	< 4.1	< 4.1	**29.3**	--	< 4	--	< 4.2	< 4.1
Benzo(k)Fluoranthene	ug/kg	< 3.9	**64.9**	< 4	< 4.2	< 4.7	< 4.1	< 4.1	< 4.8	--	< 4	--	< 4.2	< 4.1
Chrysene	ug/kg	< 3.9	**118**	**4.4**	**259**	< 4.7	< 4.1	< 4.1	**57.4**	--	< 4	--	< 4.2	< 4.1
Dibenzo(a,h)Anthracene	ug/kg	< 3.9	**21.7**	< 4	< 4.2	< 4.7	< 4.1	< 4.1	**9.7**	--	< 4	--	< 4.2	< 4.1
Fluoranthene	ug/kg	**7.9**	**320**	**12**	**645**	< 4.7	< 4.1	< 4.1	**163**	--	< 4	--	< 4.2	< 4.1
Fluorene	ug/kg	< 3.9	**12.3**	< 4	**32.6**	< 4.7	< 4.1	< 4.1	**5.6**	--	< 4	--	< 4.2	< 4.1
Indeno(1,2,3-cd)Pyrene	ug/kg	< 3.9	**71.4**	< 4	**128**	< 4.7	< 4.1	< 4.1	**32.4**	--	< 4	--	< 4.2	< 4.1
Phenanthrene	ug/kg	**4**	**231**	**8.3**	**481**	< 4.7	< 4.1	< 4.1	**91.1**	--	< 4	--	< 4.2	< 4.1
Pyrene	ug/kg	**5.9**	**267**	**8.1**	**465**	< 4.7	< 4.1	< 4.1	**113**	--	< 4	--	< 4.2	< 4.1
Metals														
Arsenic	mg/kg	**5.2**	**7.8**	**7.6**	**6.8**	**6.8**	**4.4**	--	**7.2**	--	**8.7**	**5.2**	**9.9**	**5.3**
Barium	mg/kg	**78.4**	**125**	**134**	**138**	**128**	**108**	--	**134**	--	**82.3**	**112**	**159**	**150**
Cadmium	mg/kg	< 0.55	< 0.56	< 0.54	< 0.52	< 0.67	< 0.49	--	< 0.67	--	< 0.54	< 0.53	< 0.56	< 0.59
Chromium	mg/kg	**18.9**	**14.1**	**13.8**	**10.8**	**33.6**	**12.8**	--	**18.1**	--	**13.7**	**13.5**	**15.6**	**16.3**
Lead	mg/kg	**7.8**	**14**	**12.5**	**53.4**	**11**	**6.9**	--	**151**	--	**17.1**	**7.9**	**13**	**6.8**
Mercury	mg/kg	< 0.042	**0.061**	< 0.051	**0.35**	**0.073**	< 0.047	--	**0.17**	--	< 0.033	< 0.055	**0.057**	< 0.051
Selenium	mg/kg	< 1.7	< 1.7	< 1.6	< 1.6	< 2	< 1.5	--	< 2	--	< 1.6	< 1.6	< 1.7	< 1.8
Silver	mg/kg	< 0.78	< 0.79	< 0.76	< 0.73	< 0.94	< 0.68	--	< 0.93	--	< 0.76	< 0.74	< 0.79	< 0.83

Legend

- Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Column
- Storage Tank

Drawn By: CCC

Approved by: EMW

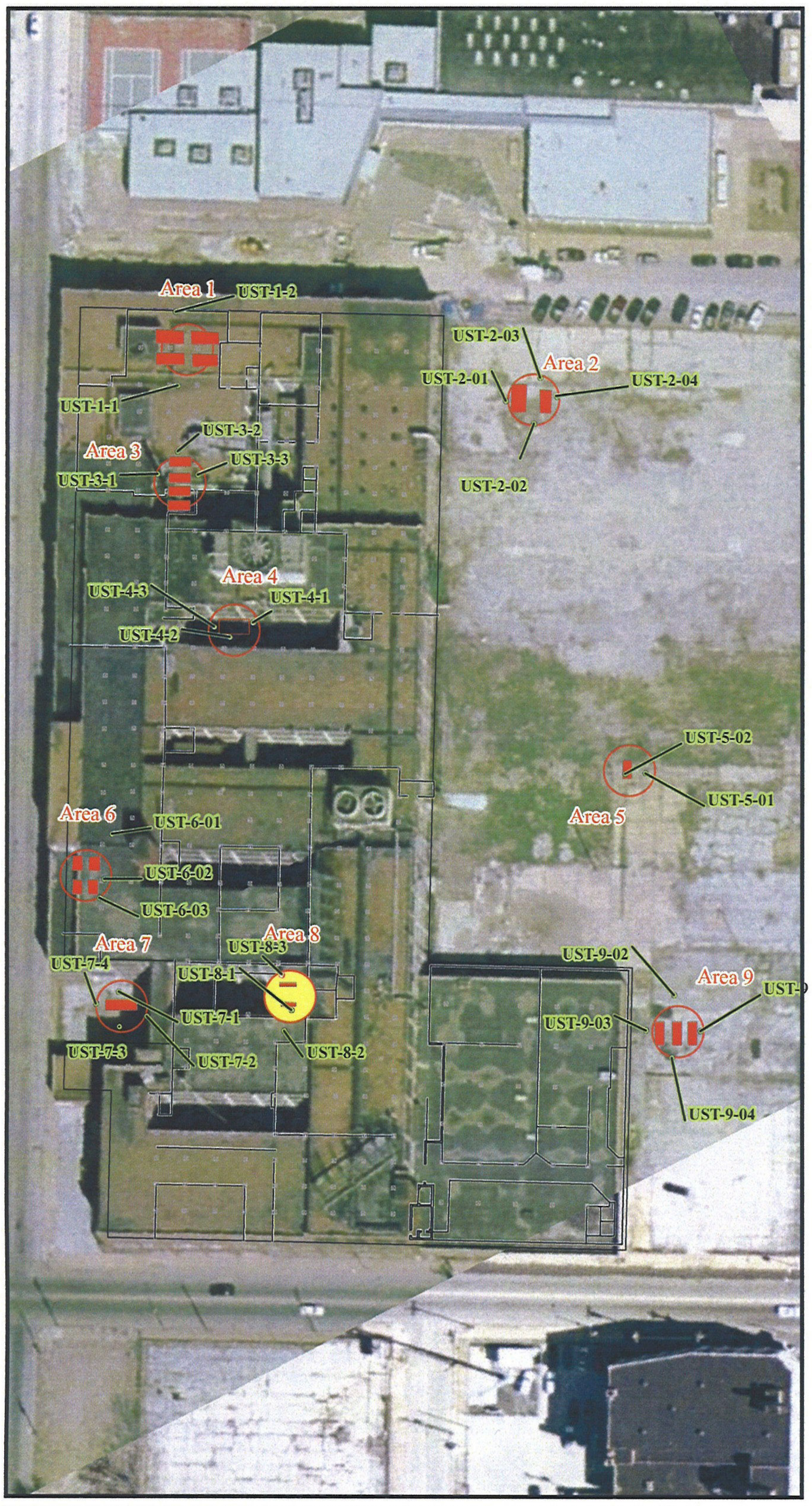
Checked By: CLT

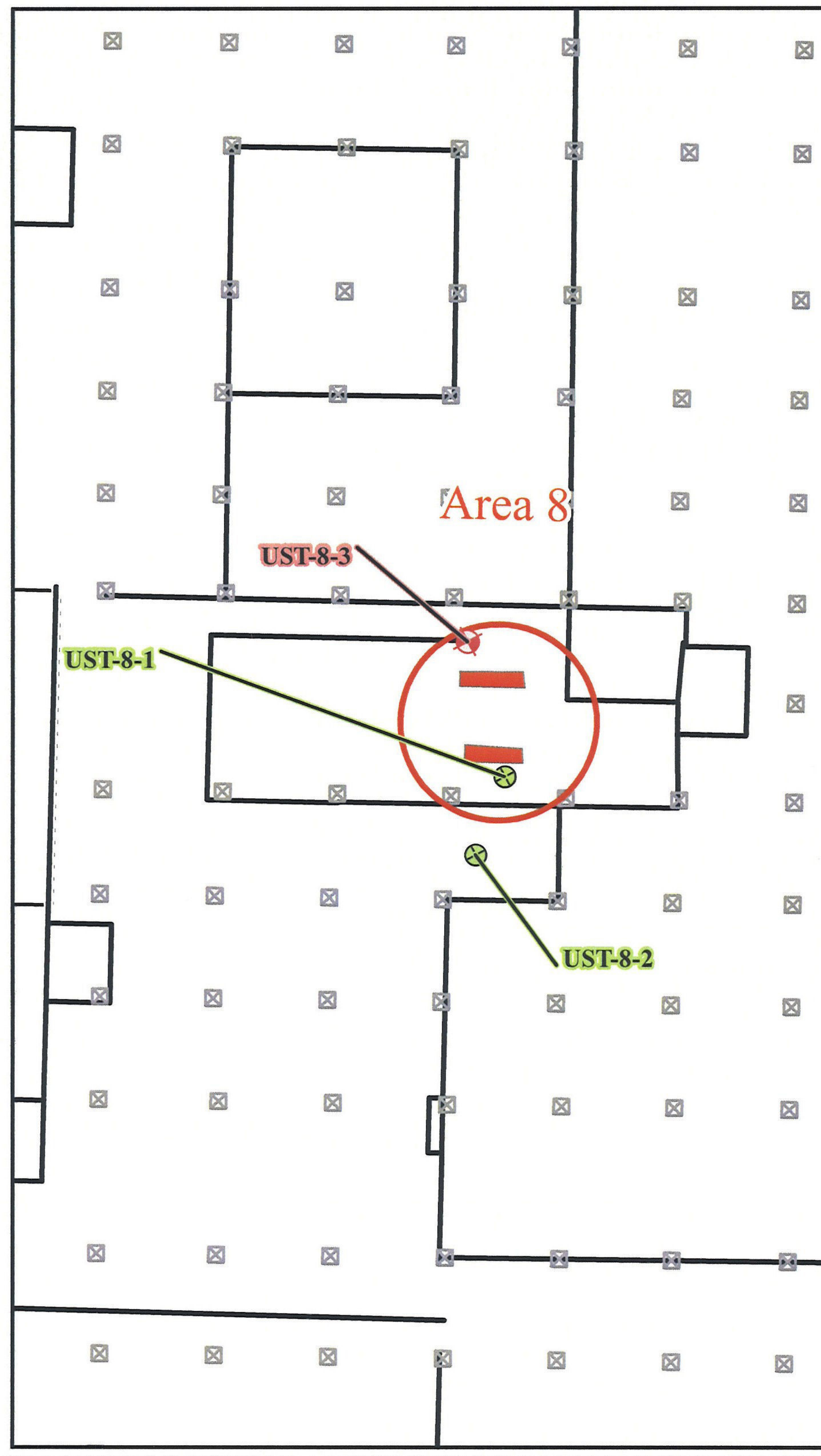
Date: January 14, 2008

MACTEC

Figure 2-11: UST Area #7 Soil Sample Analytical Results Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_7.mxd





Parameter	Units	UST-8-1-1	UST-8-1-10	UST-8-1-17	UST-8-1-23	UST-8-2-10	UST-8-2-18	UST-8-2-2	UST-8-2-24	UST-8-3-1	UST-8-3-10	UST-8-3-15	UST-8-3-22
Volatile Organic Compounds													
Benzene	ug/kg	< 5.7	< 5.8	< 4.6	< 5.5	< 6.2	< 4.8	< 5.3	< 5.9	< 5.1	< 5.3	< 6.1	< 5
Ethylbenzene	ug/kg	< 5.7	< 5.8	< 4.6	< 5.5	< 6.2	< 4.8	< 5.3	< 5.9	< 5.1	< 5.3	< 6.1	< 5
Naphthalene	ug/kg	< 22.8	< 23.4	< 18.3	< 22	< 24.7	< 19.3	< 21	< 23.8	< 20.5	< 21.2	< 24.4	< 20
Toluene	ug/kg	< 5.7	< 5.8	< 4.6	< 5.5	< 6.2	< 4.8	< 5.3	< 5.9	< 5.1	< 5.3	< 6.1	< 5
Xylenes, Total	ug/kg	< 11.4	< 11.7	< 9.1	< 11	< 12.4	< 9.7	< 10.5	< 11.9	< 10.3	< 10.6	< 12.2	< 10
Total Petroleum Hydrocarbons (TPH)													
TPH - Diesel Range Organics	mg/kg	**82**	< 18.7	< 17.9	**39.3**	< 18.5	< 18.1	< 19	< 20.2	**34.4**	< 18.4	**456**	**64.9**
TPH - Gasoline Range Organics	mg/kg	< 0.57	< 0.58	< 0.46	**0.59**	< 0.62	< 0.48	< 0.53	< 0.59	< 0.51	< 0.53	**9.7**	< 0.5
TPH - Oil Range Organics	mg/kg	**276**	**32.2**	< 17.9	**114**	< 18.5	< 18.1	< 19	< 20.2	**132**	< 18.4	**25.7**	< 18.7

Legend

- ⊕ Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Column
- Storage Tank

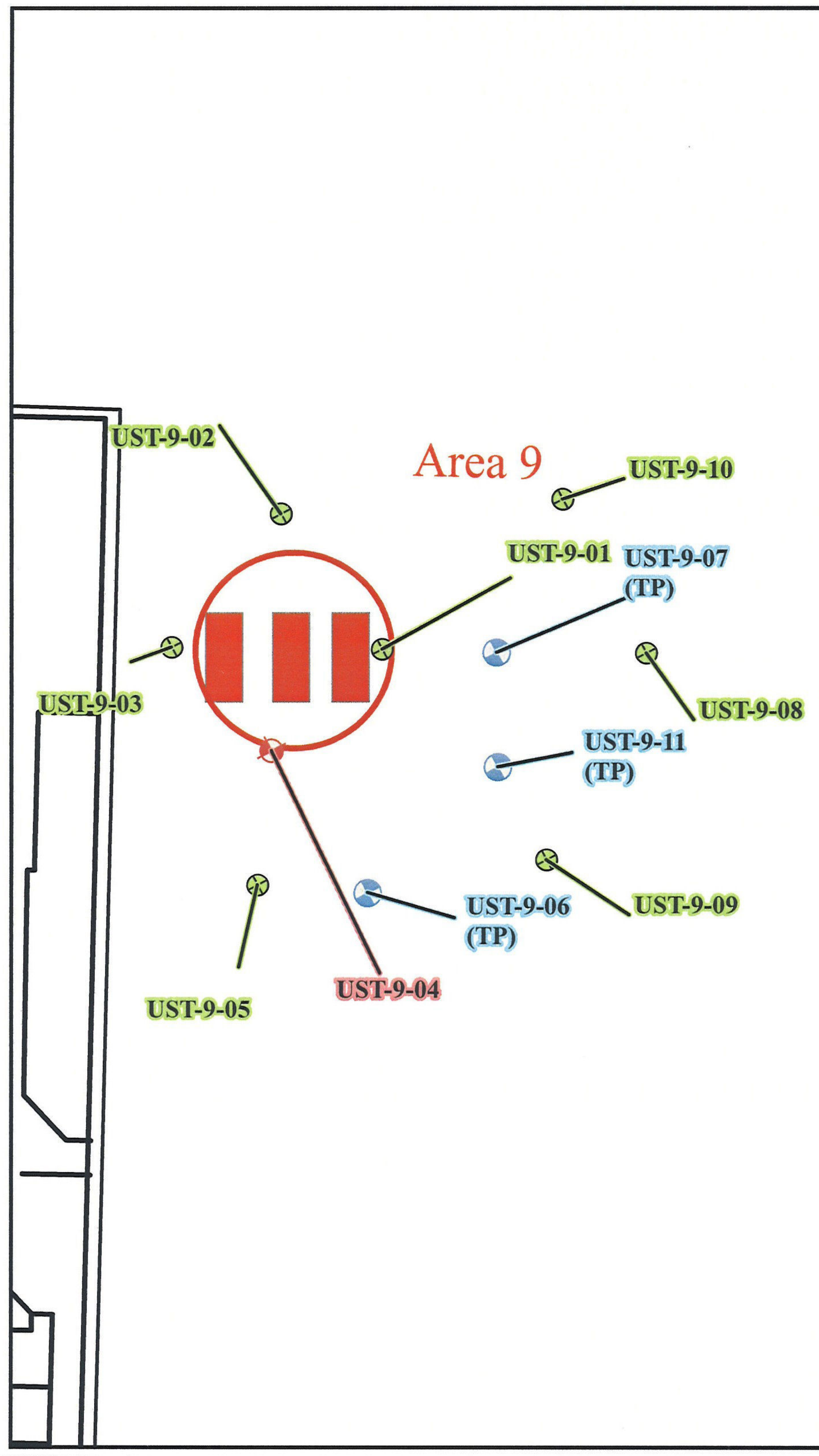
Drawn By: CCC | Approved by: EMW

Checked By: CLT | Date: January 14, 2008

MACTEC

Figure 2-12: UST Area #8 Soil Sample Analytical Results Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_8.mxd



Parameter	Units	UST-9-01-12	UST-9-01-2	UST-9-01-22	UST-9-01-8	UST-9-02-18	UST-9-02-18 DUP	UST-9-02-24
Volatile Organic Compounds								
Benzene	ug/kg	< 5.9	< 7.5	< 5.4	< 718	< 552	< 275	< 5.1
Bromobenzene	ug/kg							
Ethylbenzene	ug/kg	< 5.9	< 7.5	**6.5**	**J 164**	< 552	**J 202**	< 5.1
Naphthalene	ug/kg	< 23.5	< 4.7	**356**	**J 1,490**	< 2210	**J 61.1**	< 20.4
Toluene	ug/kg	< 5.9	< 7.5	< 5.4	< 718	< 552	**J 188**	< 5.1
Xylenes, Total	ug/kg	< 11.7	< 15	< 10.9	< 1440	< 1100	**J 160**	< 10.2
Total Petroleum Hydrocarbons (TPH)								
TPH - Diesel Range Organics	mg/kg	--	--	--	--	--	--	--
TPH - Gasoline Range Organics	mg/kg	**173**	< 0.75	**604**	**1,340**	**1,160**	**855**	**2.4**
TPH - Oil Range Organics	mg/kg	--	--	--	--	--	--	--
Semi-Volatile Compounds								
Acenaphthene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	< 4	< 4.3
Acenaphthylene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	< 4	< 4.3
Anthracene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	< 4	**6.8**
Benzo(a)Anthracene	ug/kg	< 4.2	**9.7**	< 44.1	< 44	< 4	**5.8**	**17.5**
Benzo(a)Pyrene	ug/kg	< 4.2	**10.2**	< 44.1	< 44	< 4	**4.7**	**12.5**
Benzo(b)Fluoranthene	ug/kg	< 4.2	**22.5**	< 44.1	< 44	**7**	**11.3**	**30.1**
Benzo(g,h,i)Perylene	ug/kg	< 4.2	**6**	< 44.1	< 44	< 4	< 4	**4.8**
Benzo(k)Fluoranthene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	< 4	< 4.3
Chrysene	ug/kg	< 4.2	**10.7**	< 44.1	< 44	< 4	**5.4**	**14.3**
Dibenzo(a,h)Anthracene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	< 4	< 4.3
Fluoranthene	ug/kg	**4.6**	**21.6**	< 44.1	< 44	**7.9**	15	**25.2**
Fluorene	ug/kg	< 4.2	< 4.7	< 44.1	< 44	< 4	**6.4**	< 4.3
Indeno(1,2,3-cd)Pyrene	ug/kg	< 4.2	**6.9**	< 44.1	< 44	< 4	< 4	**5.4**
Phenanthrene	ug/kg	**6.3**	**15**	< 44.1	< 44	**6**	**12.5**	**20.2**
Pyrene	ug/kg	**5.3**	**20.8**	< 44.1	< 44	**9.1**	**15.9**	**29.3**

Parameter	UST-9-02-3	UST-9-02-7	UST-9-03-12	UST-9-03-21	UST-9-03-8	UST-9-04-12	UST-9-04-18	UST-9-04-24	UST-9-04-8	UST-9-04-8 DUP
Volatile Organic Compounds										
Benzene	< 12.8	< 285	< 574	< 486	< 250	< 281	< 5.2	< 4.2	< 722	< 269
Bromobenzene										
Ethylbenzene	< 12.8	< 285	< 574	**J 255**	< 250	**J 118**	< 5.2	< 4.2	< 722	**J 147**
Naphthalene	< 51.1	< 1140	**J 549**	**395**	**J 138**	< 1120	< 20.7	< 16.8	**J 2250**	**910**
Toluene	< 12.8	< 285	< 574	< 486	< 250	< 281	< 5.2	< 4.2	< 722	< 269
Xylenes, Total	< 25.6	< 569	< 1150	< 971	< 499	**J 93.7**	< 10.3	< 8.4	< 1440	**J 117**
Total Petroleum Hydrocarbons (TPH)										
TPH - Diesel Range Organics	--	--	--	--	--	--	--	--	--	--
TPH - Gasoline Range Organics	< 1.3	**545**	**1,040**	**1020**	**272**	**1,070**	**0.71**	< 0.42	**1,600**	**4,110**
TPH - Oil Range Organics	--	--	--	--	--	--	--	--	--	--
Semi-Volatile Compounds										
Acenaphthene	**169**	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Acenaphthylene	**36.5**	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Anthracene	**461**	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Benzo(a)Anthracene	**2,000**	**7.2**	< 4.2	< 4.2	< 4.2	**599**	**6.3**	**4.9**	**76**	**68.1**
Benzo(a)Pyrene	**1,750**	**5.5**	< 4.2	< 4.2	< 4.2	**688**	**6.8**	**6**	**95.4**	**80.7**
Benzo(b)Fluoranthene	**4,570**	**13**	< 4.2	< 4.2	**8.5**	**1,770**	**18.5**	**14.5**	**225**	**186**
Benzo(g,h,i)Perylene	**492**	< 4.4	< 4.2	< 4.2	< 4.2	**353**	< 4.4	< 4	**54**	< 45.4
Benzo(k)Fluoranthene	< 4.1	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Chrysene	**2,090**	**8.5**	< 4.2	< 4.2	< 4.2	**694**	**7.6**	5.8	**90.4**	**83.5**
Dibenzo(a,h)Anthracene	< 4.1	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Fluoranthene	**5,230**	**21.8**	< 4.2	< 4.2	**4.8**	**1,310**	**16.4**	**12.3**	**188**	**158**
Fluorene	**119**	< 4.4	< 4.2	< 4.2	< 4.2	< 208	< 4.4	< 4	< 38.9	< 45.4
Indeno(1,2,3-cd)Pyrene	**559**	< 4.4	< 4.2	< 4.2	< 4.2	**379**	**4.7**	< 4	**60.6**	**47.5**
Phenanthrene	**2,050**	**8.4**	< 4.2	< 4.2	< 4.2	**596**	**8.9**	**7.1**	**140**	**94.1**
Pyrene	**3,040**	**21.6**	< 4.2	< 4.2	**5.4**	**1,260**	**16.2**	**13.3**	**141**	**102**

Legend

- Boring Location/ Groundwater Sample/ Temporary Piezometer
- Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Storage Tank
- Column

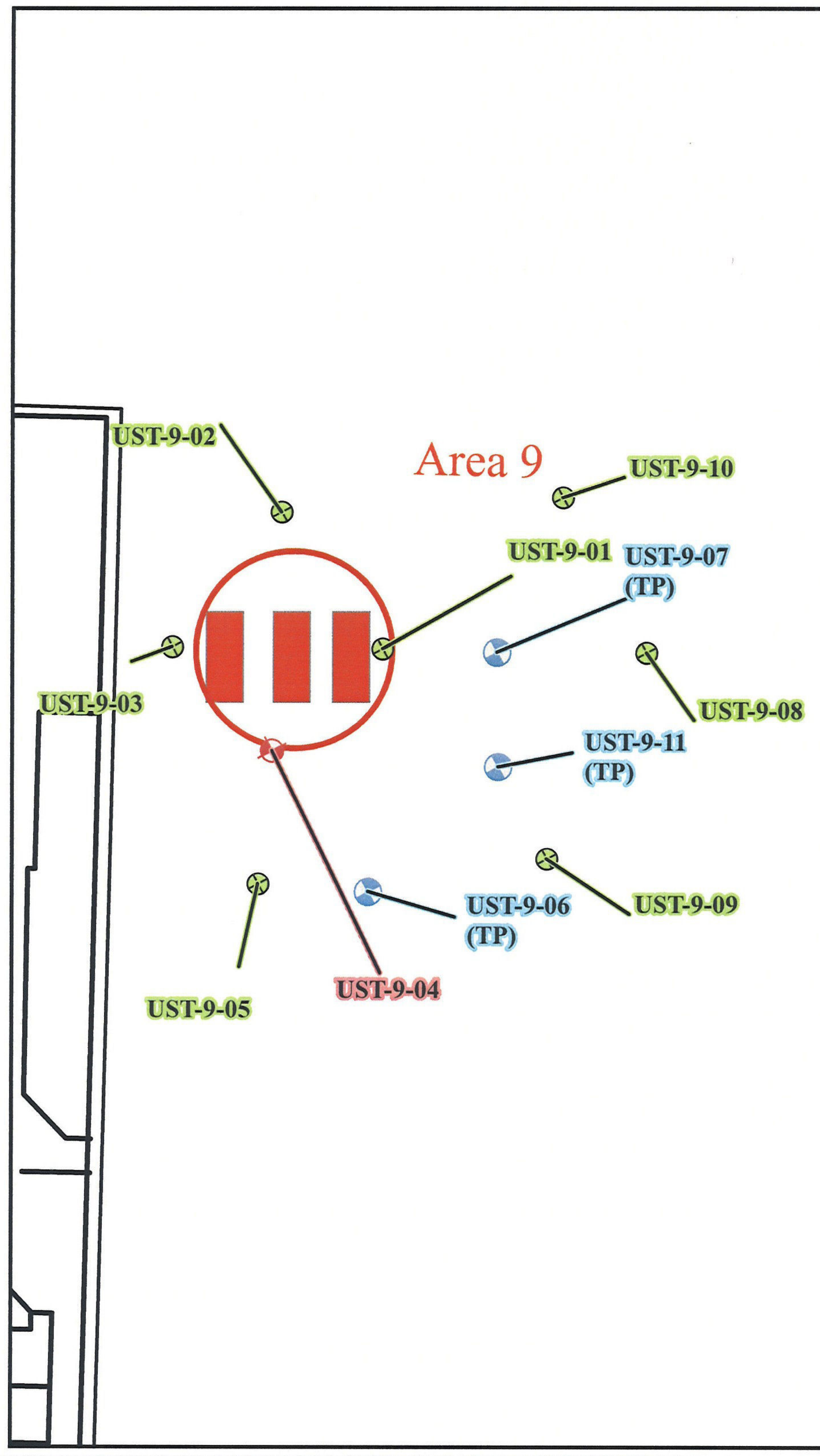
Drawn By: CCC Approved by: EMW

Checked By: CLT Date: December 10, 2007

MACTEC

Figure 2-13: UST Area #9 Soil Sample Analytical Results Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_9.mxd



Parameter	Units	UST-9-05-03	UST-9-05-12	UST-9-05-14	UST-9-05-22	UST-9-06-03	UST-9-06-06	UST-9-06-15	UST-9-06-24
Volatile Organic Compounds									
Benzene	ug/kg	< 5.3	< 7.1	< 4.3	< 5.2	< 5.4	< 5.2	< 5.2	< 5.3
Ethylbenzene	ug/kg	< 5.3	< 7.1	< 4.3	< 5.2	< 5.4	< 5.2	< 5.2	< 5.3
Naphthalene	ug/kg	< 21.1	< 28.4	< 17.4	< 20.8	< 21.5	< 20.8	< 20.8	< 21.4
Toluene	ug/kg	< 5.3	< 7.1	< 4.3	< 5.2	< 5.4	< 5.2	< 5.2	< 5.3
Xylenes, Total	ug/kg	< 10.6	< 14.2	< 8.7	< 10.4	< 10.8	< 10.4	< 10.4	< 10.7
Total Petroleum Hydrocarbons (TPH)									
TPH - Diesel Range Organics	mg/kg	< 87.1	< 20	< 20.4	< 19.7	< 96.1	< 18.6	< 18.6	< 18.7
TPH - Gasoline Range Organics	mg/kg	< 0.53	< 0.71	< 0.43	< 0.52	< 0.54	< 0.52	< 0.52	< 0.53
TPH - Oil Range Organics	mg/kg	< 87.1	< 20	< 20.4	< 19.7	**215**	< 18.6	< 18.6	< 18.7

Parameter	Units	UST-9-09-08	UST-9-09-12	UST-9-10-16	UST-9-10-18	UST-9-10-22	UST-9-11-08	UST-9-11-10	UST-9-11-24
Volatile Organic Compounds									
Benzene	ug/kg	< 6.1	< 5.2	< 5.4	< 5.5	< 5.4	< 4.7	< 6.2	< 5.5
Ethylbenzene	ug/kg	< 6.1	< 5.2	< 5.4	< 5.5	< 5.4	< 4.7	< 6.2	< 5.5
Naphthalene	ug/kg	< 24.5	< 20.9	< 21.5	< 21.9	< 21.4	< 19	< 24.6	< 22.1
Toluene	ug/kg	< 6.1	< 5.2	< 5.4	< 5.5	< 5.4	< 4.7	< 6.2	< 5.5
Xylenes, Total	ug/kg	< 12.2	< 10.5	< 10.8	< 10.9	< 10.7	< 9.5	< 12.3	< 11
Total Petroleum Hydrocarbons (TPH)									
TPH - Diesel Range Organics	mg/kg	< 21.5	< 18.6	< 19.6	< 19.6	< 19.3	**486**	< 18.4	< 18.5
TPH - Gasoline Range Organics	mg/kg	< 0.61	< 0.52	< 0.54	< 0.55	< 0.54	< 0.47	< 0.62	< 0.55
TPH - Oil Range Organics	mg/kg	< 21.5	< 18.6	< 19.6	< 19.6	< 19.3	< 17.5	< 18.4	< 18.5

Parameter	Units	UST-9-07-03	UST-9-07-11	UST-9-07-16	UST-9-07-18	UST-9-07-23	UST-9-08-16	UST-9-08-18	UST-9-08-24
Volatile Organic Compounds									
Benzene	ug/kg	< 6.4	< 5.6	< 5.4	< 5.4	< 276	< 5.2	< 5.3	< 5
Ethylbenzene	ug/kg	< 6.4	< 5.6	< 5.4	< 5.4	< 276	< 5.2	< 5.3	< 5
Naphthalene	ug/kg	< 25.8	< 22.5	< 21.8	< 21.5	< 1100	< 20.7	< 21.2	< 20.1
Toluene	ug/kg	< 6.4	< 5.6	< 5.4	< 5.4	< 276	< 5.2	< 5.3	< 5
Xylenes, Total	ug/kg	< 12.9	< 11.3	< 10.9	< 10.8	< 552	< 10.3	< 10.6	< 10
Total Petroleum Hydrocarbons (TPH)									
TPH - Diesel Range Organics	mg/kg	< 19.3	< 19.4	< 19.4	< 19.5	< 18.5	< 19	< 18.8	**200**
TPH - Gasoline Range Organics	mg/kg	< 0.64	< 0.56	< 0.54	< 0.54	**257**	< 0.52	< 0.53	**1**
TPH - Oil Range Organics	mg/kg	< 19.3	< 19.4	< 19.4	< 19.5	< 18.5	< 19	< 18.8	< 18.7

Legend

- Boring Location/ Groundwater Sample/ Temporary Piezometer
- Boring Location
- Boring Location/ Small Diameter Monitoring Well
- Storage Tank
- Column

Drawn By: CCC

Approved by: EMW

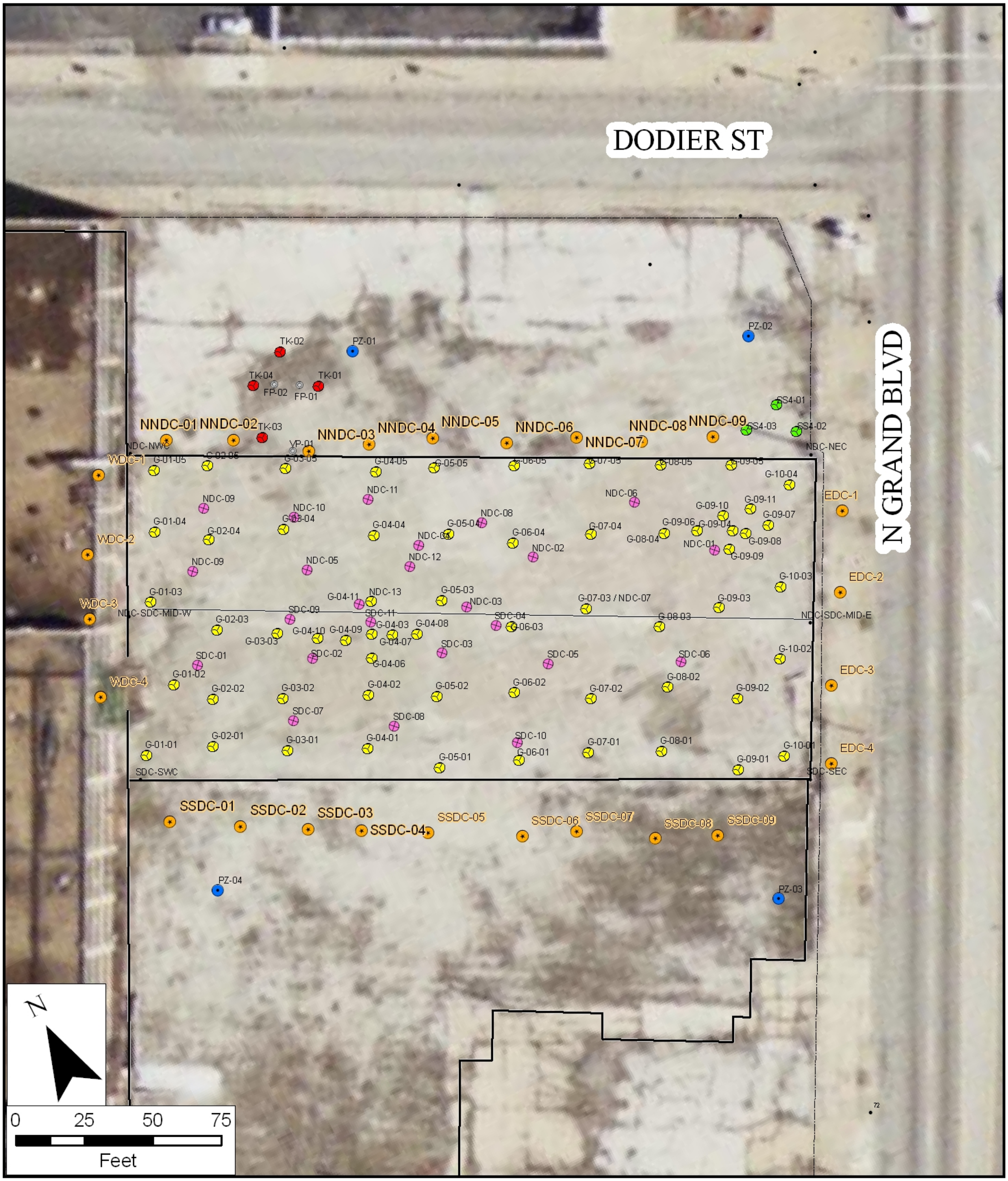
Checked By: CLT

Date: December 10, 2007

MACTEC

Figure 2-14: UST Area #9 Additional Soil Sample Analytical Results Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\UST\UST_9.mxd



Legend

- North & South Diecast Building Soil Boring
- Former Tank Location Soil Boring
- Substation #4 Soil Boring
- North & South Die Cast Building Concrete Core Sample
- Piezometer
- Fill / Vent Pipe
- North & South Die cast Building Boundary Point

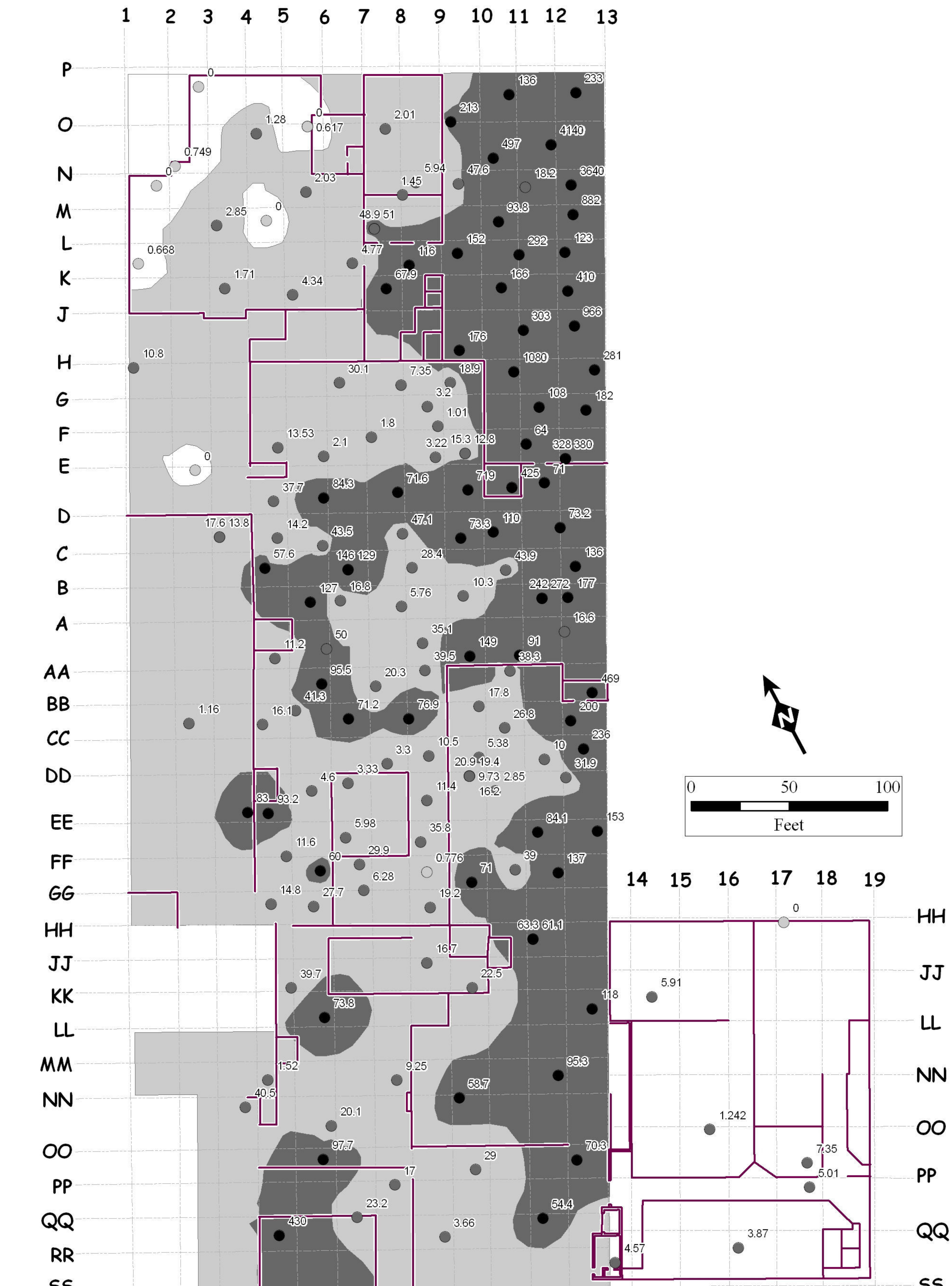
Drawn By: BSM Approved by: EMW

Checked By: CGS Date: October 24, 2005

MACTEC

Figure 2-15: Former Die Cast Area Concrete and Soil Sample Locations, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\fig3-1_boring-and- coring-loc.mxd



*Note: Brick chip samples collected surface to 1" depth.
PCB aroclors with no detections are not listed.

Legend

PCB Conc.		PCB Contour	
●	<1 mg/kg	□	< 1 mg/kg
●	1 - 50 mg/kg	■	1 - 50 mg/kg
●	>50 mg/kg	■	50 mg/kg
—	1st Floorplan		
----	Grid Line		

Drawn By: CGS Approved by: EMW

Checked By: CLT March 31, 2009

MACTEC

Figure 2-16:
Extent of Bulk Concrete Contamination, First Floor, CBI and Willco Plastics Building, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\061024\090331_11x17_1st-floor-samples.mxd

*Note: Brick chip samples collected surface to 1" depth.
PCB aroclors with no detections are not listed.

Legend

PCB Conc.		PCB Contour	
○	<1 mg/kg	□	<1 mg/kg
●	1 - 50 mg/kg	■	1 - 50 mg/kg

2nd Floorplan

Grid Line

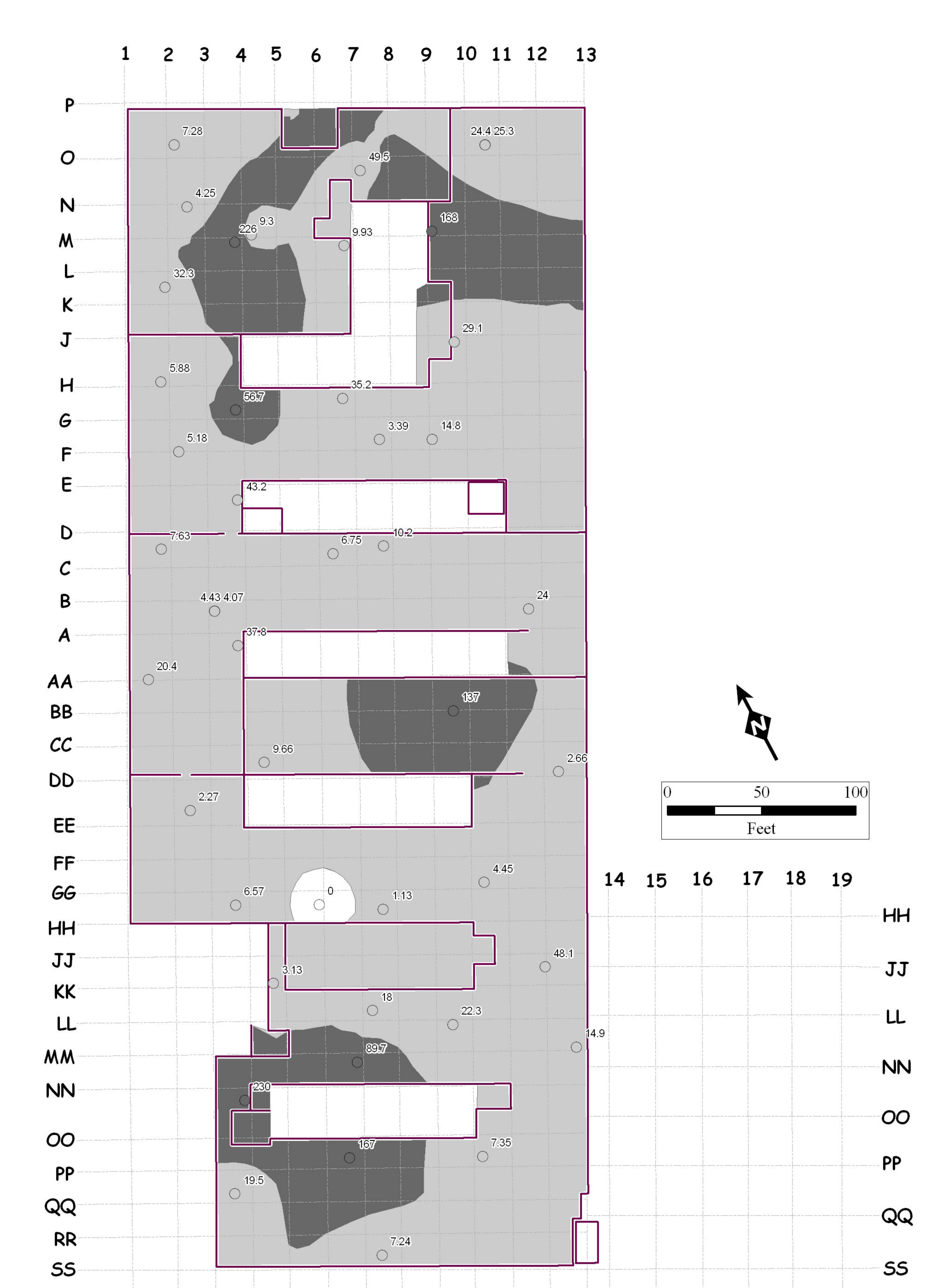
Drawn By: CGS Approved by: EMW

Checked By: CLT March 31, 2009

MACTEC

Figure 2-17: Extent of Bulk Concrete Contamination, Second Floor, CBI and Willco Plastics Building, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\061024\090331_11x17_2nd-floor-samples.mxd



*Note: Brick chip samples collected surface to 1" depth.
PCB aroclors with no detections are not listed.

Legend

PCB Conc.	PCB Contour
<1 mg/kg	< 1 mg/kg
1 - 50 mg/kg	1 - 50 mg/kg
> 50 mg/kg	> 50 mg/kg

3rd Floorplan

Grid Line

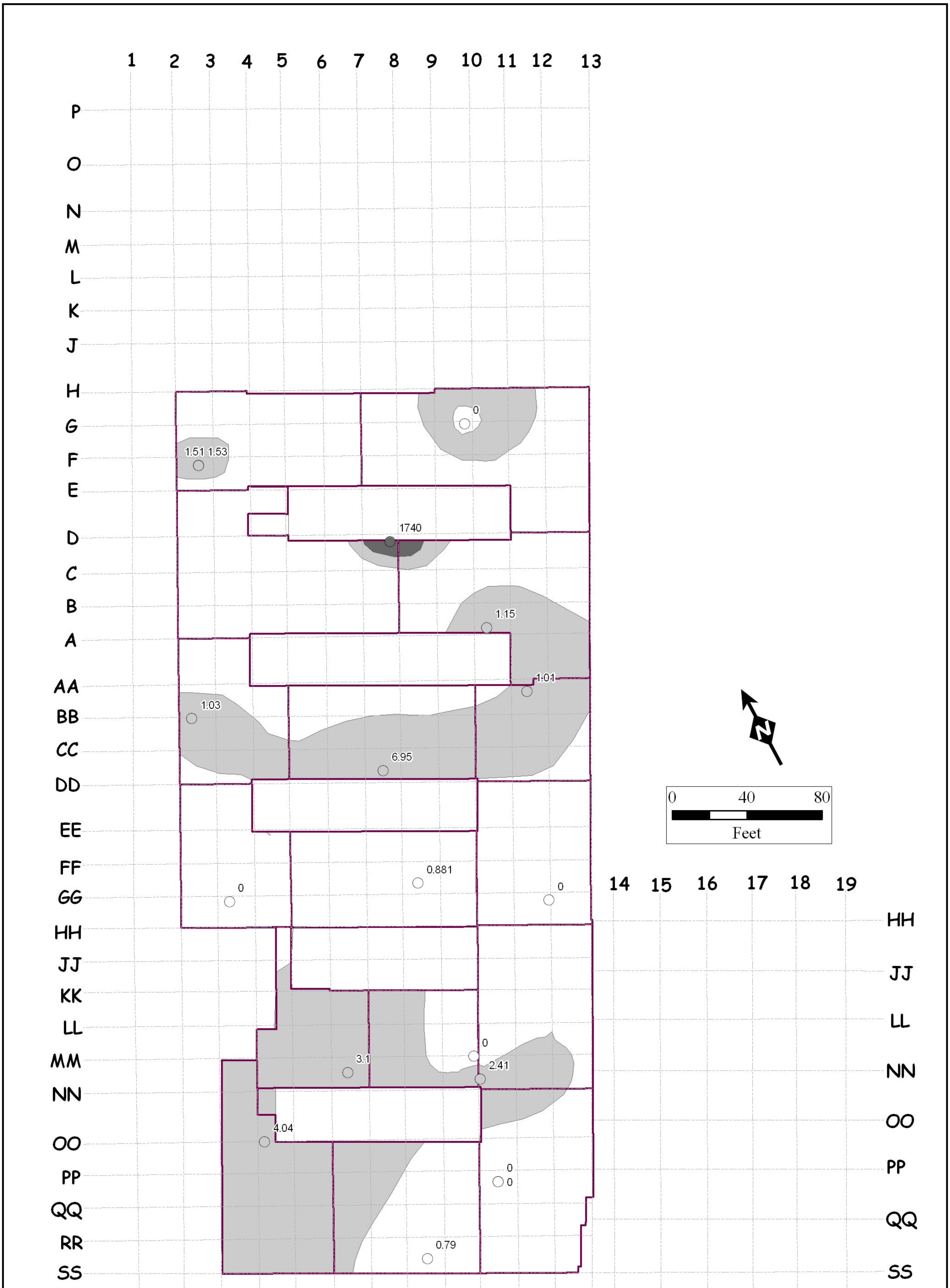
Drawn By: CGS Approved by: EMW

Checked By: CLT March 31, 2009

MACTEC

Figure 2-18:
Extent of Bulk Concrete Contamination, Third Floor, CBI Building, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\061024\090331_11x17_3rd-floor-samples.mxd



*Note: Brick chip samples collected surface to 1" depth.
PCB aroclors with no detections are not listed.

Legend

PCB Conc.	PCB Contour
<1 mg/kg	<1 mg/kg
1 - 50 mg/kg	1 - 50 mg/kg
>50 mg/kg	> 50 mg/kg

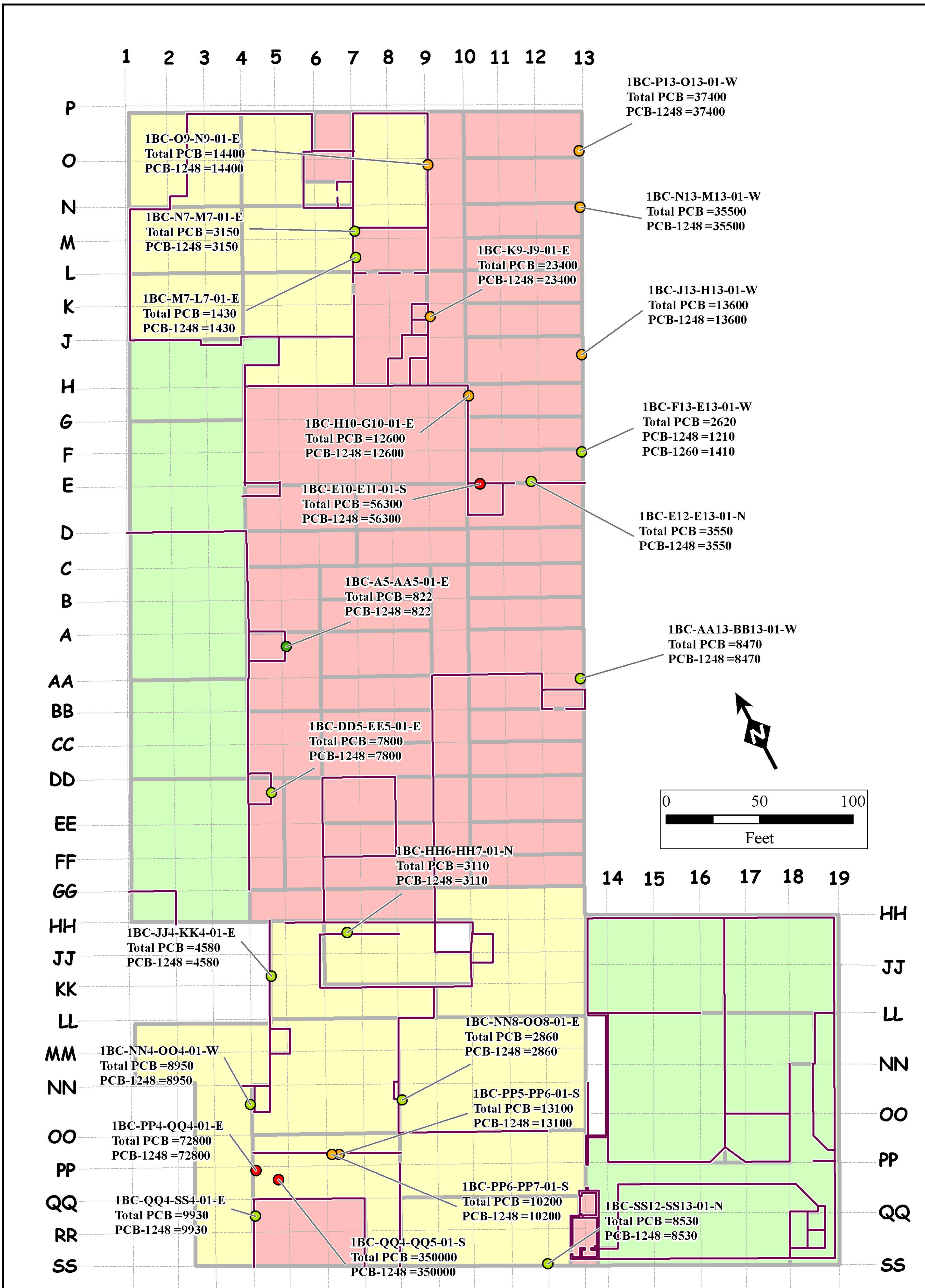
Grid Line
4th Floorplan

Drawn By: CGS Approved by: EMW
Checked By: CLT March 31, 2009

MACTEC

Figure 2-19:
Extent of Bulk Concrete Contamination, Fourth Floor, CBI Building, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\061024\090331_11x17_4th-floor-samples.mxd



*Note: Brick chip samples collected surface to 1" depth.
PCB aroclors with no detections are not listed.

Legend

Total PCB ug/Kg
- <1,000
- 1,000 - <10,000
- 10,000 - <50,000
- >50,000

1st Floorplan
Grid Line

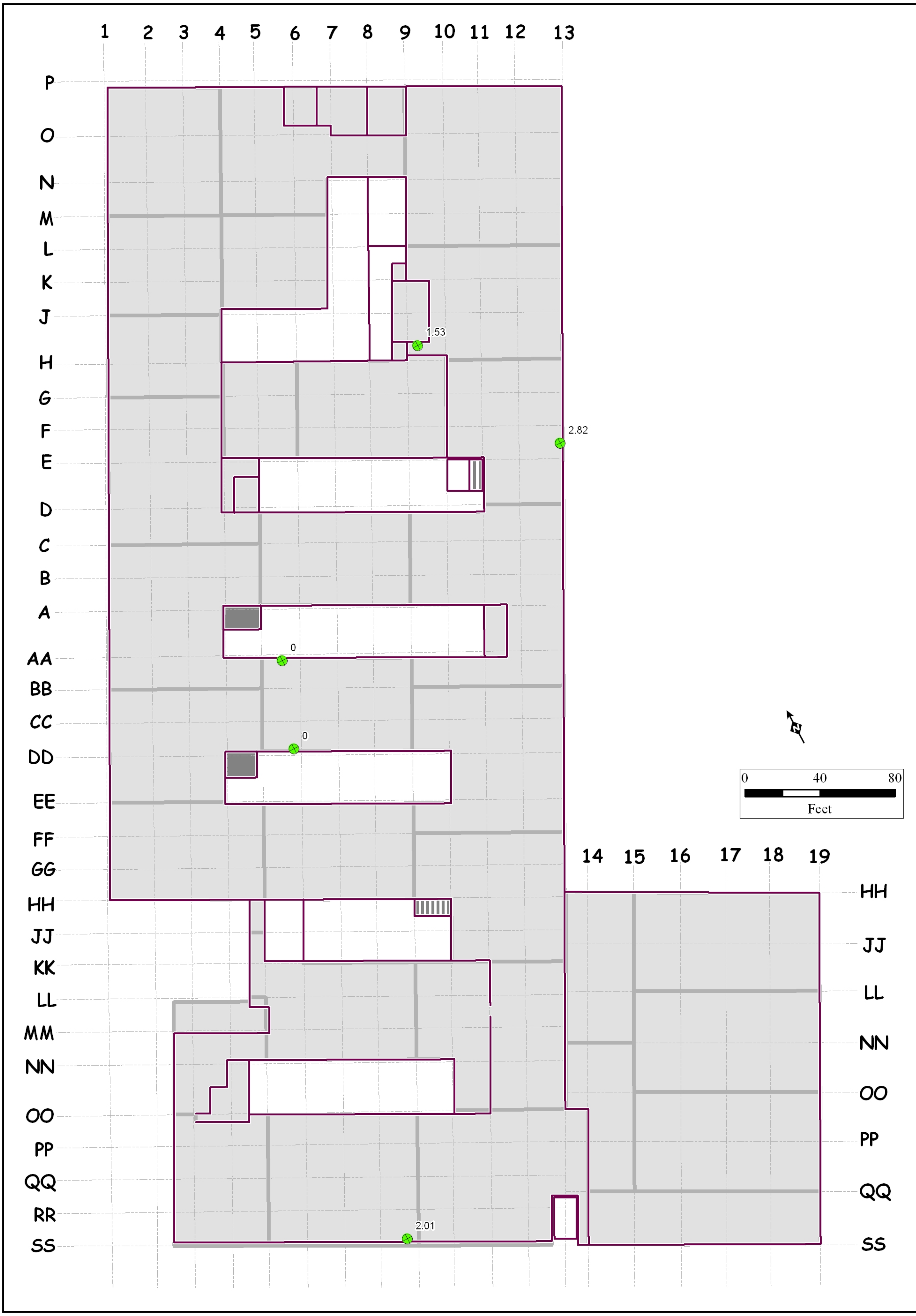
PCB Potential / Sample Area
- HIGH
- MEDIUM
- LOW

Drawn By: BSM
Approved by: EMW
Checked By: EMW
Date: October 30, 2006

MACTEC

Figure 2-20: Brick/Masonry Sample Locations, First Floor, CBI Building, Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\061024\061030_11x17_1st-floor-samples.mxd



Legend

PCB Brick/Masonry Sample (mg/kg)

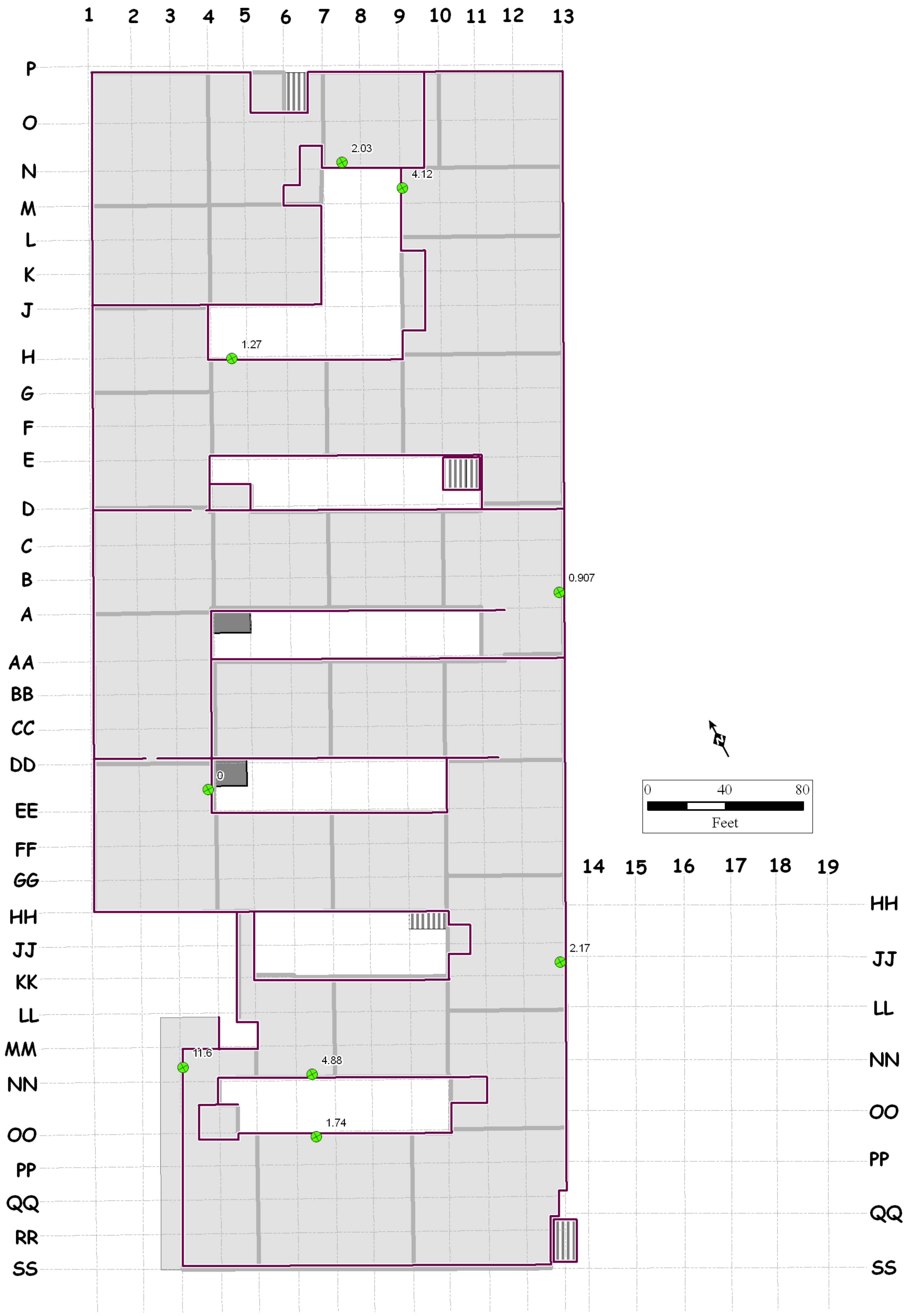
Drawn By: CGS | Approved by: EMW

Checked By: CLT | March 31, 2009

MACTEC

Figure 2-21:
Brick/Masonry Sample Locations,
Second Floor, CBI Building
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\Figure 3-6_090331_update.mxd



Legend

PCB Brick/Masonry Sample (mg/kg)

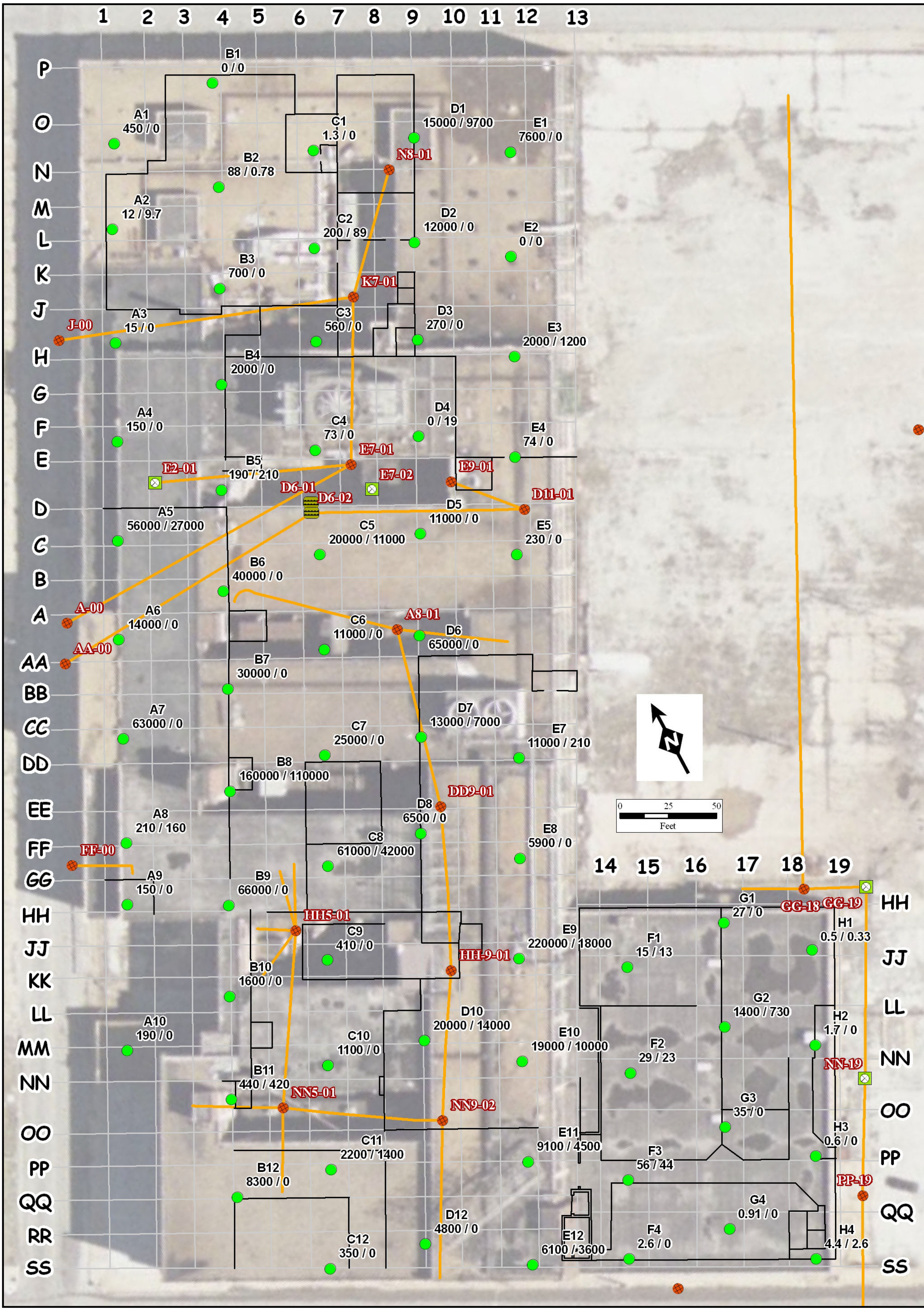
Drawn By: CGS Approved by: EMW

Checked By: CLT March 31, 2009

MACTEC

Figure 2-22:
Brick/Masonry Sample Locations,
Third Floor, CBI Building,
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\Figure 3-7_090331update.mxd



Legend

- EPA Samples (Tedlar/Summa) ppbv
- Area Inlet
- Manhole
- Vault
- Sewer Line

Original Survey: 5-29-63
Data from: 5-15-67
Plan Revised: 5-3-79
ACF Industries, Incoporated
"Carter Carburetor Division"
St. Louis, MO
Serial Number 68096
Index 69135.4

Drawn By: CGS
Approved by: EMW
Checked By: CLT
January 27, 2009

MACTEC

Figure 2-23: Sub-Slab Vapor Sampling - TCE Analysis
Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\sewer\080127_TCEvapor_sewer.mxd

Attachment 1
Streamlined Risk Evaluation

Streamlined Risk Evaluation for Former Carter Carburetor Property 2800-2840 North Spring Street St. Louis, Missouri

Prepared for:
ACF Industries, LLC
St. Louis, Missouri

Prepared by:
MACTEC Engineering and Consulting, Inc.
3199 Riverport Tech Center Drive
Maryland Heights, Missouri

February 10, 2009

MACTEC Project No. 3250055164.08

Jay Peters (by JAB with permission) 2-10-09
Jay Peters — Date
Principal Risk Assessor

Chris L. Tedder 2-10-09
Chris L. Tedder, P.G. — Date
Project Manager

MACTEC

Table of Contents

**Table of Contents
(continued)**

List of Appendices

List of Tables

Table of Contents
(continued)

List of Figures

Table of Contents (continued)

List of Acronyms and Abbreviations

ACBMs asbestos containing building materials
ACF ACF Industries, LLC
AOC Administrative Order on Consent
ARARs Applicable, Relevant, and Appropriate Requirements
ASA Administrative Settlement Agreement
AST aboveground storage tank
bgs below ground surface
BTEX benzene, toluene, ethylbenzene, and xylenes
CAL EPA California EPA
CBI Carter Building, Inc.
CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
CFR Code of Federal Regulations
cis-DCE cis-1,2-dichloroethylene
CO_2 carbon dioxide
COPC chemicals of potential concern
CSM Conceptual Site Model
DI daily intake
ECLR excess lifetime cancer risk
EE/CA Engineering Evaluation/Cost Analysis
EPC exposure point concentration
g/mol grams/mol
HEAST Health Effects Assessment Summary Tables
HHRA Human Health Risk Assessment
HI Hazard Index
HQ hazard quotient
IC Institutional Controls
IRIS Integrated Risk Information System
kg kilograms
L/kg liters per kilogram
LRA Land Reutilization Authority
MACTEC MACTEC Engineering and Consulting, Inc.
$\mu g/m^3$ micrograms per cubic meter
$\mu g/100\ cm^2$ micrograms per 100 square centimeters
mg/kg milligrams per kilogram
mg/L milligrams per liter
MSSLs media-specific screening levels
NCEA National Center for Exposure Assessment
NCP National Contingency Plan
PCB polychlorinated biphenyls
PEF particle emission factor
ppm parts per million
RAGS Risk Assessment Guidance for Superfund
RfC reference concentration
RfD reference dose
RME reasonable maximum exposure
SF Slope Factor
SRE Streamlined Risk Evaluation
SVOCs semi-volatile organic compounds
TCE trichloroethylene
trans-DCE trans-1,2-dichloroethylene
TSCA Toxic Substances Control Act
UCL upper confidence limit
UR unit risk
USEPA United States Environmental Protection Agency
UST underground storage tank
VC vinyl chloride
VOC volatile organic compounds

1.0 Introduction

This Streamlined Risk Evaluation (SRE) for the Carter Carburetor Site, located in the 2800 block of North Grand Avenue in St. Louis, Missouri ("Site"), was prepared to support the Engineering Evaluation/Cost Analysis (EE/CA) and to fulfill the obligations of the Administrative Settlement Agreement (ASA) and Order on Consent for Removal Action: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-07-2005-0372 [Administrative Order on Consent (AOC)] between ACF Industries, LLC (ACF) and the United States Environmental Protection Agency (USEPA) (USEPA, 2005). The objective of the SRE is to support removal decision making by focusing on specific problems and/or environmental threats that a removal action is designed to address (USEPA, 1993).

This SRE evaluates the potential adverse health effects to humans that may result from exposure to chemicals at the Site in the event no remedial actions are performed. In this sense, the SRE is conducted in a manner similar in concept, methodology, and procedure as the Baseline Human Health Risk Assessment (HHRA). The SRE includes the components of the Baseline HHRA, including: the exposure assessment, the toxicity assessment, and risk characterization. The ultimate results of the SRE are estimates of cumulative cancer and non-cancer risks to identified receptors that may be exposed to chemicals left in place under reasonable maximum exposure scenarios. The SRE goes further to develop remedial action goals (i.e., clean-up goals) for chemicals found to be in exceedance of acceptable risk levels. The remedial action goals will be critical elements required for use in the EE/CA to determine the most appropriate clean-up alternatives to ensure protectiveness of humans and the environment.

The SRE has been developed by primarily following the methodology presented in *Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual* (USEPA, 1989a) and *Volume II: Environmental Evaluation Manual* (USEPA, 1989b). Additional USEPA guidance documents and references for obtaining exposure parameters and toxicity information are also used and cited in the text, as appropriate.

The remaining SRE is organized into seven sections, as described below:

- **2.0 – Site Overview**. Describes the location and history of the Site, including known activities which have occurred at the Site to provide an understanding of chemical use and subsequent patterns of chemical contamination.
- **3.0 – Data Evaluation**. Given the pattern of historical chemical use at the Site, the SRE is designed to focus on those chemicals believed to be pertinent to human exposure and may require remediation. The pertinent chemicals to be evaluated are presented along with a summary of the analytical data available for use in the SRE.
- **4.0 – Exposure Assessment**. Describes all aspects of exposure including: the exposure setting, identification of exposure pathways and receptors (as demonstrated in the Site Conceptual Model), rationale for segregating the Site into exposure units, development of exposure point concentrations, and the quantification of average daily chemical intake for all chemicals, receptors, and pathways.
- **5.0 – Toxicity Assessment**. Characterizes the relationship between the dose of chemical received with the incidence of adverse health effects to receptors.

- **6.0 – Risk Characterization**. Integrates the results of the exposure and toxicity assessments into a quantitative estimation of excess cancer and noncancer risks. This section also includes a discussion of uncertainties in the risk evaluation which may have an effect of either overestimating or underestimating the risk results.
- **7.0 – Remedial Action Goals**. Describes the development of clean-up goals for those chemicals demonstrated to be present in concentrations which result in an unacceptable level of risk to potential receptors. Remedial action goals will be derived to achieve protectiveness of human health and used for further analysis in the EE/CA.
- **8.0 – Ecological Risk Evaluation.** This section discusses the presence/absence of habitat and the potential for risks to ecological receptors.
- **9.0 – References**. Presents a full list of published literature used to support the development of the SRE.

2.0 Site Overview

This Section presents an overview of the Site in order to understand the historical, current, and future site activities.

2.1 Site Location

The Carter Carburetor Site is located at 2800-2840 North Spring Street in the north-central portion of the City of St. Louis, in a mixed residential and commercial neighborhood. The surrounding area is composed primarily of medium to low income residential dwellings, with commercial development along arterial roads. The Site is located on the west side of Grand Boulevard bounded by St. Louis Avenue to the south, Dodier Street to the north, and Spring Avenue to the northwest. Figure 2-1 shows the Site location within the City of St. Louis and Figure 2-2 presents a plan view photograph of the Site. Two high schools and three elementary schools are located within a half-mile radius of the Site. The Herbert Hoover Boys and Girls Club is located to the north across Dodier Street. Residences are located west of Spring Street and east of Grand Boulevard from the Site. The Site is 80 feet in elevation above the Mississippi River and is not within the river's 100-year floodplain zone.

2.2 History of Site Activities and Ownership

The former Carter Carburetor facility was used to manufacture carburetors and other components for gasoline and diesel powered equipment. At present, the Site is occupied by a four-story manufacturing building, the Carter Building Inc. (CBI) building, which occupies the east half of the site and includes a two-story addition which is sometimes referred to as the Willco Plastics building, which is located at the southeast corner of the CBI building. The east half of the site was formerly occupied by a garage, a warehouse, the former North and South Die Cast buildings, and parking areas. The garage, warehouse, and former North and South Die Cast buildings have been removed so that only the concrete slab remains. The North and South Die Cast slab was left in place, coated with epoxy to prevent the release of polychlorinated biphenyls entrained within the concrete, and covered with three feet of limestone gravel.

Former manufacturing processes within these buildings utilized various hydraulic/lubricating oils, fuels, paints, cleaning solvents, and dielectric fluid as part of their ongoing operations. Underground storage tanks (USTs), aboveground storage tanks (ASTs), and drums were typically used to store chemical products/residues inside and outside of the buildings.

ACF owned the larger Carter Carburetor Site from the 1930s until April 26, 1985, when the entire property and buildings were conveyed to the Land Reutilization Authority (LRA) of the City of St. Louis, Missouri. During ACF's ownership, the facility was operated by the Carter Carburetor Corporation and Carter Automotive Products, both subsidiaries of ACF, which manufactured carburetors for use on gasoline and diesel powered equipment. When ACF closed the facility in 1984, the manufacturing lines were dismantled and most of the equipment was shipped to new locations or sold. At the time the property was deeded to LRA, approximately 20 transformers and undisclosed number of capacitors and switch gears, some of which contained polychlorinated biphenyl (PCB) fluids, were inspected to verify the integrity of the equipment and remained on-site for use by subsequent owners.

On April 26, 1985, LRA deeded the larger Carter Carburetor Site to Hubert and Sharon Thompson. On January 9, 1986, the Thompson's sold a portion of the larger Carter Carburetor Site to Edward Pivirotto and his wife, which consisted of the warehouse, North and South Die Cast Buildings, and the parking lot. The Pivirotto's subsequently tried, but failed, to pay the real estate taxes on the portion of the property they owned, resulting in a sheriff's sale on August 10-22, 1991. Because no substantive bids were received at the sale, the property reverted to LRA. Thus, on February, 1992, LRA became the owner of the northeastern portion of the larger Carter Carburetor Site previously owned by the Pivirotto's and the location of the North and South Die Cast Building.

Meanwhile on June 20, 1989, CBI, a Delaware Corporation (no relation to ACF or Carter Carburetor) entered into a Lease and Option to Purchase Agreement with Hubert and Sharon Thompson. On June 28, 1990, CBI provided notice to the Thompson's that CBI was exercising its right to purchase the portion of the facility owned by the Thompson's. Following the filing of a suit for breach of contract and specific performance and a subsequent foreclosure proceeding, CBI received a Trustee's Deeds under foreclosure for the facility from the Missouri Title Company, John E. O'Brien, successor Trustee in October 1991.

Three large transformers referred to as Substation #2, #3, and #4 fed the electrical requirements of the bulk of the facility. Substation #2 was located on an elevated platform within an open area of the building immediately south of the pump room, Substation #3 was located on an elevated platform between the Die Cast buildings and the CBI building, and Substation #4 was located on a rack outside of the northeast corner of the North Diecast building. These transformers were intact and functional when ACF transferred ownership of the buildings to the LRA. These transformers were later vandalized to remove their copper cores, with the dielectric fluids allowed to drain unrestricted from the transformers. The USEPA believed these spills of PCB-containing dielectric fluids accounted for the PCB concentrations of over 100,000 milligrams per kilogram (mg/kg) (parts per million [ppm] in soil). Additionally, the USEPA believed diecasting fluids from the diecasting operation resulted in PCB contamination in the former diecast buildings.

2.3 Contaminated Media

The primary contaminants released at the Site are PCBs. In addition, operations resulted in the release of trichloroethylene (TCE). The PCB-contaminated media at the Site include interior building surfaces (walls and floors), soil beneath the CBI building and beneath the former diecast building floor slab, and soil around the exterior of the CBI building. TCE contaminated media include soil adjacent to the CBI building and groundwater.

2.4 Current and Future Use and Potential Exposure Pathways

Currently, there are no activities being performed at the Site. Access to the CBI Building is controlled, the majority of the ground at the Site is paved or contaminated soil is covered with buildings or building floor slabs, and the Site is partially surrounded by a chain-link fence. Under the existing land use conditions, potentially complete exposure pathways to Site-related contamination by a trespasser are limited to infrequent contact with soil that is negligible compared to other receptors and scenarios under future land use conditions.

The future uses of the Site are proposed to be one of the following scenarios:

- An industrial/commercial setting, in which the existing building will be re-used for commercial or light industrial purposes; or
- Property transferred to the Herbert Hoover Boys and Girls Club, in which case the existing buildings will be removed and a recreational athletic (soccer) field will be constructed for adolescents.

Based on the language of the Administrative Settlement Agreement/Order on Consent (ASA/OC), the future uses of the site cannot include residential use or use as a day care.

If the building is re-used for commercial/industrial purposes, employees could be exposed to PCB contamination on interior building surfaces and to volatile organic compounds (VOCs) from groundwater via vapor intrusion. The land surrounding the building would be paved for vehicle parking with small landscaped areas; contact with soil would not be expected for employees at the facility, but might occur to landscape or maintenance workers.

If the building was removed and the Site turned into a soccer field, no exposures to interior building surfaces or to vapors that may migrate from groundwater to indoor air would occur because no building would be present. However, contaminated surface soil could be contacted by people who use and maintain the soccer field.

Under either of these two development scenarios, construction or utility workers who perform soil excavation to support construction, or who install and maintain subsurface utility lines, could be exposed to contamination in surface and subsurface soil, or to standing groundwater in excavations.

3.0 Data Evaluation

3.1 Potential Onsite Chemicals

The ASA/OC and Site historical records indicate that the following chemicals are present onsite and in concentrations which may be of concern with respect to potential human exposure:

- PCBs;
- TCE and its subsequent degradation products of cis-1,2-dichloroethylene (cis-DCE), trans-1,2-dichloroethylene (trans-DCE), and vinyl chloride (VC);
- petroleum hydrocarbons;
- asbestos containing building materials (ACBMs); and
- lead based paint.

PCBs originated from the PCB-containing oils which were used as dielectric fluids in the manufacturing process on Site. PCBs are the predominant chemical contaminant found at the Site. PCBs are a group of man-made organic chemicals which chlorinate the biphenyl molecule to varying degrees. PCBs are typically mixed with oily liquids and are found with mixtures of different compounds rather than as a single compound. In the United States, PCBs were known by a variety of industrial trade names, such as Aroclor. The Aroclor name was followed by an identifying four digit number which serves to identify the degree of chlorination of the compound. PCB Aroclors analyzed for in samples collected from the Site and included in this SRE are: 1242, 1254, and 1260.

PCBs are very stable compounds. They do not easily degrade due to temperature, aging, or microbial activity. PCBs have a high viscosity, which is a function of the extent of chlorination, and are not considered to be volatile at ambient temperature. They also have no odor in their pure form; however, an odor is typically present because PCBs are usually encountered as a mixture with other chemicals.

PCB residuals from past operations were expected to be found within the building on floors and/or walls where PCB oil spills or releases may have occurred. PCB residuals have been found on concrete walls of the first floor of the building due to drum storage, plant operations, casual transfer of PCBs due to contact, and the releases associated with the vandalizing of the former Substations. To a much lesser extent, PCB residuals have been found on the second, third, and fourth floors of the CBI building due to transfer by foot traffic as well as by hand contact during post operational periods after the sale of CBI Building by Carter Carburetor. Soil samples collected from the exterior and beneath the CBI Building and the former North and South Die Cast Buildings demonstrate PCB presence to varying degrees.

TCE is an industrial cleaning solvent reportedly used on site. TCE has been found to degrade by microbial action under primarily anaerobic conditions to cis- and trans-DCE, VC, and finally to non-toxic end-products including carbon dioxide (CO_2).

Petroleum hydrocarbons and benzene, toluene, ethylbenzene, and xylenes (BTEX) resulted from fuels (diesel fuel and gasoline) and waste oils associated with the application of dielectric fluid and other industrial oils in the manufacturing process onsite.

ACBMs were commonly used in commercial and industrial construction as fire-proofing material and are commonly found in ceiling tiles, floor tiles, pipe insulation material, and other insulating material. At the time the facility was transferred to the LRA, the building and building materials were in good condition. Due to a lack of maintenance, vandalism, and apparent abortive attempts to remediate ACBM, the ACBM has deteriorated and will require remedial action.

Lead based paint or lead bearing paint (lead content greater than 50 percent in some coatings) was commonly used in industrial settings and has been found within the paint at the facility. Due to a lack of maintenance, the condition of the lead based paint has deteriorated.

The purpose of this SRE is to evaluate health risks associated with potential exposures to Site-related constituents, which primarily include PCB Aroclors 1242, 1254, and 1260, as well as TCE and its subsequent degradation products. The evaluation of risks posed by asbestos, lead based paint, and petroleum hydrocarbons is not a part of the scope of this SRE. The remediation of the ACBM and lead based paint will be assessed during the preparation of the EE/CA. The assessment of petroleum hydrocarbons present at the site took place concurrent with the collection of site characterization data and a "No Further Action" letter with respect to the regulated underground storage tanks (USTs) has been issued by the Missouri Department of Natural Resources.

3.2 Sample Collection and Analysis

Multiple field investigations have been performed at the Site since 2003 to characterize the nature and extent of contamination, as well as to perform a variety of inspection and cleaning type activities. Data used in this SRE has been collected during those field investigations. Descriptions of samples collected, analytical methodologies, and analytical results can be found in the following reports prepared by MACTEC Engineering and Consulting, Inc (MACTEC):

- Final Environmental Field Investigation Report for Former Carter Carburetor Site, St. Louis, Missouri Facility (August 2003);
- Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site, PCB Delineation of the North and South Diecast Buildings, St. Louis, Missouri (October 2005);
- Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data, St. Louis, Missouri (November 2006); and
- Interim Data Submission Report for the Former Carter Carburetor Site, Round 2 Field Data - 2007, St. Louis, Missouri (December 13, 2007).
- In addition, soil gas data collected by USEPA are presented in a report prepared by USEPA in November, 2008 (USEPA, 2008).

In order to characterize and delineate the nature and extent of subsurface impacts at the Site, MACTEC, at ACF's request, conducted sample collection activities in 2003, 2005, 2006, and 2007. The initial sampling event, conducted in 2003, relied upon the known history of the Site to determine the sample locations and analytes. The 2005 investigation focused on PCB impacts to the former North and South Die Cast building subsurface soils and floor. The 2006 investigations focused on impacts to subsurface soils and concrete floors within the CBI building. The 2007 investigation served primarily to fill in data gaps within the CBI building, to determine impacts to the soils near the former trichloroethylene aboveground storage tank area west of Spring Avenue, and to characterize the petroleum underground storage tank clusters on the Site.

The samples collected in 2003 were collected to provide a starting point for future investigations. The soil samples were collected at varying depths and field-screened for evidence of impact (odor, appearance, presence of VOCs) in order to determine the "worst-case" sample, which was then submitted for analysis. Some preliminary information was available to determine analytical parameters for the samples. The results of the sampling and analysis were used to refine the subsequent sampling plans. Results of this sampling indicated that the primary constituents of concern at the Site were PCBs and TCE and its associated degradation products.

The 2005 field effort was conducted to delineate the vertical and horizontal extent of PCB impacted soils below the former North and South Die Cast buildings. Fifty soil borings, on an approximate 25-foot by 25-foot grid, were installed within the footprint of the buildings. Four samples from each boring, collected at discrete intervals, were submitted for analysis of PCB content. Seven borings were installed near the former location of Substation #4 and two USTs located near the North Die Cast building. An additional eleven borings were installed within the footprint of the North and South Die Cast buildings in order to refine the delineation. Twenty-five concrete cores from the North and South Die Cast buildings were also submitted for analysis of PCB content. The sampling served to delineate the horizontal and vertical extent of PCBs in the vicinity of the Die Cast area.

The field effort conducted in 2006 served to delineate the impacts to concrete in the CBI building, to delineate subsurface impacts within the CBI building footprint, to estimate the impacts at the former TCE AST, and to estimate risks associated with transient migration of PCB impacted dust.

The concrete samples were collected primarily from the top one-inch of concrete, with discrete samples collected from a depth of 1-inch below surface to 2.5-inches below surface to determine the penetration of PCBs into the concrete. These depth specific samples were collected from approximately 20 percent of the sample locations. Each floor was divided into areas deemed likely to have been impacted, possibly impacted, and unlikely to have been impacted, with the sampling frequency greatest within areas of highest probable impact. The high probability impact areas were approximately 1,000 square feet each, with two randomly generated sample locations within each area. The medium probability impact areas were also approximately 1,000 square feet in size, with one random sample location. The lowest probability impact areas were approximately 6,000 square feet in area, with one random sample location from each area.

PCB wipe samples were collected from the interior walls of the CBI building on a semi-random basis. Areas believed to be high impact area were targeted in a similar manner as the concrete samples, with higher sampling frequency in probably high impact areas. The actual sample locations were randomly generated, with all wipe samples collected from the height above floor deemed most likely to have been impacted during past activities at the plant (approximately 30 inches to 42 inches above the floor. These samples were collected to provide a means to estimate worst case risk scenarios since the wipe sample media were concrete and brick, both porous surfaces, and the samples were biased toward impacted areas

The soil samples collected from the former TCE AST area were collected from the near surface soils, the vadose zone, and the interval immediately above refusal. These samples were analyzed for VOC content only and were a preliminary investigation of the TCE impact in the area.

In addition, sediment samples were collected from the sewers within the CBI building, which led to a sewer clean-out effort in 2007.

The sampling which took place in 2007 served to fill data gaps from the previous sampling effort, with additional wipe samples collected from the walls within the building. In addition, soil samples were collected from the UST clusters on the Site. The soil and groundwater samples collected from the UST areas were collected based on the recorded contents of the USTs, with

the analyses and sample depths in accordance with the .Missouri UST program guidelines. The results of the UST sampling program were submitted to the Missouri Department of Natural Resources Tanks Section. The analytical results were also used in the completion of this risk evaluation.

A comprehensive investigation of the TCE AST area was also conducted in 2007. The TCE AST area was sampled on a modified grid, with four samples collected form each boring in order to delineate the vertical and horizontal extent of impact to soils within the area. Based on information from the USEPA, these samples were limited to analysis for VOCs only.

In 2008 USEPA performed a soil gas study at the CBI building. The results of the soil gas investigation identified TCE and its degradation products in soil gas beneath the CBI building floor slab. Evaluation of potential exposures associated with the vapor intrusion exposure pathway is evaluated using the soil gas data with fate and transport modeling.

With the exception of the bulk concrete data, data from all of the investigations performed at the Site were used in the SRE. Specifically:

- Soil samples collected during the 2003 initial sampling activities, from various locations throughout the Site, and analyzed for VOCs, semi-volatile organic compounds (SVOCs), PCBs, and inorganics;
- Soil samples analyzed for PCB Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and 1268 (note that only Aroclors 1242, 1248, 1254, and 1260 were detected);
- Wipe samples collected from the CBI building interior and analyzed for PCB Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and 1268 (note that only Aroclors 1242, 1248, 1254, and 1260 were detected);

;

- Soil samples collected from the exterior of the CBI building near the former AST #8 and analyzed for TCE, cis-DCE, trans-DCE, and VC; and
- Groundwater samples collected at multiple locations on the Site and analyzed for organic chemicals and metals.
- Sub slab soil gas samples collected from beneath the CBI building floor slab using Tedlar Bags and Summa Canisters, and were analyzed for TCE, 1,1-DCE, cis-DCE, trans-DCE, tetrachloroethene, and VC. Soil gas samples were collected from all 76 sampling locations using Tedlar Bags, and from a subset of 27 sampling locations using Summa Canisters. The Tedlar Bag sampling data provide a greater coverage of the soil gas conditions at the Site, but the Summa Canister sampling data are generally regarded as higher data quality. Both sets of soil gas data are evaluated in the SRE.

A full list of all samples used in this SRE, including their respective sample identification numbers, sample depths, and analytical chemical results is presented in Appendix A, Table A-1.

3.3 Data Qualifiers

Qualifiers pertaining to uncertainty in the identity or the reported concentration of an analyte were assigned by the laboratories or by chemists performing data validation. Presented below are various qualifiers used in validating Site chemical data, their definitions, and an explanation of how the qualified data was used in the SRE.

Qualifier	Definition	Use of Qualified Data in the Baseline Risk Assessment

Qualifier	Definition	Use of Qualified Data in the Baseline Risk Assessment
U	The analyte was not detected above the reported laboratory method detection limit.	If the analyte was selected as a chemical of potential concern (COPC), then it was assumed to be present at one-half of the method detection limit.
J	The analyte was positively identified; however, the associated numerical value is an estimate of the concentration of the analyte.	If the analyte was selected as a COPC, it was assumed to be present at the estimated concentration.
UJ	The analyte was not detected above the reported method detection limit. However, the reported method detection limit is an estimate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte.	If the analyte was selected as a COPC, then it was assumed to be present at one-half of the method detection limit.
R	The sample results are rejected and are, therefore, unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.	R qualified data are not used in this SRE.

For a more complete discussion regarding the quality of the data used to support this SRE, please see the Data Validation Reports included in the Appendices of prior data submittals (MACTEC, 2003, 2005, 2006, and 2007). More information related to data quality can be found in the Quality Assurance Project Plan, submitted and approved by USEPA in 2005 (MACTEC, 2005).

3.4 Data Summarization

The ultimate product of data evaluation and data summarization is a set of analytical data in a form that can be used in the quantitative risk assessment. Each data set developed for the risk assessment is summarized so as to provide the following statistical descriptors:

- The ratio of the number of samples in which the constituent is detected to the total number of samples (i.e., frequency of detection);
- Range of analytical quantitation limits;
- Range of detected concentrations;
- Arithmetic mean concentration.
- Upper confidence limit on the arithmetic mean and exposure point concentration (these are discussed in Section 4.5).

The following procedures were applied when summarizing the analytical data for the HHRA:

- For samples with an original and field duplicate result, the higher of the concentrations reported in the field duplicate or original is used in the risk assessment.
- For samples in which analyte concentrations are detected outside the calibration range, and the samples are diluted and reanalyzed, only the re-analysis results are used in the risk assessment.
- When calculating the arithmetic mean concentrations, one-half the value reported as the non-detect value (usually the analytical quantitation limit) is used for results reported as not-detected.
- Only data qualified as rejected (“R”-qualified results) is excluded from the risk assessment.

- Data qualified 'U' and 'UJ' is counted as non-detects, unqualified results and results qualified as 'J' are counted as detects.

3.5 Statistical summaries of data for each of the site exposure units described in Section 3.5 are presented in Tables 3-1 through 3-7. Site Exposure Units

Given the potential for multiple future use scenarios, and to support the evaluation of multiple remedial alternatives during the EE/CA, the site is segregated into exposure units appropriate for consideration of potential future receptor exposure patterns. Soil is segregated into two populations, surface soil and subsurface soil. Surface soil is defined as the population of samples collected from the depth of 0- to 1-foot from either the natural surface or the uppermost depth just below those areas that are currently paved. Subsurface soil is defined as the population of samples collected from within the depth interval of 0 foot to 10 feet. The 10-foot depth limitation is a typical depth of soil a construction worker may be exposed to while performing trenching or excavation type activities.

To segregate the Site into meaningful areas for evaluation with respect to potential future use and exposure patterns, the samples have been segregated into the following areas:

- **Soils Under the CBI Building** – Locations of samples collected from this area are shown on Figure 3-1. They were collected from under the CBI Building. One of the potential future use scenarios considers removal of the CBI Building. If this occurs, the soils under the building may be available for exposure. If the building is left in-place, no exposures to these soils would occur. Soil samples were collected from intervals 0 to 1-foot below the building and greater than 1 foot below the building.
- **Die Cast Building Area** – Locations of samples collected from this area are shown on Figure 3-2. They were collected from under the concrete slab of the area where the Die Cast Building was formerly located. This area has been segregated into one exposure unit as concentrations of PCBs are substantially greater here than at other locations on the Site, and because potential exposures to soil at this area could only occur if the building slab was removed. A close up of this area is shown on Figure 3-3 to allow for a presentation of sample location identifications. Soil samples were collected from intervals 0- to 1-foot below the beneath the floor slab and greater than 1-foot below the building floor slab.
- **Exterior Soils** – Locations of samples collected from this area are shown on Figure 3-2. They are located exterior to the CBI Building. One of the potential use scenarios is leaving the CBI Building intact with only the exterior locations available for potential exposure. Since these soils are not covered by buildings, there is a greater potential for exposure to these soils than to soils beneath the CBI Building or Die Cast Building floor slab. A close up of this area is shown on Figure 3-3 to allow for a presentation of sample location identifications. The site investigation soil samples collected in 2003 from various areas at the facility were grouped in the exterior soils data set because they are located outside of any buildings or other discrete areas of the Site. The 2003 investigation samples were all associated with sampling depths greater than 1-foot bgs and were therefore included as subsurface soil samples.
- **TCE Impacted Area** – Locations of samples collected from this area are shown on Figure 3-4. They were collected from the portion of the Site that had been impacted from the AST #8. This area has been segregated as an individual exposure unit as it is not known to be impacted by PCBs, but only the TCE solvent solution from former AST #8. This area is also geographically separated from the other soil exposure areas

at the Site. Soil samples were collected from 0- to 1-foot bgs and greater than 1-foot bgs depth intervals.

- **Interior Building Surfaces** – Wipe samples collected from the interior of the CBI Building have been segregated by floor (Floor 1 through 4), the stairwells, and the pump room. Wipe samples are segregated by floor because it is thought to be more likely that future receptors working in the building will be assigned to offices on specific floors, rather than having full access to the entire building. Locations of wipe samples are shown on Figures 3-5 through 3-8 for the individual floors and the stairwell locations matching those floors. Samples collected from the pump room are presented on Figure 3-9.
- **Groundwater** – Groundwater samples were collected and analyzed for the presence of organic chemicals and metals that may have originated in the Site ASTs and USTs. Groundwater sample analytical data was grouped together as one exposure unit because potential exposures to discrete locations (e.g., individual wells) would not occur. Locations of piezometers and wells from which groundwater samples were collected are shown on Figure 3-10.
- **Soil Gas** – Soil gas samples were collected and analyzed for the presence of chlorinated VOCs that may have originated in the Site ASTs, USTs, or from within the CBI building. Soil gas data were collected from beneath the CBI building and from beneath the former building floor slab on the west side of the CBI building. Sample locations are shown in Figure 3-11. Soil gas data were grouped as follows: CBI building grids A through E; CBI building grids F through H; former building floor slab (grids LA though LC). The CBI building was segregated into two exposure units because the soil gas concentrations in grids A through E were much higher than in grids F through H. In addition, grids A through E represent the largest contiguous area of the building, whereas grids F through H are in a smaller, adjacent section of the building (Figure 3-11). There are no complete exposure pathways to soil gas that was collected from beneath the former building slab. This area is adjacent to the TCE Impacted Area, and the highest soil gas concentrations were recorded at a location immediately adjacent to the TCE Impacted Area (location LA1-SG). The TCE Impacted area is evaluated for potential exposures to VOCs via direct contact and inhalation pathways. Therefore, the soil gas data for grids LA through LC are presented, but no quantitative evaluation of that data has been performed.

3.6 Identification of Chemicals of Potential Concern

Chemicals of potential concern (COPCs) are chemicals that may pose more than a *de minimis* health risk. A concentration-toxicity screening is used to reduce the number of chemicals evaluated in the risk assessment to only those that would potentially pose more than a *de minimis* health risk as described in *RAGS,* Part A (USEPA, 1989a).

3.6.1 COPC Selection Methods

The procedure used to select COPCs for the HHRA is summarized as follows:

A. Comparison to Available Screening Values

- The potential exposure pathways to groundwater include vapor intrusion, inhalation of vapors that may be released to ambient air (i.e., in an open trench excavation), and incidental contact; no exposures to groundwater will occur via potable use. In consideration of the potential exposure pathways to groundwater, VOCs are selected as COPCs in groundwater if the maximum detected concentration exceeds the USEPA Vapor Intrusion Screening Level. The Vapor Intrusion Screening Levels are taken from

Table 2C of the USEPA Draft Vapor Intrusion Guidance (USEPA, 2002c) and are protective for potential residential land use exposures to vapors that may migrate from groundwater to indoor air at a target cancer risk of 1E-06 and a target HI of 0.1 (the values presented in the table based on non-cancer effects are adjusted to 1/10th their published value for use in this COPC screening). These screening levels are conservative for application at this Site because vapor intrusion exposures would potentially occur to workers (not residents) in a commercial building (not a residential dwelling with a basement). For SVOCs and metals, the maximum detected concentrations are compared to the USEPA Region 6 media-specific screening levels for tap water (MSSLs) (USEPA Region 6, 2008), based on a target cancer risk of 1E-06 and a target HI of 0.1 (the values presented in the table based on non-cancer effects are adjusted to 1/10th their published value for use in this COPC screening). This represents a very conservative screening since potential exposures to groundwater at the Site would be negligible compared to exposures that may occur via consumption of groundwater as tapwater.

- The potential exposure pathway to soil gas is vapor intrusion. Soil gas data were not screened for COPCs; all detected chemicals were retained as COPCs and evaluated in the SRE.
- The potential exposure pathways to soil include direct contact and dust and vapor inhalation associated with non-residential land uses. In consideration of the potential exposure pathways to soil, the maximum detected concentrations are compared to the USEPA Region 6 MSSLs (USEPA, 2008). Specifically, the lower of the values for the industrial indoor or outdoor worker scenario are used. Values are based on a target cancer risk of 1E-06 and a target HI of 0.1 (the values presented in the table based on non-cancer effects are adjusted to 1/10th their published value for use in this COPC screening).
- The potential exposure pathways to interior building surfaces include direct contact and dust inhalation. The screening value used for evaluating PCBs on wipe samples collected from the interior of the CBI Building was the PCB decontamination standard value published in the Toxic Substance Control Act (TSCA) amendment of 1998 (known as the "Megarule") of 10 micrograms per 100 square centimeters (µg/100 cm^2) (USEPA, 1998). The maximum detected concentrations in wipe samples were compared to this value.

B. Elevated Detection Limits:

Some analytes were reported as detected at maximum concentrations below the COPC screening values, but were also reported as non-detect at elevated detection limits. These analytes were included as COPCs if one-half the highest non-detect exceeded the COPC screening value.

Analytes reported as non-detect in all samples were not included as COPCs. However, potential risks associated with analytes that were reported as non-detect in all samples, but with elevated detection limits, are evaluated in the uncertainty analysis.

3.6.2 COPC Section Results

The final list of COPCs in soil retained for further evaluation in the SRE includes the following chemicals in the following exposure units:

COPCs	CBI Building Exterior	Beneath the CBI Building	Former Die Cast Area	TCE Impacted Area

COPCs	CBI Building Exterior	Beneath the CBI Building	Former Die Cast Area	TCE Impacted Area
Soil Depth Interval of 0 to 1 foot				
PCB-1242			√	
PCB-1248	√	√	√	
PCB-1254				
PCB-1260		√	√	
TCE				√
VC				√
Soil Depth Interval of 0 foot to 10 feet				
PCB-1242	√		√	
PCB-1248	√	√	√	
PCB-1254			√	
PCB-1260	√	√	√	
PCE	√			
TCE				√
cis-DCE				√
trans-DCE				√
VC				√
Arsenic	√			

The COPC selection for soil is presented in Tables 3-1 through 3-4. Screening of the 2003 site investigation data against the MSSLs is presented in Appendix A. As indicated in Appendix A, arsenic, PCE, and TCE were detected in the 2003 data set at maximum concentrations that exceeded the MSSLs. However, the maximum concentration of TCE in these soils was only 1.05 mg/kg; TCE was detected at much higher concentrations in the TCE Impacted Area; risks associated with TCE at the TCE Impacted Area would conservatively represent potential risks associated with TCE in the Exterior Soils data set. Consequently, TCE was not retained as a COPC in the Exterior Soils data set.

Generally, the only reasons that analytes in the soil data sets were not retained as COPCs is because they were not detected in any of the samples. In some cases, the analytes were not detected, but the highest detection limits were greater than the MSSLs. These include PCB-1254 in Exterior Soil subsurface soil and Former Diecast Area surface soil, and cis-DCE and vinyl chloride in the TCE Impacted Area surface soil data set. However, these analytes were retained as COPCs in other media. The uncertainty analysis includes an evaluation of potential risks associated with these analytes in media in which they were not retained as COPCs.

The final list of COPCs on interior building surfaces retained for further evaluation in the SRE includes the following PCBs. The COPC selection for interior building surfaces is presented in Table 3-5:

COPCs	First Floor	Second Floor	Fourth Floor	Pump Room
PCB-1248	√	√	√	√
PCB-1260	√			√

PCB-1242 and PCB-1254 were not retained as COPCs in any of the building areas because they were not detected in any of the samples. The highest detection limits for these two PCBs in wipe samples collected from the first floor were elevated above the COPC screening level. Potential risks associated with these two COPCs are evaluated in the uncertainty analysis.

The final list of COPCs in groundwater retained for further evaluation in the SRE includes the following chemicals detected in groundwater at the Site. The COPC selection for groundwater is presented in Table 3-6:

COPCs in Groundwater	
1,3-Dichlorobenzene	Benzo(a)anthracene
Benzene	Benzo(a)pyrene
cis-1,2-Dichloroethene	Benzo(b)fluoranthene
Isopropylbenzene (cumene)	Benzo(g,h,I)perylene
p-Isopropyltoluene	Chrysene
Trichloroethylene	Indeno(1,2,3-cd)pyrene
Vinyl chloride	Phenanthrene
1,2,4-Trimethylbenzene	

The soil gas data are summarized in Table 3-7. All detected analytes were retained as COPCs; these include: 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, tetrachloroethene, trichloroethene, and vinyl chloride.

4.0 Exposure Assessment

To evaluate potential risks to human health at a given site, exposure must first be evaluated and quantified. Exposure occurs when there is contact between a human and a chemical in the environment. The purpose of this exposure assessment is to estimate the magnitude, frequency, duration, and route of the potential exposure of the human receptors to COPCs present at the Carter Carburetor Site, considering both current and future uses of the site.

4.1 Potentially Exposed Populations

Currently, no activities are occurring on the Site. While evidence of trespassing events has been observed, the frequency and duration of such on-site, unauthorized activities are deemed to be so infrequent and of such short duration that evaluating risk does not merit quantification. Moreover, a trespasser who visits the Site would not be exposed to surface soil because all contaminated soil is either covered by pavement or by building floor slabs. Therefore, no current receptors will be evaluated.

Multiple potential future receptors may be exposed to site contaminants depending on the final decision with regard to the future site land use. Therefore, as prescribed by USEPA's *RAGS*, this SRE will consider multiple potential future receptors that may be affected if no remedial actions (i.e., Site clean-up activities) are conducted. As any new future activity may require construction, including trenching, or excavation, a future construction worker has been evaluated. In the event that the CBI building will be left in place for office or light industrial activities, the industrial/commercial worker has been evaluated. The most likely future use scenario is that the property will be converted to a recreational soccer field for use by the nearby Herbert Hoover Boys and Girls Club members and staff. In summary, under the two most likely redevelopment scenarios for the property, the following populations of receptors may be present at the Site.

- The building may be left in place and used for commercial/industrial purposes:
    - Commercial/industrial workers;
    - Visitors to the commercial/industrial facility;
    - Groundskeepers/Landscape workers;
    - Construction Workers
    - Adolescent trespassers

- The buildings are removed and the Site is re-developed into a soccer field:
    - Adolescent soccer players;
    - Adult staff members;
    - Groundskeepers;
    - Visitors (spectators)
    - Construction workers
    - Adolescent trespassers

As discussed in Section 4.2, it is not necessary to quantitatively evaluate potential exposures to each of these receptor populations. Rather, potential exposures can be evaluated for the receptor populations that would incur the greatest potential exposures under each of the potentially complete exposure pathways, and risks for those receptors can then be used to conservatively represent the potential risks to the other receptor populations.

The breadth of the SRE provides quantitative evaluations in consideration of the above scenarios to understand the risks to future receptors such that appropriate remedial action goals can be derived which provide an appropriate level of protectiveness.

4.2 Conceptual Site Model and Exposure Pathways

The Conceptual Site Model (CSM) is a graphical illustration of the routes of chemical exposure from source/media to all receptors identified at the Site. The CSM for the Site is presented as Figure 4-1. As the predominant COPCs at this site are PCBs, it is important to acknowledge the expected fate of PCBs in the environment as this has an affect on the potential for exposure to receptors, as well as migration to other media or to off-site locations.

Currently, buildings or pavement cover most of the site in various states of repair. For the purposes of this SRE, and to support the need for appropriate remedial action goals for the EE/CA, future scenarios will be evaluated as if the uppermost depth interval of soil is exposed. This is in keeping with the concepts and methodologies as presented in RAGS (USEPA, 1989) and presents a more conservative and therefore protective approach.

The conceptual model for the Site indicates that PCB-impacted soil is present in soils near and surrounding the existing buildings, as well as beneath concrete floor slabs of buildings that are present or were formerly at the Site. The concrete floor slabs of buildings that have been removed (such as the former Die Cast Buildings) are presently covered with up to 3 feet of crushed limestone. The analytical data for PCBs in soil, as well as the observations of Site conditions during investigation activities, indicate that PCB-contaminated soil extends from approximately 3 feet below ground surface (bgs) (i.e., directly beneath the floor slabs) to bedrock (greater than 20 feet bgs in some areas of the Site). Some portions of the impacted area contain oil-saturated soils and free oil product. These findings suggest that vertical migration of oil has occurred within the soil column. Based on analytical results, it is difficult to ascertain if the oil encountered during the field investigation was dielectric/hydraulic (Pydraul) fluid or used motor/diesel fuel blend from historic operations at the site. The mobility of PCBs within the soil column is likely due to the oil matrix that the PCBs were present in. PCBs have a very high affinity for binding with the organic fraction of soil; the octanol-carbon coefficient (K_{oc}) of Aroclor-1242 is 3.2E+05 liters per kilogram (L/kg) (USEPA, 1996a). Therefore, in areas of the Site where the soil is not saturated with PCB-containing oil, it is unlikely that migration of PCBs within the soil column will occur.

PCBs are relatively insoluble in water; for example, the solubility limit of Aroclor-1242 is 0.3 milligrams per liter (mg/L) (ATSDR, 2000). This low solubility, combined with the very high affinity for binding with soil, suggests that PCB migration to and dissolution in groundwater would not be expected. PCBs have not been detected in the groundwater collected from Site wells, and USEPA concurred that PCB migration to groundwater is not a complete pathway at this Site.

TCE is an industrial cleaning solvent reportedly used on site. TCE has been found to degrade by microbial action under primarily anaerobic conditions to cis- and trans-DCE, VC, and finally to non-toxic end-products including carbon dioxide (CO_2). TCE and its degradation products are volatile and may also leach from soil to groundwater. The results of the various investigations performed at the Site indicate that TCE and its degradation products are present in soil in the vicinity of the TCE Impacted area, groundwater beneath the Site, and soil gas beneath the CBI Building.

PCBs and TCE (and its degradation products) in soil can be contacted directly if the contaminated soil is accessible for human contact. The exposure routes applicable to direct contact include dermal contact and incidental soil ingestion. Dermal contact exposures can occur when skin contacts the soil, the soil adheres to the skin, and contaminants are absorbed from the soil, through the skin. Incidental ingestion exposures can occur if contaminated soil is adhered to the skin (e.g., fingers), and hand-mouth activity occurs, which can transfer contaminated soil from the fingers to the mouth where it is swallowed and can be absorbed in the gastrointestinal tract.

Under the existing land use conditions, contaminated soil at the Site is generally not accessible for direct contact because it is generally located beneath pavement or beneath concrete floor slabs that are, themselves, covered with two layers of epoxy and up to 3 feet of crushed limestone. However, in the future, uses of the Site include such possibilities as leaving the building intact for industrial/commercial activities, removing the building for construction of a recreational athletic field, or the construction of structures such as parking lots. Any of these future uses may result in the potential for future receptors to be exposed to underlying PCB- or TCE-laden soil.

For this SRE, soil data is segregated into two specific depth intervals: (1) the uppermost depth interval of 0 to 1 foot represents surface soil and (2) surface plus subsurface soil to include the depth interval of 0 to 10 feet. Since the construction worker digs down from the surface to lower depths, for this receptor only, the soil chemical data for surface and subsurface samples will be pooled into one population to include samples collected from depths of 0 to 10 feet. For all other receptors, they are typically only exposed to the uppermost depth interval, surface soil (0 to 1 foot).

Soil that is exposed to the ambient air, either through an uncovered or un-vegetated surface or through soil excavation activities, can liberate dust. PCBs that are adsorbed to soil particles can migrate in wind-blown dust (fugitive dust). Presently, most of the PCB-contaminated soil at the Site is covered with concrete building slabs and clean limestone sand fill. Therefore, the dust migration pathway is incomplete under the existing land use conditions. However, if PCB-contaminated soil was to become uncovered in the future, PCBs could migrate in wind-blown dust. Humans who inhale the dust, or contact dust that has deposited on surfaces, could be exposed to PCBs.

Inhalation exposure may also result from inhaling chemicals which have volatilized. VOCs, including TCE and its degradation products, are generally those having reported Henry's Law constants greater than 1.0E-05 atm-m^3/mol and molecular weights less that 200 g/mol. PCBs are not highly volatile based on their inherent chemical/physical properties; for example, the Henry's Law Constant of Aroclor-1242 is 5.2E-04 atm-m^3/mol and its molecular weight is 266.5 g/mol (ATSDR, 2000). TCE and its degradation products in soil may be released to the outdoor air via volatilization from soil to soil gas, and then to the ambient air. Receptors present at the Site may be exposed to these volatile chemicals by inhaling the outdoor air, although the presence of buildings and pavement tends to mitigate this exposure pathway.

Currently, there are no receptors utilizing the groundwater beneath the Site as a potable water source. Further, it is not likely that future receptors will be utilizing such water as the City of St. Louis has passed an Ordinance prohibiting the construction of wells and withdrawal of groundwater anywhere within the city limits (City of St. Louis, 2005). Therefore, potable uses of water will not be evaluated in this SRE. Although it is an unlikely scenario, the groundwater analytical data is evaluated with respect to the risk to construction workers from potential contact. While there is a potential for the construction worker to encounter groundwater during trenching and excavation activities, it is not likely that construction workers will be allowed to remain in trenches or pits that contain standing water for any length of time. It is more likely that if groundwater is encountered, measures will be taken to pump the water out to mitigate their exposure. However, as there is a potential for exposure, dermal contact with groundwater and inhalation of vapors that may migrate from standing groundwater into an open trench are considered to be potentially complete pathways and are evaluated in the SRE.

Groundwater analytical data and soil gas data are also evaluated with respect to the potential for the vapor intrusion pathway into the CBI Building to be complete for future industrial/commercial workers. As this is a modeled effort utilizing USEPA software, this pathway is evaluated considering the specific characteristics of the site and building (where obtained data permit), and the built-in default exposure parameters for the industrial/commercial workers.

Currently, no surface water bodies are present directly on Site and any stormwater is channeled to city storm sewers, therefore there are no complete pathways for exposure to Site surface water.

COPCs resulting from the wipe samples are used to evaluate risk to industrial/commercial workers with respect to exposure to PCBs on the interior of the building. The industrial/ commercial worker is assumed to work full-time in the building in the future. The worker is assumed to spend the majority of time on one assigned floor. This person may potentially come into contact with interior surfaces, primarily walls that contain PCBs. Contacting the dusty interiors can result in adherence of the dust on the hands. Dust on the fingers can be transferred to the mouth during hand-mouth contact; PCBs contained in the dust can therefore be taken in orally. PCBs contained in the dust can also be directly absorbed through the skin. In addition, PCB-contaminated dust that is stirred up into the air can be inhaled. Under potential industrial/commercial uses of the building, workers would contact building surfaces infrequently, yet more frequently and over a longer period of years than any other population that may also access the building during industrial/commercial uses (e.g., visitors, repair workers). Industrial/commercial workers are evaluated with respect to exposure by the incidental ingestion, dermal absorption, and inhalation of COPCs in dust from interior surfaces.

Potentially complete exposure pathways exist, as shown on the CSM, for several receptor populations for potential exposure to site soils via ingestion, dermal absorption, and inhalation. Construction workers and adolescent recreational visitors are evaluated at each of the four soil exposure points: Exterior Soils, Soil Beneath the Building, The Die Cast Area, and the TCE Impacted Area. Complete exposure pathways also exist for industrial/commercial workers with respect to exposure to PCBs on the interior of the CBI Building and from the potential intrusion of vapors from VOCs into the building. The groundwater direct contact pathway is only considered to be potentially complete for future construction workers with respect to dermal contact with and inhalation of VOCs in groundwater that may collect in an excavated area of soil.

The following receptors/scenarios and potentially complete pathways are evaluated quantitatively in this SRE, under the two most likely future uses of the Site. Table 4-1 provides a summary of the receptor populations and exposure points that are evaluated in the SRE.

- The building may be left in place and used for commercial/industrial purposes:
  - Future industrial/commercial workers may be exposed to dust on the interior of the building and vapors that may migrate from groundwater or soil gas to indoor air (vapor intrusion). Exposures to dust can occur via dermal contact (by touching contaminated building surfaces), incidental ingestion (putting figures that have been contaminated by dust on surfaces into the mouth), and by dust inhalation (inhaling dust that is re-suspended from surfaces into the indoor air). The vapor intrusion pathway is associated with inhalation exposures. Potential exposures to COPCs in

surface soil outside the CBI building foot print would only occur if the Site was unpaved and/or the Die Cast Building floor slab was removed, thereby exposing soils beneath it. It is not plausible to assume that the Site would be unpaved and that surface soil would be available for daily contact by employees at the facility and therefore potential exposures to soil by a future commercial/industrial worker are not quantitatively evaluated. Risks for potential exposures to soil associated with future use of the Site as a soccer field would be greater than those associated with commercial/industrial worker exposures to soil. Risks associated with hypothetical contact with soil by a future full-time worker are qualitatively evaluated in the risk characterization.

- o Future construction workers may be exposed to surface and subsurface soils only outside the building footprint, and they may be exposed to groundwater that may pool in an excavation or trench. Potential exposure routes to soil include dermal contact, incidental ingestion, and dust and vapor inhalation. Potential exposure routes to groundwater include dermal contact and vapor inhalation.

Receptor populations that are not quantitatively evaluated include visitors, landscape workers, and trespassers. Since the Site would be almost entirely paved, there would be virtually no exposure potential to soil for these receptor groups. Risk estimates associated with future use of the facility as a soccer field would provide a conservative assessment of potential risks for these receptors.

- The building may be removed and a soccer field built; this land use assumes that all soil that is presently covered by pavement and/or building slabs is accessible for direct contact (i.e., buildings, pavement, and floor slabs are removed).
  - o Future adolescent recreational visitors (soccer players) may be exposed to surface soils anywhere on the property while playing and practicing soccer.
  - o Future adult staff workers, associated with the Herbert Hoover Boys and Girls club, may be exposed to surface soil anywhere on the property while supervising adolescents playing and practicing soccer.
  - o A future adult outdoors groundskeeper may be exposed to surface soil anywhere on the property while performing soccer field maintenance activities.

  These receptors may be exposed to COPCs in surface soil by dermal contact, incidental ingestion, and dust and vapor inhalation.

  - o Future construction workers may be exposed to surface and subsurface soils anywhere on the property during efforts to convert the property to an athletic field, as well as to groundwater during trenching activities. Exposure routes for the construction are the same as described for the commercial/industrial re-use of the Site.

Receptor populations that are not quantitatively evaluated include spectators/visitors and trespassers. These receptor groups would visit the Site much less frequently, and have much less intense exposures, than the receptor groups that are quantitatively evaluated. Risk estimates for the receptors evaluated would provide a conservative assessment of potential risks for these receptors.

4.3 Receptor Exposure Factors

The magnitude of human exposure to chemicals in environmental media is usually described in terms of average daily intake (DI), which is the amount of chemical in contact with an exchange surface of the body (skin, lungs, and gastrointestinal tract). The discussion of methodology to use for calculation of average DI of COPCs is included in the following subsection (see

Section 4.4). However, before quantification of average DI, factors relevant to exposure for receptors evaluated must be determined. Typically, this is performed by the selection of published and/or site-specific information relative to the receptors being evaluated. As required by USEPA in *RAGS*, the SRE uses what is called the reasonable maximum exposure (RME) scenario as the highest exposure that is reasonably expected to occur at the site (USEPA, 1989a). Tables 4-2 through 4-4 present summaries of all exposure parameters used to calculate chemical intake.

Industrial /Commercial Worker Exposure Scenario

The industrial/commercial worker scenario considers a full-time, long-term employee who is assumed to be exposed to dust on interior building surfaces by dermal contact, incidental ingestion, and dust inhalation, and to indoor air (via vapor intrusion) by inhalation. The exposure scenario considers inhalation exposures to vapors and dust to occur 8 hours per day, 250 days per year (five days per week, 50 weeks per year), for a 25-year duration.

Exposures to dust on interior building surfaces were evaluated assuming that incidental ingestion, dermal uptake, and dust inhalation exposure pathways are complete. Incidental ingestion exposures to dust were quantified by assuming that dust adheres to fingers and is then subsequently transferred to the mouth during hand-mouth contact. Dermal exposure was based on adherence of dust to the palms of hands and subsequent absorption through the skin. The exposure frequency value used to quantify incidental ingestion and dermal exposures to PCBs in dust on surfaces is the same value used by USEPA to derive surface contamination limits in the TSCA PCB MegaRule. USEPA selected a frequency of 12 days per year to reflect the unlikelihood of worker contact with building surfaces, particularly since most building surfaces are typically covered by materials such as paint, carpeting, floor tiles, sealers, and drywall. Incidental ingestion intakes are then based on the assumption that on the days when contact with building surfaces occurs, a worker has hand-mouth contact once per hour (equal to eight times per day). It is also assumed that the fingers that have the hand-mouth contact are 'reloaded' with dust prior to each hand-mouth contact event. Therefore, the incidental ingestion intake is actually based on 96 ingestion events per year. Dust inhalation exposures were assumed to occur 8 hours per day, 250 days per year.

This exposure scenario differs from the exposure scenario used by USEPA to derive the surface contamination limits for PCBs as follows:

- The SRE scenario considered two additional exposure pathways, dermal uptake and particulate inhalation, which were not included in the derivation of the TSCA surface contamination limits;
- The SRE scenario assumed that the dust on a single finger, as opposed to the surface area of both hands, would be available for incidental ingestion;
- The incidental ingestion component of the scenario incorporated a saliva extraction factor from the literature;
- The SRE scenario used a 25-year exposure duration, as opposed to a 10-year exposure duration;
- The SRE scenario used the most recent PCB dose-response values published in IRIS;

The exposure scenario described above and used in the SRE to derive baseline health risks associated with potential exposures to removable surface contamination on indoor building surfaces. Remedial goals for building surfaces will be based on the decontamination values provided in the TSCA Megarule.

Construction Worker Exposure Scenario

For a construction worker, the maximally exposed individual would be a worker who is engaged in soil excavation activities. The scenario considers a worker who is engaged in work involving soil contact and groundwater contact.

A construction worker could be exposed to soil via incidental ingestion, dermal contact, and inhalation of dust and vapors. Exposure parameters that are used to quantify soil exposures are USEPA default parameters with the exception of the exposure frequency. The exposure frequency is based on the understanding that active excavation activities during a construction project typically occur in phases: initial site work and grading; excavation for foundations and backfilling; excavation for utility and storm water corridors; and final grading. Each of these phases may take a week or two, and be separated by several weeks where no active excavation/soil moving activities occur. The construction worker scenario is intended to evaluate short-term, high-intensity exposures to soil that might occur during active excavation activities. To provide a conservative assessment of potential exposures, the construction worker is assumed to be exposed to soil 5 days per work week, for 18 weeks (equivalent to 90 exposure days per 126 calendar days).

Because the groundwater table at the Site is, at times, shallow (within 10 feet of the ground surface), a construction worker who is engaged in utility trench excavation or excavations to place building footings could contact groundwater that accumulates in the excavations, as well as be exposed to vapors that may migrate from groundwater, through soil, to the ambient air. However, excavations that breach the groundwater table are normally dewatered in order to prevent soil from washing into the excavation, to allow construction work to proceed (e.g., pouring cement or laying utility lines), and to prevent workers from getting wet. Realistically, worker contact with groundwater would be incidental at best, likely limited to dermal contact with hands and forearms. However, to provide a conservative assessment of potential exposures, it is assumed that the hands, forearms, feet and lower legs would become wet. A worker who incidentally contacts the water would attempt to remain dry, so it is further assumed that skin would remain wet a total of 2 hours over an 8 hour work day.

Utility trench and footings work does not occur each day over the course of a construction project. It is therefore assumed that a worker engaged in this type of work would be exposed to groundwater and vapors from groundwater a total of four work weeks out of the construction project (20 work days over 126 calendar days). Since a worker would be in close proximity to the excavations during this work, it is assumed that vapor inhalation exposures would occur over the course of the work day (8 hours per day).

Outdoor Groundskeeper Exposure Scenario

It is anticipated that future use of the site will be to either leave the building in place or remove it to allow the construction of a recreational, youth soccer field. If the building is left in place, it is anticipated that green space would be limited to strips of landscaped areas, and although landscape workers would maintain it, the frequency and duration of time spent manning such areas would be negligible. If the building is removed and the Site turned into a soccer field, then groundskeeper exposure at the Site may be substantial. The outdoor groundskeeper exposure scenario considers a long-term employee who is assumed to contact surface soil while working outdoors maintaining a soccer field. Exposures are assumed to occur via incidental ingestion, dermal contact, and the inhalation of dust and vapors. From discussion with the Manager of the Sportport Soccer Facility in Maryland Heights (located in St. Louis County) maintenance of soccer fields corresponds primarily to either the grass growing season (April through October) or the soccer season (March through November). Grass mowing is performed two times per week during the grass growing season and it takes generally less than 1 hour to mow one soccer field. Activities performed during the soccer season include: line striping (once every other week, one hour per event) and weed trimming/trash pick-up (two times per week, one hour per event). Additional activities occur during the year, including: overseeding (two times per year, one hour per event), aeration (four times per year, one hour per event), fertilizer application (three times per year, one hour per event), and pesticide application (two times per year, one hour per event). All of these exposure parameters sum to 173 days/year, one hour per day. To account for an RME scenario for the outdoor groundskeeper, the number of days associated with the exposure frequency (days/year) are increased by 10 percent, resulting in 190 days per year at one hour per day. Soil exposure values are based on USEPA default values for workers (USEPA, 2002).

Recreational Visitor Exposure Scenario

The recreational visitor scenario is based on the assumption that members of the Herbert Hoover Boys and Girls Club use recreational athletic fields that may be constructed at the Site in the future. This receptor is evaluated considering an older child/adolescent (ages 7 through 18) who has higher intake-to-body weights than adults. They may use the fields for a period of 12 years. Exposures to PCB-contaminated surface soil are assumed to occur via the incidental ingestion, dermal contact, and dust and vapor inhalation exposure routes. Exposure to soil is assumed to occur two hours per day, 156 days per year, which corresponds to approximately four days of exposure per week, April through November. Youth soccer seasons are typically only from August or September until near the end of the year, per St. Louis Youth Soccer Association. The YMCA of Greater St. Louis has youth soccer seasons that are of an even shorter duration. The total number of days in the longest season is typically no more than 113 days (the number of days from August 23 to December 21, per the SLYSA). Consulting youth soccer practice manuals, it is advised to have practice sessions no longer than two hours per day (per Competitive Soccer Practice Plans and Drills, Copyright Sauder Consulting, Inc.) from arrival to departure. Therefore, using exposure parameters of 156 days/year, 2/hours per day are very conservative in nature and deemed to be protective.

Adult Staff Worker Exposure Scenario

The adult staff worker exposure scenario is based on the assumption that the adolescent members of the Herbert Hoover Boys and Girls Club will need supervision when they are practicing and competing in soccer games on the athletic field that may be constructed on the Site in the future. It is assumed that exposure pathways and exposure frequency are the same as that of the recreational visitors (youth soccer players), but that staff members may be present at the field for more time each day (e.g., coaching two soccer teams), resulting in an exposure time of four hours per day.

4.4 Exposure Point Concentrations

Exposure point concentrations (EPCs) are statistical representations of the COPC concentrations to which receptors are assumed to be exposed at exposure points. Separate EPCs are calculated for each exposure pathway at each point. In accordance with USEPA guidance, EPCs should provide a conservative estimate of the average concentration to which a receptor may be exposed. Typically, EPCs are based on the upper confidence limit (UCL) on the arithmetic mean of the concentration, or the maximum detected concentration, of the data set for each exposure point (USEPA, 2002a). Because of the uncertainty associated with estimating the true average concentration at a site, USEPA recommends that *the lesser* of the UCL of the mean concentration, or the maximum detected concentration, be used as the appropriate estimate of the average site concentration for a RME scenario (USEPA, 2002a). By using the UCL, the probability of underestimating the true mean is less than 5 percent.

The UCLs of all chemicals included in this SRE have been calculated by using the USEPA's software *Pro-UCL* (USEPA, 2007). The software takes into account the data distribution type prior to making a recommendation as to which UCL result is appropriate (e.g., the 95 percent UCL, 95 percent Bootstrap UCL, 97.5 percent Chebyshev UCL, etc.). The software also provides the descriptive statistics of the data including the minimum, maximum, and mean concentrations. Print-outs resulting from use of the Pro-UCL software to calculate summary statistics for all chemicals in this SRE are included in Appendix A.

EPCs may be based on COPC concentrations that are directly measured or based on COPC concentrations that are modeled. In this SRE, EPCs that are used to evaluate exposures associated with direct contact are based on measured data. These include EPCs for soil by ingestion and dermal contact pathways, EPCs for building surfaces by ingestion and dermal contact pathways, and EPCs for groundwater by dermal contact. EPCs for soil, building surfaces, and groundwater, for these pathways, are presented in Tables 3-1 through 3-6.

Since the true exposure medium for evaluation of inhalation exposures is air, and no analytical data for air were collected, EPCs that are used to evaluate inhalation exposures must be modeled from source media concentrations. Specifically, the EPCs that are used for evaluation of direct contact exposures (Tables 3-1 through 3-6) are used as media source EPCs in fate and transport models; the fate and transport models are used to derive EPCs for air. The basis of modeled EPCs used in the SRE is as follows:

- Soil – Vapors in Ambient Air: The Jury model, as presented in USEPA guidance (USEPA, 2002b), is used to estimate ambient air concentrations that may exist above soil that contains VOCs. A site-specific Q/C parameter value that is based on a 1/2-acre site size to correspond to the size of the TCE Area (which is the only area of the Site with appreciable VOCs in soil) and the St. Louis region is used. Other parameters used in the model are USEPA default values. These EPCs were used to evaluate ambient vapor inhalation from soil for all outdoor receptor exposure scenarios. Model calculations are presented in Appendix C.
- Soil – Dust in Ambient Air: The Jury model, as presented in USEPA guidance (USEPA, 2002b), is used to estimate a particulate emission factor that can then be used to derive dust concentrations in ambient air. A site-specific Q/C parameter value that is based on a 10-acre site size and the St. Louis region is used. Other parameters used in the model are USEPA default values, to derive a PEF of 9.46E+08 m^3/kg. (calculations performed using USEPA's on-line calculator [USEPA, 2008]). These EPCs were used to evaluate ambient vapor inhalation from soil for the recreational visitor, staff worker, and groundskeeper. To account for increased dust concentrations that may be present during soil excavation activities due to wind erosion, excavating and dumping activities, grading, dozing, and tilling, the PEF is calculated using dispersion models that account for the cumulative dust loading in air from each of these activities. Dust generation from truck traffic on unpaved roads is not included in this calculation because unpaved roads would not exist at the Site. The Site is 10-acre area constrained within a city block. The significant source of dust emissions would be associated with the excavation and grading activities, and not trucks driving on the Site. The PEF for the construction worker scenario is 2.14E+07.
- Dust – Interior Building Air: EPCs for inhalation of dust in indoor air are derived by assuming that removable surface contamination (dust) is re-suspended and mixed with indoor air. EPCs are calculated by combining the building surface EPCs with a re-suspension factor, building ventilation rate of 1 air change per hour, and CBI-specific volume estimates, as described in Section 4.5. These EPCs were used to evaluate dust inhalation exposures to indoor workers.
- Groundwater – Vapors in Ambient Air: Vapor concentrations in air that may occur from migration of VOCs from standing (open) groundwater to ambient air were derived using the trench model developed by Virginia Department of Environmental Quality. The default modeling parameters were used, which assume a section of trench with standing water that is 8 feet long, 8 feet deep, and 3 feet wide, with an air exchange rate of two changes per hour. These EPCs were used to evaluate ambient vapor inhalation

from groundwater by a construction worker. Modeling calculations are presented in Appendix C.

- Groundwater and Sub Slab Soil Gas – Vapors in Indoor Air: The conceptual model for vapor intrusion is that VOCs migrate (i.e., volatilize) from groundwater to soil gas that is present within the pore space of unsaturated soil. The soil gas then passively migrates and/or is actively drawn into the breathing zone within buildings that overlie (or are within 100 feet) of the VOC-containing soil gas. In this SRE, vapor intrusion was evaluated using both groundwater and sub slab soil gas data. The results of the evaluations are compared in the Risk Characterization (Section 6), but use of the sub slab soil gas data is considered to be a better method for evaluating vapor intrusion.

Since indoor air within the CBI building was not sampled, indoor air EPCs were estimated from the groundwater and soil gas EPCs using attenuation coefficients (also known as alpha factors) that relate the VOC concentration in sub slab soil gas or groundwater to the VOC concentration in indoor air. Indoor air EPCs were calculated by multiplying the groundwater or sub slab soil gas EPCs (defined as the lesser of the maximum detected concentrations or 95% UCL concentrations) by the applicable attenuation coefficient. The indoor air EPCs were used to evaluate indoor air inhalation risks by a full-time indoor commercial/industrial worker. Attenuation coefficients were based on values that were empirically derived by USEPA, and on values that were calculated for Site-specific conditions using fate and transport modeling.

USEPA has developed a vapor intrusion data base consisting of paired indoor air and source medium (i.e., soil gas, sub slab soil gas, groundwater) measurements from which the agency has developed attenuation factors (USEPA, 2008). The attenuation factors for sub slab soil gas to indoor air are summarized below (taken from Figure 12 of USEPA (2008)).

Statistic	Data Set 1 (2008)	Data Set 2 (2008)
Min	2.5E-05	7.2E-05
5%	4.5E-04	5.0E-04
25%	1.9E-03	1.8E-03
50%	5.5E-03	5.0E-03
75%	2.8E-02	9.8E-03
95%	4.8E-01	1.5E-01
Max	9.6E-01	8.8E-01

Data Set 1 is derived from a data set consisting of 991 paired measurements. Data Set 2 is a derived from a subset of data within Data Set 1, which has undergone additional screening (detection limits, background, removal of high-end and low-end outliers) and consists of 311 paired measurements.

Additional evaluation of the attenuation factors, performed by USEPA, shows that as sub slab soil gas concentrations increase, the attenuation coefficients decrease. For sub slab soil gas concentrations in excess of 10,000 ug/m^3, attenuation factors are generally not higher than 1E-02, and cluster around 1E-03. The attenuation factors associated with sub slab soil gas concentrations of 100,000 ug/m^3 or more are generally 1E-03 to 1E-04 or lower. Since the 95% UCL sub slab soil gas concentration for TCE at Building areas A through E is 167,000 ug/m^3, attenuation factors in the lower percentile of the USEPA data base appear to be more applicable. Given this information, the sub slab soil gas to indoor air attenuation factors that were selected for use in this SRE were targeted at the range of 1E-03 to 1E-02. The 25th percentile value of 1.8E-03 and the 75th percentile value of 9.8E-03 are close to this range, and provide health risk estimates associated with a range of possible vapor intrusion conditions.

It is important to recognize that the majority of the attenuation factors in the USEPA data base were derived from sites where chlorinated VOCs were migrating into residential buildings with basements. The ratio of indoor air volume to infiltration area is much larger in an industrial slab-on-grade building such as the CBI building than in a residential dwelling with a basement. Therefore, use of the USEPA-derived attenuation coefficients to estimate indoor air concentrations in the CBI building introduces an additional level of uncertainty. Consequently, attenuation coefficients were also calculated for site-specific conditions using fate and transport modeling.

Attenuation coefficients based on modeling were derived from groundwater source EPCs and soil gas EPCs using the Johnson-Ettinger Model (USEPA Advanced Groundwater Model and USEPA Advanced Soil Gas Model). Site-specific inputs to the model include slab-on-grade construction (floor slab of 15 centimeters); depth to groundwater of 10 feet; soil gas sampling depth of 20 cm (this is a conservative estimate) soil type sand for soil gas evaluations and silt for groundwater evaluations, CBI building dimensions, and an air exchange rate of 1 change per hour. The soil type sand was selected for soil gas evaluations because the sub slab soil gas sampling depth was shallow and the soil beneath the slab could be sand that placed beneath the floor during construction of the building. The sub slab soil gas to indoor air attenuation factor derived from the modeling is 9.5E-05, which falls within the 5th percentile of attenuation coefficients in the USEPA data base. The soil type silt was selected for groundwater evaluations because the boring logs at the Site indicate a mix of silty clay, and sandy silt. The fate and transport parameters for soil type silt provide for a conservative assessment of vapor intrusion potential (leaving only soil types sand and sandy loam as being more conducive to vapor intrusion potential). Modeling calculations are provided in Appendix C.

4.5 Pathway Specific Intake Equations

Presented in this subsection are the multiple equations used to quantify chemical intake by all complete pathways evaluated in the SRE. The magnitude of human exposure to chemicals in environmental media is usually described in terms of average DI, which is the amount of chemical in contact with an exchange surface of the body (skin, lungs, and gastrointestinal tract). Each of the equations requires the input of specific parameters relating to exposure. A summary of all exposure parameters used to calculate chemical intake is presented in Tables 4-2 through 4-4. Intake calculations are presented in Appendix B.

4.5.1 Exposure to Soil

Incidental Ingestion

Average daily chemical intake for the incidental ingestion of soil is calculated by use of the following formula (USEPA, 1989a):

$$DI_{Soil\text{-}Ing} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

where: $DI_{Soil\text{-}Ing}$ = average daily chemical intake via soil ingestion (mg/kg-day)
CS = chemical concentration in soil (mg/kg)

IR	=	ingestion rate (mg soil/day)
CF	=	conversion factor (10^{-6} kg/mg)
FI	=	fraction ingested from contaminated source (unitless)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged, days)

Particulate and Vapor Inhalation

Average daily chemical exposure by inhalation of vapors is calculated by use of the following formula (USEPA, 1989a):

$$DI_{Inh} = \frac{CA \times ET \times EF \times ED}{AT \times CF}$$

where:	DI_{Inh}	=	average daily chemical exposure via inhalation (mg/m^3)
	CA	=	chemical concentration in air (mg/m^3)
	ET	=	exposure time (hours/day)
	EF	=	exposure frequency (days/year)
	ED	=	exposure duration (years)
	CF	=	conversion factor (24 hours per day)
	AT	=	averaging time (period over which exposure is averaged, days)

The chemical concentration in air (CA) term is calculated as follows:

$$CA = CS \times [(1/PEF) + (1/VF)]$$

where:	PEF	=	Particle emission factor (m^3/kg)
	VF	=	Volatilization factor (m^3/kg)

The particle emission factor (PEF) is calculated as described in the USEPA's *Soil Screening Guidance* (USEPA, 1996a) using input parameters for the St. Louis region and a 10-acre site size. The PEF was calculated using USEPA's on-line calculation tools (USEPA, 2008) The volatilization factor is chemical-based and is also calculated as described in USEPA's *Soil Screening Guidance* (USEPA, 1996a) and a 10-acre site size. The VF calculation is presented in Appendix C.

Dermal Contact

Average daily chemical intake for the dermal absorption of chemicals in soil is calculated by use of the following formula (USEPA, 2004):

$$Intake = \frac{DAevent * SA * EV * EF * ED}{BW * AT}$$

and:

$$DAevent = CS * AF * ABSd * CF$$

where:	Intake	=	average daily dose of COPC received over the averaging period (mg chemical/kg body weight-day)
	DAevent	=	dose of COPC absorbed per unit skin surface area during each exposure event (milligrams per square centimeter (mg/cm^2)-event)
	CS	=	concentration of the COPC at the exposure point to which the receptor of interest is exposed (i.e., the EPC) (mg/kg),
	SA	=	skin surface area in contact with the soil on days exposed (cm^2)

AF = mass of soil adhered to the unit surface area of skin exposed each exposure event (mg/cm^2-event)
ABSd = absorption factor representing the fraction of COPC that may be absorbed through the skin from soil (unitless)
EF = exposure frequency representing the number of exposure events during each year of exposure (days/year),
EV = event frequency representing the number of exposure events at the exposure point each day (event/day),
ED = exposure duration representing the period of time over which exposure may occur (years),
CF = *appropriate units conversion factor (e.g., kg/mg)*
BW = body weight of the hypothetically exposed individual (kg)
AT = averaging time (for carcinogens, AT = 70 years times 365 days per year; for noncarcinogens, AT = ED times 365 days per year).

The dermal absorption factor (unitless) describes the fraction of COPC that may be absorbed through the skin and into the blood stream (i.e., amount that may become bioavailable) following dermal exposure to soil. Dermal absorption factors are published by USEPA (USEPA, 2004a) for some of the chemicals detected in soil at the Site. These include: arsenic (0.03) and PCBs (0.14). Dermal exposures are only quantitatively evaluated for the COPCs with published dermal absorption factors.

4.5.2 Exposure to Interior Dust

Exposures to dust on interior building surfaces are evaluated assuming that incidental ingestion, dermal uptake, and dust inhalation exposure pathways are complete. Incidental ingestion exposures to dust are quantified by assuming that dust adheres to fingers and is then subsequently transferred to the mouth during hand-mouth contact. Dermal exposure is based on adherence of dust to the palms of hands and subsequent absorption through the skin. Inhalation of dust is based on the assumption that dust on surfaces is re-suspended and mixed with the indoor air, as described below.

Incidental Ingestion

Average daily chemical intake for the incidental ingestion of chemicals associated with interior dust is calculated by use of the following formula:

$$DI_{Ing\text{-}Dust} = \frac{CS \times FTSS \times FQ \times ET \times SA_{finger} \times EF \times ED}{BW \times AT}$$

where: $DI_{Ing\text{-}Dust}$ = average daily chemical intake from incidental ingestion of interior dust (mg/kg-day)
CS = chemical concentration on surface (µg/100 cm^2) (wipe sample data)
FTSS = fraction transferred, surface to skin (%)
FQ = frequency of hand-mouth contact (1/hr)
ET = exposure time (hr/day)
SA = surface area, fingers (cm^2)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged, days)

Dermal Contact

Average daily chemical intake for the absorption of chemicals associated with interior dust is calculated by use of the following formula:

$$DI_{Derm\text{-}Dust} = \frac{CS \times FTSS \times ABS \times SA_{body} \times EF \times ED \times CF}{BW \times AT}$$

where:

$DI_{Derm\text{-}Dust}$	=	average daily chemical intake from dermal contact of interior dust (mg/kg-day)
CS	=	chemical concentration in dust (mg/cm^2), wipe sample data
FTSS	=	fraction transferred, surface to skin (%)
SA_{Body}	=	surface area, palms (cm^2/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
CF	=	conversion factor (10^{-6} kg/mg)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged, days)

Particulate Inhalation

Inhalation of dust assumed to contain PCBs (i.e., contaminated concrete dust) is based on re-suspension of dust on surfaces into the air where it can be inhaled. For quantification of this pathway, a re-suspension factor [obtained from USEPA (1997)] is required. The re-suspension factor is derived from an evaluation of the area of PCB-contaminated surfaces in the specific building evaluated. For this Site building, the surface area was assumed to be the entire floor area, the bottom four feet of walls, and the volume of air space into which surface contamination can be re-suspended. It is assumed that each level of the building functions as its own ‘compartment’, or exposure unit, for the purposes of calculating indoor dust concentrations. Consequently, the building dimensions for a single floor of the building were used.

Inhalation of interior dust is evaluated by first quantifying the chemical concentration in air based on building parameters, as follows:

$$CA_{Bld} = [(CS \times RSF \times A) / (V \times VR)] \times 1E{+}06\ cm^3/m^3$$

where:

CA_{Bld}	=	chemical concentration in building air (mg/m^3)
CS	=	chemical concentration in dust (mg/cm^2)
RSF	=	resuspension factor (1/hr)
A	=	area of contaminated surfaces (cm^2)
V	=	volume of building (floor) (cm^3)
VR	=	ventilation rate of building (1/hr)

Once the CA value based on building parameters is calculated, the chemical concentration taken in via inhalation can be calculated by utilizing the receptor exposure parameters, as follows:

Average daily chemical exposure by inhalation of vapors is calculated by use of the following formula (USEPA, 1989a):

$$DI_{Inh} = \frac{CA \times ET \times EF \times ED}{AT \times CF}$$

where:

DI_{Inh}	=	average daily chemical exposure via inhalation (mg/m^3)
CA	=	chemical concentration in air (mg/m^3)
ET	=	exposure time (hours/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
CF	=	conversion factor (24 hours per day)
AT	=	averaging time (period over which exposure is averaged, days)

4.5.3 Exposure to Groundwater

Dermal Contact – Groundwater

Average daily chemical intake for the dermal absorption of chemicals in groundwater for the construction worker who may come in contact with groundwater while digging/trenching activities is calculated by use of the following formula:
The equation for calculating chemical intake via dermal contact with surface water is as follows:

$$Intake = \frac{DAevent * EV * ED * EF * SA}{BW * AT}$$

For Inorganics:

$$DA_{event} = Kp * CW * t_{event} * \mathrm{CF}$$

For Organics when $t_{event} < t^*$:

$$DA_{event} = 2 * FA * Kp * CW * CF *[6 * T_{event} * t_{event} / 3.14]^{\wedge 0.5}$$

For Organics when $t_{event} > t^*$:

$$DA_{event} = FA * Kp * CW * CF *[(t_{event} /1 + B) + 2 * T_{event} (1+ 3 * B + 3 * B^2 / (1 + B)^2)]$$

where:

where:	Intake	=	average daily dose of COPC received over the averaging period (mg chemical/kg body weight-day)
	CW	=	concentration of the COPC at the exposure point to which the receptor of interest is exposed (i.e., the EPC) (mg/L)
	DA_{event}	=	dose of COPC absorbed per unit skin surface area during each exposure event (mg/cm^2-event)
	SA	=	skin surface area in contact with the water on days exposed (cm^2)
	Kp	=	permeability constant, representing the rate at which the COPC may be absorbed through the skin from water (cm/hr)
	t_{event}	=	event duration, representing the amount of time per event that exposure occurs (hr/event)
	T_{event}	=	lag time per event (hr/event)
	FA	=	fraction absorbed (unitless)
	t*	=	time to reach steady state (hr)
	B	=	ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless)
	EF	=	exposure frequency representing the number of exposure events during each year of exposure (days/year)
	EV	=	event frequency representing the number of exposure events at the exposure point each day (events/day)
	ED	=	exposure duration representing the period of time over which exposure may occur (years)
	BW	=	body weight of the hypothetically exposed individual (kg)
	AT	=	averaging time (for carcinogens, AT = 70 years times 365 days per year; for noncarcinogens, AT = ED times 365 days per year).
	CF	=	units conversion factor (0.001 L/cm^3)

Values for FA, Kp, T_{event}, t*, and B are chemical-specific, and were obtained from USEPA guidance (USEPA, 2004a).

Because the DA_{event} term in the equation for deriving dermal intake from water contains variables that are receptor specific (t_{event}), exposure point specific (CW), and chemical specific (e.g., Kp), the calculation of DA_{event} is performed in a two-step process. In the first step, permeability per event (PC_{event}; cm/event) is calculated by excluding the CW and CF terms from the DA_{event} equations. In the second step, PC_{event} is combined with the CW and CF terms, as well as the other terms in the intake equation (e.g., EF, ED) to calculate dermal intake. The PC_{event} calculations are provided in Appendix C.

Vapor Inhalation

Average daily chemical exposure by inhalation of vapors in ambient air or indoor air is calculated by use of the following formula (USEPA, 1989a):

$$DI_{Inh} = \frac{CA \times ET \times EF \times ED}{AT \times CF}$$

where:

DI_{Inh}	=	average daily chemical exposure via inhalation (mg/m^3)
CA	=	chemical concentration in air (mg/m^3)
ET	=	exposure time (hours/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
CF	=	conversion factor (24 hours per day)
AT	=	averaging time (period over which exposure is averaged, days)

5.0 Toxicity Assessment

5.1 Introduction

The toxic effects of a chemical generally depend not only upon the inherent toxicity of the chemical and the level of exposure (intake), but also on the route of exposure (oral, inhalation, or dermal) and the duration of exposure. Thus, a full description of toxic effects of a chemical includes a listing of what adverse health effects the chemical may cause, and how the occurrence of these effects depend upon intake, route, and duration of exposure.

There are two major types of adverse health effects evaluated in the SRE: carcinogenic effects and noncarcinogenic effects, each evaluated separately and described further below.

5.2 Carcinogenic Evaluation Methodology

It has been generally assumed historically that carcinogenic effects are non-threshold effects. This means that any dose, no matter how small, is assumed to pose a finite probability of generating a response. Thus, no dose of a carcinogen is thought to be risk-free. USEPA assigns a cancer weight-of-evidence category to each chemical in order to reflect the overall confidence that the chemical is likely to cause cancer in humans. Three major factors are considered in characterizing the overall weight-of-evidence for carcinogenicity: (1) the quality of evidence from human studies; (2) the quality of evidence from animal studies; and (3) other supportive information, such as mutagenicity data and structure-activity relationships. These carcinogenic categories and their meanings are summarized below (USEPA, 1989a):

Carcinogenic Category	Meaning	Basis
A	Known human carcinogen.	Sufficient evidence of increased cancer in exposed humans.
B1	Probable human carcinogen.	Suggestive evidence (limited data) of increased cancer incidence in exposed humans.
B2	Probable human carcinogen.	Sufficient evidence of increased cancer incidence in animals, but lack of data or insufficient data from humans.
C	Possible human carcinogen.	Suggestive evidence of carcinogenicity in animals.
D	Cannot be evaluated.	No evidence or inadequate evidence of cancer in animals or humans.

USEPA's *Guidelines for Carcinogen Risk Assessment* (USEPA, 2005) has been adopted as agency policy for cancer risk assessment. These guidelines contain a revised classification system for carcinogenic effects with the following classifications:

- Carcinogenic to humans;
- Likely to be carcinogenic to humans;
- Suggestive evidence of carcinogenic potential;
- Inadequate information to assess carcinogenic potential; and
- Not likely to be carcinogenic in humans.

The weight of evidence classification for a given chemical, as published in USEPA's Integrated Risk Information System (IRIS), may reflect either of the two classification schemes identified above.

When data permit, the USEPA derives numeric values that are useful in quantifying the toxicity and carcinogenicity of a compound. For cancer health effects, the numeric descriptors of carcinogenic potency are Slope Factors (SFs) and inhalation unit risks (URs). These are route-specific estimates of the slope of the cancer dose-response curve at low doses, and represent the upper-bound excess lifetime cancer risk (ELCR) estimated to result from continuous lifetime exposure to an agent. The units of the SFs are $(mg/kg\text{-}day)^{-1}$ and are used to quantify cancer risk associated with oral and dermal exposure routes. The units of the URs are $(\mu g/m^3)^{-1}$ and are used to quantify cancer risks associated with the inhalation exposure route. Cancer SF and UR values are typically calculated for chemicals that are "carcinogenic to humans" and "likely to be carcinogenic to humans." The cancer SF and UR are typically an estimate of the upper 95% Confidence Limit of the slope of the dose-response curve extrapolated to low doses.

Presently, toxicological data do not exist from which dermal SFs can be derived. To evaluate the dermal pathway, USEPA has adopted methodology to obtain dermal SFs by adjusting the oral SFs (USEPA, 2004a). The equation for extrapolation of a default dermal SF is as follows:

$$\text{Default Dermal SF} = \frac{\text{Oral SF}}{\text{Oral Absorption Factor (\%)}}$$

Oral absorption factors used in this SRE are obtained from USEPA's *RAGS: Part E, Supplemental Guidance for Dermal Risk Assessment* (USEPA, 2004a). In accordance with USEPA guidance (USEPA, 1989a), oral toxicity values are adjusted using an oral absorption value if the chemical has an oral absorption value less than 50 percent. Otherwise, the oral SF value is used as the dermal SF value.

.

Slope factor and UR values may be obtained from multiple published sources; however, USEPA has recommended a hierarchy approach. As noted in USPEA's OSWER Directive 9285.7-53 (USEPA, 2003), the USEPA approved hierarchy of toxicity data retrieval is as follows:

- Tier 1 – USEPA's IRIS (Integrated Risk Information System) Database. This is an on-line database that can be found at www.epa.gov/iris.
- Tier 2 – USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs) published by the National Center for Environmental Assessment (NCEA). This database can be accessed at http://hhpprtv.ornl.gov/.
- Tier 3 – Other Toxicity Values. If no data exist in the Tier 1 or 2 categories, USEPA allows for the consideration of additional databases for toxicity values, including:
    - California EPA's (Cal EPA) toxicity values. This database can be accessed at http://www.oehha.ca.gov/risk/chemicalDB//indes.asp.

- o Agency for Toxic Substances and Disease Registry (ATSDR) Minimum risk levels (MRLs) (ATSDR, 2008). This database addresses only noncancer effects and can be found at http://www.atsdr.cdc.gov/mrls.html.
- o USEPA's *Health Effects Assessment Summary Tables* (HEAST) (USEPA, 1997a).

Cancer SFs and URs and associated supporting information, such as weight-of-evidence, oral absorption factors, etc., are presented in Table 5-1 for the oral and dermal pathway, Table 5-2 for the inhalation pathway.

5.3 Noncarcinogenic Evaluation Methodology

In contrast to carcinogens, noncarcinogens are believed to have threshold exposure levels below which adverse effects are not expected. USEPA has derived standards and guidelines based on acceptable levels of exposure for such compounds. Noncarcinogenic effects of concern on which many of the standards and guidelines are based include liver toxicity, reproductive effects, neurotoxicity, teratogenicity, and other chronic toxicities. Various criteria have been developed from experiments that can be used to estimate the dose-response relationship of noncarcinogens. Some of the same uncertainties involved in deriving cancer risk estimates (namely, selection of an appropriate data set and extrapolation of high-dose animal data to low-dose human exposure) are also involved in deriving noncarcinogenic dose-response criteria. Dose-response values used most often to evaluate noncarcinogenic effects are RfDs.

RfDs are route- and duration-specific estimates of the average daily intake (mg chemical/kg-day) that may occur without appreciable risk of any adverse effect. Because the quality and quantity of toxicological data available to support derivation of RfD values vary among chemicals, USEPA also provides an indication of the overall confidence associated with each RfD value. In general, the lower the confidence, the more conservative USEPA is in deriving the RfD.

For the inhalation pathway, noncancer reference values are expressed in terms of the reference concentration (RfC), having the units of mg chemical/m^3 of air.

Oral RfDs were adjusted to derive dermal RfDs in an approach similar as that described above for the derivation of dermal SFs, and as follows:

$$\text{Dermal RfD} = \text{Oral RfD} \times \text{Oral Absorption Factor (\%)}$$

Oral absorption factors used in this SRE are obtained from USEPA's *RAGS: Part E, Supplemental Guidance for Dermal Risk Assessment* (USEPA, 2004a). As for carcinogens, only chemicals reported with oral absorption factors less than 50 percent are adjusted, otherwise, the oral RfD is used for the dermal RfD.

Noncancer RfDs and RfCs are obtained from published sources following the hierarchy approach as noted for carcinogenic SFs and URs in Section 5.2 above. Noncancer RfDs and RfCs, and associated supporting information, are presented in Tables 5-3 and 5-4. Chronic RfDs and RfCs were used to evaluate risk to industrial/commercial workers and adolescent recreational visitors. However, for construction workers, as they are only assumed to be on the Site for a period of one year, subchronic RfDs and RfCs, when available, are used to evaluate risk.

5.4 Toxicity Information Pertinent to PCBs

PCBs are assumed to cause both carcinogenic and noncarcinogenic effects. Based on the information presented in USEPA's IRIS (USEPA, 2008), a tiered approach is to be used to determine the cancer slope factors for PCBs. The criteria for using the High Risk and Persistence values include "dust or aerosol inhalation" and "dermal exposure, if an absorption factor has been applied." USEPA has developed a range of cancer SF values ranging from 0.04 to 2 $(mg/kg/day)^{-1}$. In accordance with the USEPA guidance, the upper-bound High Risk and Persistence SF of 2 $(mg/kg/day)^{-1}$ was chosen for use in this SRE. Reference Dose data are available in IRIS for only Aroclor 1016 and Aroclor 1254. Since PCBs detected at the Site are other than Aroclor-1016 (primarily Aroclor-1242, -1248, and -1260), the RfD for Aroclor-1254 of $2x10^{-5}$ mg/kg-day (chronic) and $5x10^{-5}$ mg/kg-day [subchronic; as published in HEAST (USEPA, 1997a)] are selected for use at this Site. No RfC has been published for PCBs by USEPA in IRIS. However, MDNR and USEPA Region 7 have concurred that it is appropriate to make a route-to-route extrapolation for PCBs and derive an RfC from the oral RfD values. The extrapolated RfC is used to evaluate noncarcinogenic risks for the inhalation pathway.

5.5 Toxicity Information Pertinent to TCE

Presently, TCE is under evaluation by USEPA toxicologists and has therefore been withdrawn from the IRIS database. A January 15, 2009 memorandum from USEPA Office of Solid Waste and Emergency Response (USEPA, 2009) directs risk assessments to use the following sources to obtain dose-response values for TCE:

- Oral and dermal slope factor: CAL EPA
- Unit risk: CAL EPA
- RfC: NYSDOH and CAL EPA

The RfC developed by NYSDOH is 10 ug/m^3 and the RfC developed by CAL EPA is 600 ug/m^3. Both of the RfCs are based on literature that reported effects to humans following subchronic exposures (8 to 11 years) to TCE in workplace settings. The lowest observable adverse effect levels (LOAELs) were 60 mg/m^3 in the study used by CAL EPA, and 10 mg/m3 in the study used by NYSDOH. RfCs were derived from these LOAELs by application of a 100-fold uncertainty factor by CAL EPA, to derive an RfC of 600 ug/m^3, and by application of a 1000-fold uncertainty factor by NYSDOH, to derive an RfC of 10 ug/m^3. USEPA (2009) noted uncertainties in the data bases that were used to derive each of the values. USEPA has identified both of these values as Tier 3 toxicity values. Non-cancer risks associated with inhalation exposures to TCE are calculated using the 10 ug/m^3 RfC value, but are also calculated using the 600 ug/m^3 RfC value in cases where hazard index values are above 1 due to use of the 10 ug/m^3 RfC value. The January 15, 2009 memorandum from USEPA did not specify a source or value to be used as the oral RfD. Therefore, as previously directed by USEPA Region 7, the oral RfD developed by NCEA of 3E-04 mg/kg/day is used in the SRE.

Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments into a quantitative description of excess cancer and noncancer risks and also includes a consideration of uncertainties. To characterize potential noncarcinogenic risks, comparison are made between projected intakes of substances and toxicity values. To characterize potential carcinogenic risks, probabilities that an individual will develop cancer over a lifetime are estimated from projected intakes and chemical specific dose response information. The methods for risk characterization used in this SRE are based upon guidance provided in USEPA's *RAGS* (USEPA, 1989a) and are summarized below.

5.6 Risk Characterization Methods

Cancer Risks

The objective of the risk characterization for carcinogenic chemicals is to derive an estimate of overall excess cancer risk associated with exposure to potential carcinogens at a site. The risk of cancer from exposure to a chemical is described in terms of the probability that an individual will develop cancer by age 70. For each COPC, this value is calculated by multiplying the daily intake, averaged over a lifetime, for each route of exposure, by the SF or UR for the chemical/route, as follows:

$$CR = DI \times SF$$

$$CR = DE \times UR$$

where:	CR	=	cancer risk (unitless)
	DI	=	daily intake of chemical (mg/kg-day)
	DE	=	daily exposure of chemical (ug/m^3)
	SF	=	cancer slope factor $(mg/kg\text{-}day)^{-1}$
	UR	=	cancer unit risk $(ug/m^3)^{-1}$

Cancer risks are presented as increased excess lifetime cancer risk, which is not a specific estimate of expected cancers. Rather, it is a plausible upper-bound estimate of the probability that a person may develop cancer sometime in his or her lifetime following exposure to site chemical contaminants under the assumed exposure scenario. Excess cancer risks are summed across all COPCs and all exposure pathways to provide a cumulative excess cancer risk for each receptor evaluated.

For chemicals with published SF or UR values, cancer risks were calculated for all receptor populations of concern for this SRE. For evaluation of resulting cancer risk estimates, the USEPA generally considers remedial action at a site when cumulative excess cancer risk to any current or future population exceeds a risk of 1E-04 (i.e., one case of cancer in one- thousand) (USEPA, 1991a and USEPA, 1990). Chemicals found to exceed this risk level, for any receptor, are highlighted in risk result summary tables in this SRE.

Risk calculations are presented in Appendix B and risks are summarized in Tables 6-1 through 6-5.

Non-Cancer Risks

The objective of the risk characterization for noncarcinogenic chemicals is to compare the estimated intake for a constituent to the level of intake that is recognized as unlikely to result in adverse noncarcinogenic health effects. The potential for noncancer effects from exposure to a constituent is derived by dividing the estimated intake of the constituent over a specific time period by the RfD for that constituent, derived for a similar exposure period. This comparison results in a noncancer hazard quotient, derived as follows:

$$HQ = \frac{DI}{RfD}$$

$$HQ = \frac{DE}{RfC}$$

where:			
	HQ	=	hazard quotient (unitless)
	DI	=	daily chemical intake (mg/kg-day)
	DE	=	daily exposure of chemical (ug/m^3)
	RfD	=	noncancer reference dose (mg/kg-day)
	RfC	=	noncancer reference concentration (ug/m^3)

HQs are calculated independently for each chemical evaluated. Since exposure occurs simultaneously to more than one chemical, HQ values may be summed, resulting in an overall Hazard Index (HI). Where the total HI is less than or equal to unity (i.e., 1.0 or 1.0E+00), it is believed that there is no appreciable risk that noncancer adverse health effects will occur. However, if an HI exceeds one, there is some possibility, although not a certainty, that noncancer adverse health effects could occur. For chemicals resulting in HIs greater than 1.0, it does not necessarily apply that the level of concern increases linearily as the HI increases. Furthermore, it is not appropriate to assign a statistical probability to the HI approach.

Summing HQ values across all chemicals and HI values across all pathways assumes that all noncancer effects are additive. As this is not generally true, when a population total HI exceeds unity, it is appropriate to re-examine the noncancer risks for that population and segregate them by effect to target organ (USEPA, 1989a).

In similar manner that site remediation is not generally warranted when cancer risk estimates do not exceed the level of 1E-04, in the absence of carcinogenic COPCs, and when the resulting non-carcinogenic HI is less than one, remedial action is generally not warranted (USEPA, 1991).

Risk calculations are presented in Appendix B and risks are summarized in Tables 6-1 through 6-5.

5.7 Risk Characterization Results

Future Construction Workers

Future construction workers may be exposed to soils from the surface to an estimated depth of 10 feet (the typical excavation depth for building construction), and to groundwater that may accumulate in deep subsurface excavations, during re-development of the Site.

Table 6-1 presents a summary of cancer and non-cancer risks for construction workers.

Cancer risks are within or below a risk range of 1E-06 to 1E-04 for the following exposure points:

- Groundwater
- Exterior Soils (surface and subsurface soil)
- Soils Beneath the CBI Building (surface and subsurface soil)
- TCE Impacted Area (surface and subsurface soil)

Cancer risks exceed 1E-04 for potential exposures to Former Die Cast Area (surface soil and subsurface soil) due primarily to potential oral and dermal contact with PCBs.

Non-cancer HI values do not exceed a value of 1 for the following exposure points:

- Exterior Soils (surface soil only)
- Soils Beneath the CBI Building (surface and subsurface soil)
- TCE Impacted Area (surface and subsurface soil).

Non-cancer HI values exceed a value of 1 for the following exposure points:

- Groundwater, due primarily to inhalation of TCE, vinyl chloride, and 1,2,4-trimethylbenzene
- Exterior Soils (subsurface soil), due primarily to PCBs
- Soils at Former Die Cast Area, due primarily to oral and dermal exposures to PCBs
- TCE Impacted Area (surface and subsurface soil), due to TCE.

The HI values associated with vapor inhalation exposures to VOCs in groundwater and soil at the TCE Impacted Area would decrease substantially if calculated using the RfC for TCE of 600 ug/m^3. However, total HI values would still exceed 1 due to risks from other exposure routes (e.g., ingestion or dermal contact).

Collectively, this information suggests that health risks need to be managed for construction workers who may contact subsurface soil associated with the Exterior Soils, surface and subsurface soil at the TCE Impacted Area, surface and subsurface soil associated with the Former Die Cast Area, or be exposed to groundwater that accumulates in trench-type excavations.

Future Outdoor Groundskeeper, Adolescent Recreational Visitor, and Adult Staff Worker

These receptors may be exposed to surface soils if the Site is re-developed into a soccer field for the Herbert Hoover Boys and Girls Club. The conclusions of the SRE are the same for each of these receptors, so the SRE results are discussed collectively.

Tables 6-2 through 6-4 present summaries of cancer and non-cancer risks for these receptors.

Cancer risks are within or below a risk range of 1E-06 to 1E-04, and non-cancer HI values do not exceed 1, for the following exposure points:

- Exterior Soils
- Soils Beneath the CBI Building
- TCE Impacted Area

Cancer risks exceed 1E-04 and HI values exceed 1 for potential exposures to surface soil at the Former Die Cast Area due primarily to potential oral and dermal contact with PCBs. The HI values for potential exposures to surface soil at the TCE Impacted Area are 1.1 (Outdoor Groundskeeper), 1.4 (Adolescent Recreational Visitor), and 1.2 (Adult Staff Worker) but have been reported in one significant figure to be commensurate with the non-cancer dose-response values for the principal risk-contributing COPC (TCE), which are expressed as one significant figure (the RfD is 3E-04 mg/kg/day and the RfC is 10 ug/m^3). For all of these receptors, the HI values would drop to below 1 if inhalation risks were calculated using the TCE RfC of 600 ug/m^3.

Collectively, this information suggests that health risks need to be managed for soil associated with the Former Die Cast Area if the Site is re-developed as an athletic field.

Future Commercial Workers

Future commercial or industrial workers may be exposed to PCBs in removable surface contamination on the interior of the building, and to vapors that may migrate from subsurface sources (groundwater and soil gas) to indoor air. Tables 6-5 and 6-6 present summaries of cancer and non-cancer risks for this receptor.

With respect to indoor building surfaces, cancer risks are within or below a risk range of 1E-06 to 1E-04 and non-cancer HI values do not exceed 1 for the following exposure points:

- CBI Building – second floor
- CBI Building – fourth floor

Cancer risks exceed 1E-04 and the HI exceeds 1 for potential exposures to interior building surfaces on the first floor, due primarily to potential inhalation exposures to PCBs in re-suspended dust. In addition, the non-cancer HI for potential exposure to PCBs in the pump room exceeds a value 1, due primarily to potential inhalation exposures to PCBs in re-suspended dust.

The risks associated with vapor intrusion were calculated separately for building grid areas A through E (the main part of the CBI building) and F through H (the smaller extension to the CBI building; see Figure 3-11). In addition, risks were calculated for vapor intrusion from groundwater using groundwater data in fate and transport models, and for vapor intrusion from sub slab soil gas using a range of empirically derived attenuation coefficients (alpha factors) and an attenuation coefficient calculated using Site-specific fate and transport modeling. Sub slab soil gas risks were also calculated for both the Tedlar Bag sample and Summa Canister sample data sets. Since sub slab soil gas provides for a better method of evaluating vapor intrusion, the risks associated with vapor intrusion from sub slab soil gas are provided in Table 6-6 and estimates of risk from vapor intrusion from groundwater are discussed qualitatively. Finally, because the predominant VOC in the source media (soil gas and groundwater) is TCE, and USEPA has recommended two RfC values for TCE, two HI values were calculated for vapor intrusion exposures, thus representing the range of potential risks that may be associated with TCE.

As shown in Table 6-6, risks for building grid areas A through E were higher than for building grid areas F through H, and risks calculated for the Tedlar Bag and Summa Canister data sets were similar to each other.

The cancer risks associated with indoor air concentrations that could occur in the building under the assumption that the alpha factor is ~0.01 exceed1E-04. Non-cancer HI values calculated using the RfC of 10 ug/m^3 exceed a value of 1 for indoor air concentrations that could occur in the building under the assumption that the alpha factor is ~1E-02 or ~1E-03. Cancer and non-cancer risks associated with indoor air concentrations that could occur in the building under the assumption that the alpha factor is a Site-specific factor of ~1E-04 are below a cancer risk of 1E-04 and below a HI of 1. In addition, no HI values that are calculated using the 600 ug/m^3 RfC exceed a value of 1.

Cancer risks would not exceed 1E-04 if the sub slab soil gas to indoor air alpha factor for the CBI building is 2E-03 or lower. Non-cancer HI values would not exceed 1 if the sub slab soil gas to indoor air alpha factor for the CBI building is 1.6E-02 or lower when based on the RfC of 600 ug/m^3, and 2E-04 or lower when based on the RfC of 10 ug/m^3. The following table illustrates where these alpha factors fall within the range of alpha factors that were empirically derived by USEPA.

Statistic	Data Set 1 (USEPA, 2008)	Data Set 2 (USEPA, 2008)
Min	2.5E-05	7.2E-05
Site-Specific	*1E-04*	
Corresponding to HI of 1 for 10 ug/m^3 RfC	*2E-04*	
5%	4.5E-04	5.0E-04
25%	1.9E-03	1.8E-03
Corresponding to cancer risk of 1E-04	*2E-03*	
50%	5.5E-03	5.0E-03
Corresponding to HI of 1 for 600ug/m^3 RfC	*1.6E-02*	
75%	2.8E-02	9.8E-03
95%	4.8E-01	1.5E-01
Max	9.6E-01	8.8E-01

When considering if alpha factors in the 1E-03 to 1E-04 range are applicable to the CBI Building, the following information should also be considered:

- A review of Figure 10 from USEPA (2008) suggests that alpha factors in the 1E-04 range would be expected when sub slab soil vapor concentration exceed 100,000 ug/m^3, as is the case at the CBI building.

- The majority of the attenuation factors in the USEPA data base were derived from sites where chlorinated VOCs were migrating into residential buildings with basements. The ratio of indoor air volume to infiltration area is much larger in an industrial slab-on-grade building such as the CBI building than in a residential dwelling with a basement. It is possible, therefore, that alpha factors from the USEPA database over estimate the vapor intrusion potential for a building such as the CBI building.

- The Site-specific attenuation factor of ~1E-04 is within the range of empirically derived attenuation factors.

It should also be recognized that the best measure of vapor intrusion pathway completeness is indoor air sampling coupled with sub slab soil gas sampling. However, indoor air sampling at the CBI building, if performed, may not provide a good representation of indoor air quality due to the deteriorated condition of the building (e.g., broken windows, inoperative HVAC, etc).

At areas F through H, only the HI of 2 that was associated with the Tedlar Bag data set and calculated using the 10 ug/m^3 RfC for the highest attenuation factor (9.8E-03) exceeded a value of 1. Cancer risks were within or below the USEPA cancer risk range of 1E-06 to 1E-04. Given the information presented above, it appears that an alpha factor of ~1E-02 may be too conservative for the CBI building. For comparison, the vapor intrusion risks estimated from groundwater VOC concentrations were a cancer risk of 1E-06 and a HI of 0.05. As discussed previously, the sub slab soil gas data provide a better characterization of vapor source medium, and a more reliable indicator of potential indoor air quality.

Collectively, this information suggests that health risks need to be managed for full-time indoor workers who may be exposed to indoor air, and who may contact PCBs in removable surface contamination on the first floor and pump room of the CBI building.

5.8 Risk Summary for Receptors and Exposure Units

Exposure Units that pose potential health risks in excess of a cancer risk of 1E-04 or HI of 1 are identified for each receptor scenario below (denoted by a checkmark in that cell). .

Industrial/Commercial Workers	Excess Lifetime Cancer Risk	Non-cancer Hazard
Interior Dust - CBI Building First Floor	√	√
Interior Dust - CBI Building Second Floor		
Interior Dust - CBI Building Fourth Floor		
Interior Dust - CBI Building Pump Room		√
Interior Air – Vapors (vapor intrusion)	√ (1)	√ (1) (2)

(1) The range of soil gas to indoor air attenuation factors that are potentially applicable for the building result in a range of estimated cancer risks that span 3E-06 to 3E-04 and a HI of 0.4 to 37.

(2) USEPA recommends two RfC values for TCE. No HI values exceed 1 if calculated using the RfC of 600 ug/m^3, whereas HI values exceed 1 if calculated using the RfC of 10 ug/m^3 and alpha factors greater than 2E-04.

Construction Workers	Excess Lifetime Cancer Risk	Non-cancer Hazard
Exterior Soils (0 - 1 ft)		
Exterior Soils (0 - 10 ft)		√
Soils Beneath Building (0 - 1 ft)		
Soils Beneath Building (0 - 10 ft)		
Die Cast Area Soil (0 - 1 ft)	√	√
Die Cast Area Soil (0 - 10 ft)	√	√
TCE Impacted Area (0 - 1 ft)		√
TCE Impacted Area (0 - 10 ft)		√
Groundwater		√

Outdoor Groundskeeper	Excess Lifetime Cancer Risk	Non-cancer Hazard
Exterior Soils (0 -1 ft)		
Soils Beneath Building (0 -1 ft)		
Die Cast Area Soil (0 -1 ft)	√	√
TCE Impacted Area (0 -1 ft)		

Adolescent Recreational Visitors	Excess Lifetime Cancer Risk	Non-cancer Hazard
Exterior Soils (0 -1 ft)		
Soils Beneath Building (0 -1 ft)		
Die Cast Area Soil (0 -1 ft)	√	√
TCE Impacted Area (0 -1 ft)		

Adult Staff Workers	Excess Lifetime Cancer Risk	Non-cancer Hazard
Exterior Soils (0 -1 ft)		
Soils Beneath Building (0 -1 ft)		
Die Cast Area Soil (0 -1 ft)	√	√
TCE Impacted Area (0 -1 ft)		

Remedial action goals are developed for exposure scenarios associated with excess lifetime cancer risks greater than 1E-04 or non-cancer HI values greater than 1. The results of the SRE indicate that remedial action goals will be developed for:

- PCBs in soil for all receptors;
- TCE in soils for the construction worker;
- PCBs in removable surface contamination within the first floor and pump room of the CBI building, for commercial/industrial workers;
- TCE, vinyl chloride, and 1,2,4-trimethylbenzene in groundwater, for construction workers who may inhale vapors or contact groundwater if they excavate into the groundwater table.

Although vapor intrusion from sub slab soil gas was identified as an exposure pathway and source medium that may be associated with risks in excess of risk management criteria, soil gas is not a medium that is remediated. Therefore, remedial action goals for soil gas are not derived.

It is relevant to recognize that potential exposures to soil associated with the Former Die Cast Area could only occur if the existing floor slab, which is covered with clean soil, was removed and the contaminated soil beneath it then made accessible. Likewise, inhalation exposure to VOCs in standing groundwater is an unlikely occurrence at this Site, as described in the uncertainty analysis.

Section 7.0 presents a discussion of methodology used to calculate remedial action goals, as well as the resulting values.

5.9 Assessment of Uncertainties

The objective of the uncertainty analysis is to evaluate the assumptions and uncertainties inherent in the risk evaluation in order to place the risk estimates in proper perspective. Site-specific uncertainties that have a potentially significant bearing on the interpretation of this SRE are discussed below.

5.9.1 Analytical Data

Detection limits for analytes in some data sets were elevated (e.g., more than two-times the COPC screening levels). Specific examples in this SRE include:

- PCB-1254 (Exterior Soils – subsurface soil): highest detection limit = 32 mg/kg versus MSSL of 0.83 mg/kg
- PCB-1254 (Die Cast Area Soils – surface soil): highest detection limit = 60,000 mg/kg versus MSSL of 0.83 mg/kg
- Vinyl chloride (TCE Impacted Area – surface soil): highest detection limit = 34 mg/kg versus MSSL of 0.86 mg/kg
- PCB-1242 and PCB-1254 (Interior Wipe Samples, First Floor): highest detection limit = 500 ug/100 cm^2 versus screening level of 10 ug/100 cm^2.

Elevated detection limits introduce an uncertainty when analytes are not positively detected in any of the samples within the data set, but have detection limits (non-detect values) that are highly elevated, because it becomes uncertain as to whether the analyte may be present at a concentration that could pose more than a de minimis risk.

With respect to the analytes listed above that were non-detect with elevated detection limits, PCB-1254 was only detected in one sample among all media at the Site (a soil sample from the Former Die Cast Area at a concentration of 10 mg/kg). Because most of the samples and most of the data sets exhibited low detection limits, it appears that PCB-1254 is not a PCB that is present at the Site. In addition, the exposure points where PCB-1254 and vinyl chloride were associated with non-detect value at elevated detection limits, were determined in this SRE to pose potential risks in excess of USEPA risk management limits. Therefore, even if PCB-1254 or vinyl chloride were present at those exposure points, the conclusions of the SRE would not change.

5.9.2 Exposure Assessment

Samples were collected at the Site from areas of known or suspected Site-related impact. Overall, four areas of soil impact were identified. However, these areas constitute only a portion of the overall property area. Risks were then evaluated for each of the four soil exposure areas under the assumption that a receptor scenario exposure will occur only at that area. In reality, exposures would occur over the entire area of the Site (if the Site was turned into recreational fields), including areas that are not contaminated. Treating the entire Site as one exposure unit would provide a more realistic estimate of EPCs.

Because the groundwater table at the Site is, at times, shallow (within 10 feet of the ground surface), a construction worker who is engaged in utility trench excavation or excavations to place building footings could contact groundwater that accumulates in the excavations, as well as be exposed to vapors that may migrate from groundwater, through soil, to the ambient air. However, excavations that breach the groundwater table are normally dewatered in order to prevent soil from washing into the excavation, to allow construction work to proceed (e.g., pouring cement or laying utility lines), and to prevent workers from getting wet. Realistically, worker contact with groundwater would be incidental at best, likely limited to dermal contact with hands and forearms. The assumptions made in the SRE that a construction worker would contact water over the surface of their hands, forearms, feet, and lower legs and remain wet two hours per day over 20 work days is highly conservative.

Vapor intrusion calculations could not be performed for isopropyltoluene in groundwater because fate and transport parameters and, more significantly, dose-response data, are not readily available for this compound. However, the groundwater EPC for this COPC was only 6.1 ug/L. Vapor intrusion risks are dominated by VOCs that are associated with a higher order of toxicity (e.g., TCE, PCE, VC). It is unlikely that lack of quantification of vapor intrusion risks associated with isopropyltoluene would change the conclusions of the SRE.

Potential exposures to VOCs that may migrate from soil to ambient air, which is a pathway that is only applicable to the TCE Impacted Area, were evaluated using EPCs for surface soil. A review of the surface soil and subsurface soil data (Table 3-4) indicates that the TCE EPC is much higher in surface soil than in subsurface soil, but that more VOCs were retained as COPCs in subsurface soil. A review of SRE results for the construction worker, which was evaluated for both surface and subsurface soil inhalation risks, indicates that inhalation risks for surface soil at the TCE Impacted Area were higher than inhalation risks for subsurface soil. Therefore, lack of evaluation of inhalation risks for subsurface soil, does not introduce an uncertainty that would change results or conclusions of the risk assessment.

A full-time outdoor commercial worker scenario was not evaluated because realistic future uses of the Site would not include full-time outdoor workers who would be exposed to soil; if the Site is used for commercial/industrial purposes it will be paved. Regardless, the groundskeeper scenario used an exposure frequency of 190 days per year for 25 years. The USEPA default exposure frequency for full-time outdoor workers is 225 days per year to 250 days per year (USEPA, 2002b), representing up to a 30% greater exposure than was assumed in the outdoor groundskeeper scenario. However, a review of the SRE results indicates that a 30% increase in outdoor groundskeeper risks would not result in any changes to the conclusions of the SRE. Therefore, risks for the outdoor groundskeeper scenario are protective for a hypothetical full time outdoor worker scenario.

5.9.3 Toxicity Assessment

There are a number of factors that contribute uncertainty to the estimates of exposure and risk presented above. Uncertainties based upon derivation and use of toxicological values are inherent in each risk characterization. Some of these include:

- The use of animal data to predict potential human health effects.
- Extrapolation of experimental data obtained by exposing animals to high chemical doses to the likely outcome in humans following exposure to low chemical levels in the environment.
- The use of conservatively derived toxicological criteria. The oral or dermal RfDs and inhalation RfCs have been established with sequential application of uncertainty factors to account for various sources of uncertainty. As such, uncertainty factors ranging from 1 to 10,000 may be applied when developing RfDs/RfCs. According to IRIS (USEPA, 2008), RfDs/RfCs are estimates with uncertainty spanning perhaps an order-of-magnitude. These estimates can change when additional information becomes available.
- The carcinogenic SFs and unit risks are typically calculated by the USEPA using a linearized multistage model, which leads to a plausible upper-bound estimate of the risk. The true value of the risk is unknown and may be as low as zero (USEPA, 1989a). The limitation and conservatism of this approach has long been recognized and new guidelines for cancer assessment have been proposed (USEPA, 2005).
- The lack of toxicity data for some chemicals evaluated in the risk characterization.
- Lack of toxicity criteria specific for evaluating the dermal route of exposure. The current EPA default position is to adjust the oral criterion with an oral absorption factor and adopt this adjusted value as the surrogate criterion for dermal exposure. The validity and scientific basis for this extrapolation warrant further deliberation, because the mechanism for absorption through a skin barrier (i.e., dermal route) is expected to be different from absorption through a gastrointestinal system (i.e., oral route). It should be noted, however, the current method recommended by USEPA for extrapolating default dermal toxicity criteria does not reflect the specific conditions under which the reference toxicological study was conducted (e.g., method of administration such as gavage, water, or diet, and vehicle of administration such as solvent, oil, or solution). Therefore, uncertainty is added to the assessment of dermal pathways.

6.0 Remedial Action Goals

Human health remedial action goals (RAGs) were developed for chemicals of concern (COCs), for media which posed health risks in excess of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) risk management limits, as identified from the results of the SRE.

Media that require RAGs were identified as an exposure medium if, for any of the land use receptor scenarios evaluated in the SRE:

- the excess lifetime cancer risk is greater than $1x10^{-4}$, or
- the HI is greater than 1.

A COC is a COPC that is associated with an excess lifetime cancer risk greater than $1x10^{-6}$ or a HI greater than 1 for any of the land use scenarios that trigger a need for RAGs. The exposure scenarios and COCs associated with risks exceeding these thresholds are as follows:

- Construction worker: PCB-1242, PCB-1248, PCB-1260, and TCE in soil
- Construction worker: TCE, vinyl chloride, 1,2,4-trimethylbenzene in groundwater
- Adult groundskeeper: PCB-1242, PCB-1248, PCB-1260 in soil
- Adolescent recreational visitor: PCB-1242, PCB-1248, PCB-1260 in soil
- Adult staff worker: PCB-1242, PCB-1248, PCB-1260 in soil
- Adult commercial/industrial indoor worker: PCB-1248, PCB-1260 on interior building surfaces

A RAG is a COC concentration that is protective for media exposures at specified risk levels. RAGs include risk-based concentrations that are back-calculated from the site-specific exposure scenarios at a target excess lifetime cancer risk of $1x10^{-6}$ to $1x10^{-4}$ and a HI of 1, Applicable, Relevant, and Appropriate Requirements (ARARs), and background concentrations.

Institutional Controls (ICs) are anticipated as a vital component of the ultimate disposition of the former Carter Carburetor Site. The ICs to be evaluated in depth in the EE/CA, including an assessment of the feasibility of implementation and an assessment of associated costs include: Governmental Controls, in particular the zoning of the parcel(s) to exclude the future use of the site as either a day care facility or for residential use; filing of deed notices/restrictions detailing engineering controls designed and installed as part of the selected remedial alternative; and enforcement of existing permit requirements as required by the City of St. Louis code. These alternatives are not exclusive to each other, and the final selected alternative is not limited to and may include a combination of these ICs.

Remedial action goals are essentially derived by performing the risk assessment process in reverse. The target risk levels are set to acceptable levels, the same exposure intake factors are applied, and the remedial action goal is calculated.

Risk-based RAGs can be calculated by re-arranging the intake and risk calculation algorithms, in which a target risk is specified as an input into the equation and the corresponding EPC is calculated. The EPC, in this case, represents the RAG because it is the media concentration that corresponds to a specified level of risk for the receptor specific intake parameters and toxicity data.

However, the same numerical RAG can be calculated using a simple algebraic equality with information from the SRE, as follows:

$$\frac{\text{(RAG)}}{\text{(target risk for RAG)}} = \frac{\text{(EPC as shown in SRE)}}{\text{(risk associated with EPC as shown in SRE)}}$$

When evaluating multiple COCs at the same exposure point, it is necessary to consider additivity of non-cancer risks among target organs, to ensure that residual concentrations that meet the RAG for each COC will not result in HI values greater than 1 for a specific target organ.

6.1 Remedial Action Goals for Soil

The remedial action goals for soil are presented in Table 7-1. For the construction worker, both PCBs and TCE contribute to non-cancer risks. However, the target organ for TCE is the nervous system, and the target organ for PCBs is the skin and liver. Therefore, RAGs can be developed for each of these COCs based on a target HI of 1.

6.2 Remedial Action Goals for Groundwater

The remedial action goals for groundwater are calculated in Table 7-2. The predominant risk contribution from groundwater to the construction worker is via ambient vapor inhalation. The RfC target organ for TCE is the nervous system and the RfC target organ for vinyl chloride is the liver. Therefore, RAGs can be developed for each of these COCs based on a target HI of 1.

6.3 Remedial Action Goals for Interior Building Surfaces

The RAG for PCBs on non-porous interior building surfaces, evaluated using wipe samples collected from the interior of the CBI Building, will be the PCB decontamination standard value published in the Toxic Substance Control Act (TSCA) amendment of 1998 (known as the "Megarule") of 10 micrograms per 100 square centimeters (µg/100 cm^2) (USEPA, 1998).

7.0 Ecological Risk Evaluation

As described by USEPA's *Environmental Evaluation Manual* (USEPA, 1989b), environmental evaluation, or more appropriately "ecological assessment," is a qualitative and/or quantitative appraisal of the actual or potential effects of a hazardous waste site on plants and animals other than people and domesticated species (USEPA, 1989b). The purpose of the environmental evaluation performed for the Carter Carburetor Site is to evaluate and quantify the potential adverse effects that chemicals present in site media could have on wildlife receptors identified on site. USEPA recommends (in USEPA, 1999) that each ecological risk assessment be performed in accordance with *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (ERAGS) (USEPA, 1997b). As described by ERAGS, the evaluation typically consists of the following steps:

1. Development of the site conceptual model to identify potential ecological receptors, fate and transport mechanisms, and exposure pathways;
2. Identification of chemicals of ecological concern (COPECs);
3. Development of toxicity profiles for the COPECs that represent thresholds for adverse effects; and
4. Determination of the likelihood and characteristics of adverse effects to receptors.

Ecological evaluations result with the derivation of risks for each receptor-COPEC scenario using the hazard quotient (HQ) approach, which provides an index of individual receptor risk. The results of the ecological risk evaluation are then used to determine if a risk management decision is necessary for the protection of wildlife receptor species at the Site.

For a determination of potential habitat, the Site is observed with regard to vegetation available for cover, nesting, and as food and water resources. Under current conditions, land cover at this Site is comprised of a large building, pavement, and parking areas. Aside from weed species of vegetation growing through cracks in pavement, very little plant life exists. As the Site is also located in a highly urbanized city in high traffic areas (see Figure 2-1), very little, if any terrestrial habitat exists on nearby properties. The quality and diversity of the on-site and near-by terrestrial habitat therefore appears to be quite low, to the extent that wildlife habitat for small mammals, and reptiles does not appear to exist. Very few potential offerings for wildlife at the Site are available for birds. Nesting opportunities exist in the building roofing, gravel on the Site may provide a source of grit, and dusty areas may provide a resource for dust-bathing for various birds.

In consideration of potential future site conditions, the site may be converted to a recreational soccer field. While the potential exists for a large, vegetated area, because soccer fields are intensively managed (see the discussion presented in Section 4.3 above relative to the outdoor groundskeeper), including weekly mowing, these areas do not typically present high quality habitat. Terrestrial mammals are more likely to avoid such areas as there is little in the way of plant cover, due to constant mowing, and little in the way of food (prey) sources (e.g., subsurface grubs and larvae) as pesticides are typically applied to minimize them.

Therefore, current habitat does not exist, and it not anticipated to exist in the future, to the extent that further ecological evaluation is warranted.

8.0 References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Minimum Risk Levels. January, 2008. www.atsdr.cdc.gov/mrls.htm

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Polychlorinated Biphenyls (PCBs). Atlanta, Ga. www.atsdr.cdc.gov/toxprofiles/tp17.pdf

California Environmental Protection Agency (Cal EPA). 2008. Toxicity Criteria Database. Office of Environmental Health Hazard Assessment. On-line, August, 2008.www.oehha.ca.gov/risk/ChemicalDB/

City of St. Louis. 2005. St. Louis City Revised Code 11.81 – Groundwater. St. Louis, Missouri.

Driver, J.H., J.J. Konz, and G.K. Whitmyre, 1989. "Soil adherence to human skin." *Bull. Environ. Contam. Toxicol.* Vol 43, pp. 814-820.

Hawley, J.K. 1985. "Assessment of Health Risk from Exposure to Contaminated Soil"; *Risk Analysis*; Vol. 5, No. 4, pp. 289-302.

Kim, N.K and J. Hawley. 1985. "RE-entry Guidelines: Binghamton State Office Building. New York State Department of Health, Bureau of Toxic Substances Assessment, Division of Health Risk Control. Albany, NY. August. Document 0549P.

Kissel, J.C., K.Y. Richter, and R.A. Fenske. 1996. "Field Measurement of Dermal Loading Attributable to Various Activities: Implications for Exposure Assessment." *Risk Analysis*, Vol. 16, No. 1.

Lepow, M.L., L. Bruckman, M. Gilette, S. Markowitz, R Rubino, and J. Kapish. 1975. "Investigations into sources of lead in the environment of urban children." *Environ. Res*., Vol. 10, pp. 415-426.

MACTEC Engineering and Consulting, Inc. 2007. *Interim Data Submission Report for the Former Carter Carburetor Site, Round 2 Field Data*. St. Louis, Missouri. November, 2006.

MACTEC Engineering and Consulting, Inc. 2006. *Interim Data Submission Report for the Former Carter Carburetor Site, Round 1 Field Data.* St. Louis, Missouri. December, 2007.

MACTEC Engineering and Consulting, Inc. 2005. *Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site – PCB Delineation of the North and South Diecast Buildings.* St. Louis, Missouri, October 2005.

MACTEC Engineering and Consulting, Inc. 2005. *Limited Groundwater Investigation Report for the Former Carter Carburetor Site*. St. Louis, Missouri, October 2005.

MACTEC Engineering and Consulting, Inc. 2003. *Final Environmental Field Investigation Report for Former Carter Carburetor Site St. Louis.* Missouri Facility, August 2003.

Michaud, J.M., S.L. Huntley, M.M. Sherer, and D.J. Paustenbach. 1994. PCB and Dioxin Re-entry Criteria for Building Surfaces and Air. J Exp Anal and Env Epidem, 4(2):197-227.

Michigan Department of Environmental Quality (MDEQ). 1998. "Part 201 Generic Groundwater and Soil Volatilization to Indoor Air Inhalation Criteria Technical Support Document." August, 1998.

Que Hee, S.S., B. Peace, C.S. Clark, J.R. Boyle, R.L. Bornschein, and P.B. Hammond. 1985. "Evolution of efficient methods to sample lead sources, such as house dust and hand dust, in the homes of children." *Environ. Res.,* Vol. 38, pp. 77-95.

Roels, H.A., J.P. Buchet, R.R. Lauwenys, P. Branx, F. Claeys-Thoreau, A. Lafontaine, and G. Verduyn. 1980. "Exposure to lead by oral and pulmonary routes of children living in the vicinity of a primary lead smelter." *Environ. Res*., Vol. 22, pp. 81-94.

United States Environmental Protection Agency (USEPA). 2009. *Interim Recommended Trichloroethene (TCE) Toxicity Values to Asses Human Health Risk and Recommendations for the Vapor Intrusion Pathway Analysis.* Office of Emergency and Remedial Response. Washington, D.C. Memorandum from Susan Parker Bodine to Regional Administrators, January 15, 2009.

United States Environmental Protection Agency (USEPA). 2008. "Integrated Risk Information System". National Center for Environmental Assessment. Cincinnati, Ohio. Available as an on-line data-base at www.epa.gov/iris. Data search, December, 2008.

United States Environmental Protection Agency (USEPA). 2007. *ProUCL Version 4.0 User Guide*. Office of Research and Development, EPA Technical Support Center. EPA/600/R-07/038. Las Vegas, NV.

United States Environmental Protection Agency (USEPA). 2005. G*uidelines for Carcinogen Risk Assessment*. EPA/630/P-03/001F. Risk Assessment Forum. Washington, D.C.

United States Environmental Protection Agency (USEPA). 2004. *Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part E Supplemental Guidance for Dermal Risk Assessment, Interim Guidance).* Office of Emergency and Remedial Response. NCEA-W-0364. Washington, D.C.

United States Environmental Protection Agency (USEPA). 2004. Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings.

www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

United States Environmental Protection Agency (USEPA). 2003. *Human Health Toxicity Values in Superfund Risk Assessments.* Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-53. Washington, D.C.

United States Environmental Protection Agency (USEPA). 2002a. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* Office of Emergency Response, OSWER 9285.6-10. Washington, DC.

United States Environmental Protection Agency (USEPA). 2002b. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites*. OSWER 9355.4-24. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 2002c. *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance.* EPA 530-D-02-004. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 1999. "Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites." OSWER Directive 9285.7-28 P. Office of Solid Waste and Emergency Response. Washington, DC. October, 1999.

United States Environmental Protection Agency (USEPA). 1998. TSCA Megarule – Technical Support Documentation (Support Document for the PCB Disposal Amendments, Final Rule. April 16, 1998.

United States Environmental Protection Agency (USEPA). 1997a. Health Effects Summary Tables (HEAST), Annual Update. Office of Solid Waste and Emergency Response. NCEA-W-0364. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1997b. Ecological Risk Assessment Guidance for Superfund: Process for Designing and conducting Ecological Risk Assessments. EPA 540-R-97-006. OSWER Directive 9285.7-25. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 1997c. *Standard Default Exposure Factors. Human Health Evaluation Manual, Supplemental Guidance.* Office of Emergency and Remedial Response. OSWER Directive 9285.6-03. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1996. *Soil Screening Guidance: User's Guide*. Office of Solid Waste and Emergency Response. Publication 9355-4-23. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1993. *Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA*. EPA/540-R-93-057. Office of Solid Waste and Emergency Response. Washington, DC.

United States Environmental Protection Agency (USEPA). 1992. *Dermal Exposure Assessment: Principles and Applications.* Office of Research and Development. EPA/600/8-91/011B. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1991a. Role of the Baseline Risk Assessment in Superfund Remedy Selection. Office of Solid Waste and Emergency Response. OSWER Directive 9355.0-.30. Washington, DC.

United States Environmental Protection Agency (USEPA). 1991b. *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual (Part B Development of Risk-based Preliminary Remediation Goals*. Office of Emergency and Remedial Response. EPA/540/R-92/003, Publication 9285.7-01B. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1990. National Oil and Hazardous Substances Pollution Contingency Plan. Code of Federal Regulations, Title 40, Part 300, Federal Register, March 8.

United States Environmental Protection Agency (USEPA). 1989a. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)*. Office of Solid Waste and Emergency Response. EPA/540/1-89/002. Washington, D.C.

United States Environmental Protection Agency (USEPA). 1989b. *Risk Assessment Guidance for Superfund Volume II, Environmental Evaluation Manual.* EPA/540/1-89/001. Office of Solid Waste and Emergency Response. Washington, D.C.

United States Environmental Protection Agency (USEPA), Region 7. 2005. *Administrative Settlement Agreement and Order on Consent for Removal Action*, in the matter of: Carter Carburetor Site, St. Louis, Missouri, September 29, 2005

United States Environmental Protection Agency (USEPA), Region 6. 2008. Media-Specific Remediation Levels. Kansas City, KS. Revised March 2008.

United States Environmental Protection Agency (USEPA), 2008. *U.S. EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors (Draft)*. Office of Solid Waste and Emergency Response. Washington, D.C. March 4, 2008.

Appendix A

Samples and Analytical Data Used in the SRE

Appendix A: Table A1
Carter Carburetor EE/CA
PCBs in Exterior Soils - Surface Soil 0 to 1 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Exterior	PCB-SSDC-01-1	1	mg/kg	ND	0.159	ND	0.159	ND	0.159	ND	0.159
Exterior	PCB-SSDC-02-1	1	mg/kg	ND	0.1945	ND	0.1945	ND	0.1945	ND	0.1945
Exterior	PCB-SSDC-03-1	1	mg/kg	ND	0.1655	ND	0.1655	ND	0.1655	ND	0.1655
Exterior	PCB-SSDC-04-1	1	mg/kg	ND	0.1835	ND	0.1835	ND	0.1835	ND	0.1835
Exterior	PCB-WDC-1-1	1	mg/kg	ND	0.1685	ND	0.1685	ND	0.1685	ND	0.1685
Exterior	PCB-WDC-2-1	1	mg/kg	ND	0.155		1.27	ND	0.155	ND	0.155
Exterior	PCB-WDC-4-1	1	mg/kg	ND	0.2095	ND	0.2095	ND	0.2095	ND	0.2095
Exterior	PCB-WDC-5-1	1	mg/kg	ND	0.2025	ND	0.2025	ND	0.2025	ND	0.2025

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	8	8	8	8
	no. hits	0	1	0	0
	min-D	0	1.27	0	0
	max-D	0	1.27	0	0
	min-ND	0.31	0.318	0.31	0.31
	max-ND	0.419	0.419	0.419	0.419
	mean	0.17975	0.319125	0.17975	0.17975
	95% UCL	0.194	0.912	0.194	0.194

ND = non-detect
No duplicates to remove.
All ND values are at 1/2 the detection limit.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Surface Soil Interval (0-1 ft) - PCB-1242, 1254, and 1260

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	8	Number of Unique Samples	8
Raw Statistics		Log-transformed Statistics	
Minimum	0.155	Minimum of Log Data	-1.864
Maximum	0.21	Maximum of Log Data	-1.563
Mean	0.18	Mean of log Data	-1.722
Median	0.176	SD of log Data	0.115
SD	0.0207		
Coefficient of Variation	0.115		
Skewness	0.277		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.922	Shapiro Wilk Test Statistic	0.925
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.194	95% H-UCL	0.195
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.212
95% Adjusted-CLT UCL	0.193	97.5% Chebyshev (MVUE) UCL	0.225
95% Modified-t UCL	0.194	99% Chebyshev (MVUE) UCL	0.252
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	54.31	Data appear Normal at 5% Significance Level	
Theta Star	0.00331		
nu star	869		
Approximate Chi Square Value (.05)	801.6	Nonparametric Statistics	
Adjusted Level of Significance	0.0195	95% CLT UCL	0.192
Adjusted Chi Square Value	785.1	95% Jackknife UCL	0.194
		95% Standard Bootstrap UCL	0.191
Anderson-Darling Test Statistic	0.343	95% Bootstrap-t UCL	0.194
Anderson-Darling 5% Critical Value	0.715	95% Hall's Bootstrap UCL	0.19
Kolmogorov-Smirnov Test Statistic	0.212	95% Percentile Bootstrap UCL	0.191
Kolmogorov-Smirnov 5% Critical Value	0.294	95% BCA Bootstrap UCL	0.192
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.212
		97.5% Chebyshev(Mean, Sd) UCL	0.226
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.253
95% Approximate Gamma UCL	0.195		
95% Adjusted Gamma UCL	0.199		
Potential UCL to Use		**Use 95% Student's-t UCL**	**0.194**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Surface Soil Interval (0-1 ft) - PCB-1248

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Samples	8	Number of Unique Samples	8
Raw Statistics		Log-transformed Statistics	
Minimum	0.159	Minimum of Log Data	-1.839
Maximum	1.27	Maximum of Log Data	0.239
Mean	0.319	Mean of log Data	-1.459
Median	0.189	SD of log Data	0.693
SD	0.385		
Coefficient of Variation	1.205		
Skewness	2.816		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.464	Shapiro Wilk Test Statistic	0.556
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.577	95% H-UCL	0.61
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.595
95% Adjusted-CLT UCL	0.687	97.5% Chebyshev (MVUE) UCL	0.73
95% Modified-t UCL	0.599	99% Chebyshev (MVUE) UCL	0.993
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.162	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.275		
nu star	18.59		
Approximate Chi Square Value (.05)	9.82	Nonparametric Statistics	
Adjusted Level of Significance	0.0195	95% CLT UCL	0.543
Adjusted Chi Square Value	8.257	95% Jackknife UCL	0.577
		95% Standard Bootstrap UCL	0.526
Anderson-Darling Test Statistic	1.974	95% Bootstrap-t UCL	3.874
Anderson-Darling 5% Critical Value	0.726	95% Hall's Bootstrap UCL	2.572
Kolmogorov-Smirnov Test Statistic	0.475	95% Percentile Bootstrap UCL	0.588
Kolmogorov-Smirnov 5% Critical Value	0.298	95% BCA Bootstrap UCL	0.725
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.912
		97.5% Chebyshev(Mean, Sd) UCL	1.168
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.672
95% Approximate Gamma UCL	0.604		
95% Adjusted Gamma UCL	0.719		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**0.912**

Appendix A: Table A2
Carter Carburetor EE/CA
PCBs in Exterior Soils - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Exterior	PCB-EDC-1-10	10	mg/kg	ND	0.1615	ND	0.1615	ND	0.1615	ND	0.1615
Exterior	PCB-EDC-1-3	3	mg/kg	ND	0.1775	ND	0.1775	ND	0.1775	ND	0.1775
Exterior	PCB-EDC-2-10	10	mg/kg	ND	0.1765	ND	0.1765	ND	0.1765	ND	0.1765
Exterior	PCB-EDC-2-3	3	mg/kg	ND	0.188	ND	0.188	ND	0.188	ND	0.188
Exterior	PCB-EDC-3-10	10	mg/kg	ND	0.1725	ND	0.1725	ND	0.1725	ND	0.1725
Exterior	PCB-EDC-3-3	3	mg/kg	ND	0.153	ND	0.153	ND	0.153	ND	0.153
Exterior	PCB-EDC-4-10	10	mg/kg	ND	0.173	ND	0.173	ND	0.173	ND	0.173
Exterior	PCB-EDC-4-3	3	mg/kg	ND	0.157	ND	0.157	ND	0.157	ND	0.157
Exterior	PCB-NNDC-01-3	3	mg/kg	ND	0.203	ND	0.203	ND	0.203	ND	0.203
Exterior	PCB-NNDC-01-9	9	mg/kg	ND	0.1945	ND	0.1945	ND	0.1945	ND	0.1945
Exterior	PCB-NNDC-02-10	10	mg/kg	ND	0.197	ND	0.197	ND	0.197	ND	0.197
Exterior	PCB-NNDC-02-2	2	mg/kg	ND	0.2125	ND	0.2125	ND	0.2125	ND	0.2125
Exterior	PCB-NNDC-03-2	2	mg/kg	ND	0.193	ND	0.193	ND	0.193	ND	0.193
Exterior	PCB-NNDC-04-3	3	mg/kg	ND	0.1975	ND	0.1975	ND	0.1975	ND	0.1975
Exterior	PCB-NNDC-04-8	8	mg/kg	ND	0.1805	ND	0.1805	ND	0.1805	ND	0.1805
Exterior	PCB-NNDC-05-3	3	mg/kg	ND	0.211	ND	0.211	ND	0.211	ND	0.211
Exterior	PCB-NNDC-05-9	9	mg/kg	ND	0.1885	ND	0.1885	ND	0.1885	ND	0.1885
Exterior	PCB-NNDC-06-2	2	mg/kg	ND	0.188	ND	0.188	ND	0.188	ND	0.188
Exterior	PCB-NNDC-06-9	9	mg/kg	ND	0.1865	ND	0.1865	ND	0.1865	ND	0.1865
Exterior	PCB-NNDC-07-3	3	mg/kg	ND	0.1765	ND	0.1765	ND	0.1765	ND	0.1765
Exterior	PCB-NNDC-07-9	9	mg/kg	ND	0.1795	ND	0.1795	ND	0.1795	ND	0.1795
Exterior	PCB-NNDC-08-3	3	mg/kg	ND	9.45	ND	9.45	ND	9.45		409
Exterior	PCB-NNDC-08-9	9	mg/kg	ND	1.8	ND	1.8	ND	1.8		46.8
Exterior	PCB-NNDC-09-9	9	mg/kg	ND	0.2045	ND	0.2045	ND	0.2045	ND	0.2045
Exterior	PCB-SSDC-01-1	1	mg/kg	ND	0.159	ND	0.159	ND	0.159	ND	0.159
Exterior	PCB-SSDC-01-9	9	mg/kg	ND	0.1665	ND	0.1665	ND	0.1665	ND	0.1665
Exterior	PCB-SSDC-02-1	1	mg/kg	ND	0.1945	ND	0.1945	ND	0.1945	ND	0.1945
Exterior	PCB-SSDC-02-10	10	mg/kg	ND	0.231	ND	0.231	ND	0.231	ND	0.231
Exterior	PCB-SSDC-03-1	1	mg/kg	ND	0.1655	ND	0.1655	ND	0.1655	ND	0.1655
Exterior	PCB-SSDC-03-9	9	mg/kg	ND	0.195	ND	0.195	ND	0.195	ND	0.195
Exterior	PCB-SSDC-04-1	1	mg/kg	ND	0.1835	ND	0.1835	ND	0.1835	ND	0.1835
Exterior	PCB-SSDC-05-10	10	mg/kg	ND	0.1715	ND	0.1715	ND	0.1715	ND	0.1715
Exterior	PCB-SSDC-06-10	10	mg/kg	ND	0.2015	ND	0.2015	ND	0.2015	ND	0.2015
Exterior	PCB-SSDC-07-10	10	mg/kg	ND	0.1855	ND	0.1855	ND	0.1855	ND	0.1855
Exterior	PCB-SSDC-07-4	4	mg/kg	ND	0.1815	ND	0.1815	ND	0.1815	ND	0.1815
Exterior	PCB-SSDC-08-2	2	mg/kg	ND	0.1945	ND	0.1945	ND	0.1945	ND	0.1945
Exterior	PCB-SSDC-08-9	9	mg/kg	ND	0.1835	ND	0.1835	ND	0.1835	ND	0.1835
Exterior	PCB-SSDC-09-2	2	mg/kg	ND	0.1635	ND	0.1635	ND	0.1635	ND	0.1635
Exterior	PCB-SSDC-09-9	9	mg/kg	ND	0.163	ND	0.163	ND	0.163	ND	0.163
Exterior	PCB-WDC-1-1	1	mg/kg	ND	0.1685	ND	0.1685	ND	0.1685	ND	0.1685
Exterior	PCB-WDC-1-8	8	mg/kg	ND	0.175	ND	0.175	ND	0.175	ND	0.175
Exterior	PCB-WDC-2-1	1	mg/kg	ND	0.155		1.27	ND	0.155	ND	0.155

Appendix A: Table A2
Carter Carburetor EE/CA
PCBs in Exterior Soils - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Exterior	PCB-WDC-2-10	10	mg/kg	ND	0.17		2.61	ND	0.17	ND	0.17
Exterior	PCB-WDC-2-3	3	mg/kg	ND	0.203		0.936	ND	0.203	ND	0.203
Exterior	PCB-WDC-3-2	2	mg/kg	ND	0.1865	ND	0.1865	ND	0.1865	ND	0.1865
Exterior	PCB-WDC-3-8	8	mg/kg	ND	0.1805	ND	0.1805	ND	0.1805	ND	0.1805
Exterior	PCB-WDC-4-1	1	mg/kg	ND	0.2095	ND	0.2095	ND	0.2095	ND	0.2095
Exterior	PCB-WDC-4-8	8	mg/kg	ND	0.199	ND	0.199	ND	0.199	ND	0.199
Exterior	PCB-WDC-5-1	1	mg/kg	ND	0.2025	ND	0.2025	ND	0.2025	ND	0.2025
Exterior	PCB-WDC-5-8	8	mg/kg	ND	0.1995	ND	0.1995	ND	0.1995	ND	0.1995
Exterior	SB-06-04	4	mg/kg	ND	0.165	ND	0.165	ND	0.165	ND	0.165
Exterior	SB-13-08	8	mg/kg	ND	0.16	ND	0.16	ND	0.16	ND	0.16
Exterior	SB-14-04	4	mg/kg	ND	0.155	ND	0.155	ND	0.155	ND	0.155
Exterior	SB-14-08	8	mg/kg	ND	0.16	ND	0.16	ND	0.16	ND	0.16
Exterior	SB-19-04	4	mg/kg	ND	16	ND	16	ND	16		67.6
Exterior	SB-31-05	5	mg/kg	ND	0.155	ND	0.155	ND	0.155	ND	0.155
Exterior	SS4-01-08	8	mg/kg		2.1	ND	0.31	ND	0.31	ND	0.31
Exterior	SS4-02-06	6	mg/kg	ND	0.31	ND	0.31	ND	0.31		1.2
Exterior	SS4-03-07	7	mg/kg	ND	0.31	ND	0.31	ND	0.31		1.3
Exterior	TK01-06	6	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Exterior	TK02-06	6	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Exterior	TK03-04	4	mg/kg	ND	0.315	ND	0.315	ND	0.315	ND	0.315
Exterior	TK03-07	7	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Exterior	TK04-06	6	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	64	64	64	64
	no. hits	1	3	0	5
	min-D	2.1	0.936	0	1.2
	max-D	2.1	2.61	0	409
	min-ND	0.306	0.306	0.306	0.306
	max-ND	32	32	32	0.63
	mean	0.643281	0.682313	0.615313	8.397031
	95% UCL	1.888	1.93	1.856	48.89

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are at 1/2 the detection limit.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - PCB-1242

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	64	Number of Unique Samples	49
Raw Statistics		Log-transformed Statistics	
Minimum	0.153	Minimum of Log Data	-1.877
Maximum	16	Maximum of Log Data	2.773
Mean	0.643	Mean of log Data	-1.443
Median	0.187	SD of log Data	0.845
SD	2.285		
Coefficient of Variation	3.552		
Skewness	5.911		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.495	Lilliefors Test Statistic	0.362
Lilliefors Critical Value	0.111	Lilliefors Critical Value	0.111
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.12	95% H-UCL	0.423
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.511
95% Adjusted-CLT UCL	1.339	97.5% Chebyshev (MVUE) UCL	0.587
95% Modified-t UCL	1.155	99% Chebyshev (MVUE) UCL	0.736
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.596	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.079		
nu star	76.29		
Approximate Chi Square Value (.05)	57.17	Nonparametric Statistics	
Adjusted Level of Significance	0.0463	95% CLT UCL	1.113
Adjusted Chi Square Value	56.79	95% Jackknife UCL	1.12
		95% Standard Bootstrap UCL	1.114
Anderson-Darling Test Statistic	18.43	95% Bootstrap-t UCL	3.838
Anderson-Darling 5% Critical Value	0.805	95% Hall's Bootstrap UCL	3.611
Kolmogorov-Smirnov Test Statistic	0.459	95% Percentile Bootstrap UCL	1.17
Kolmogorov-Smirnov 5% Critical Value	0.117	95% BCA Bootstrap UCL	1.418
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.888
		97.5% Chebyshev(Mean, Sd) UCL	2.427
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.485
95% Approximate Gamma UCL	0.858		
95% Adjusted Gamma UCL	0.864		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**1.888**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - PCB-1248

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Samples	64	Number of Unique Samples	50
Raw Statistics		Log-transformed Statistics	
Minimum	0.153	Minimum of Log Data	-1.877
Maximum	16	Maximum of Log Data	2.773
Mean	0.682	Mean of log Data	-1.374
Median	0.188	SD of log Data	0.893
SD	2.29		
Coefficient of Variation	3.357		
Skewness	5.823		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.47	Lilliefors Test Statistic	0.343
Lilliefors Critical Value	0.111	Lilliefors Critical Value	0.111
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.16	95% H-UCL	0.481
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.583
95% Adjusted-CLT UCL	1.376	97.5% Chebyshev (MVUE) UCL	0.674
95% Modified-t UCL	1.195	99% Chebyshev (MVUE) UCL	0.852
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.602	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.134		
nu star	76.99		
Approximate Chi Square Value (.05)	57.78	Nonparametric Statistics	
Adjusted Level of Significance	0.0463	95% CLT UCL	1.153
Adjusted Chi Square Value	57.4	95% Jackknife UCL	1.16
		95% Standard Bootstrap UCL	1.139
Anderson-Darling Test Statistic	16.54	95% Bootstrap-t UCL	3.339
Anderson-Darling 5% Critical Value	0.805	95% Hall's Bootstrap UCL	3.467
Kolmogorov-Smirnov Test Statistic	0.444	95% Percentile Bootstrap UCL	1.21
Kolmogorov-Smirnov 5% Critical Value	0.117	95% BCA Bootstrap UCL	1.468
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.93
		97.5% Chebyshev(Mean, Sd) UCL	2.47
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.531
95% Approximate Gamma UCL	0.909		
95% Adjusted Gamma UCL	0.915		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**1.93**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - PCB-1254

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics

Number of Valid Observations	64	Number of Distinct Observations	48
Raw Statistics		Log-transformed Statistics	
Minimum	0.153	Minimum of Log Data	-1.877
Maximum	16	Maximum of Log Data	2.773
Mean	0.615	Mean of log Data	-1.473
Median	0.187	SD of log Data	0.799
SD	2.278		
Coefficient of Variation	3.702		
Skewness	6.001		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.506	Lilliefors Test Statistic	0.35
Lilliefors Critical Value	0.111	Lilliefors Critical Value	0.111
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.091	95% H-UCL	0.389
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.467
95% Adjusted-CLT UCL	1.312	97.5% Chebyshev (MVUE) UCL	0.534
95% Modified-t UCL	1.126	99% Chebyshev (MVUE) UCL	0.664
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.604	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.019		
nu star	77.26		
Approximate Chi Square Value (.05)	58.01	Nonparametric Statistics	
Adjusted Level of Significance	0.0463	95% CLT UCL	1.084
Adjusted Chi Square Value	57.63	95% Jackknife UCL	1.091
		95% Standard Bootstrap UCL	1.068
Anderson-Darling Test Statistic	19.12	95% Bootstrap-t UCL	16.9
Anderson-Darling 5% Critical Value	0.805	95% Hall's Bootstrap UCL	5.995
Kolmogorov-Smirnov Test Statistic	0.466	95% Percentile Bootstrap UCL	1.11
Kolmogorov-Smirnov 5% Critical Value	0.117	95% BCA Bootstrap UCL	1.4
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.856
		97.5% Chebyshev(Mean, Sd) UCL	2.393
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	3.448
95% Approximate Gamma UCL	0.819		
95% Adjusted Gamma UCL	0.825		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**1.856**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - PCB-1260

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	64	Number of Unique Samples	50
Raw Statistics		Log-transformed Statistics	
Minimum	0.153	Minimum of Log Data	-1.877
Maximum	409	Maximum of Log Data	6.014
Mean	8.397	Mean of log Data	-1.297
Median	0.187	SD of log Data	1.405
SD	51.87		
Coefficient of Variation	6.178		
Skewness	7.573		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.508	Lilliefors Test Statistic	0.384
Lilliefors Critical Value	0.111	Lilliefors Critical Value	0.111
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	19.22	95% H-UCL	1.184
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.432
95% Adjusted-CLT UCL	25.62	97.5% Chebyshev (MVUE) UCL	1.744
95% Modified-t UCL	20.25	99% Chebyshev (MVUE) UCL	2.356
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.213	Data do not follow a Discernable Distribution (0.05)	
Theta Star	39.38		
nu star	27.29		
Approximate Chi Square Value (.05)	16.38	Nonparametric Statistics	
Adjusted Level of Significance	0.0463	95% CLT UCL	19.06
Adjusted Chi Square Value	16.18	95% Jackknife UCL	19.22
		95% Standard Bootstrap UCL	19.26
Anderson-Darling Test Statistic	22.17	95% Bootstrap-t UCL	74.83
Anderson-Darling 5% Critical Value	0.904	95% Hall's Bootstrap UCL	77.56
Kolmogorov-Smirnov Test Statistic	0.531	95% Percentile Bootstrap UCL	20.82
Kolmogorov-Smirnov 5% Critical Value	0.123	95% BCA Bootstrap UCL	29.65
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	36.66
		97.5% Chebyshev(Mean, Sd) UCL	48.89
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	72.92
95% Approximate Gamma UCL	13.99		
95% Adjusted Gamma UCL	14.16		
Potential UCL to Use		**Use 97.5% Chebyshev (Mean, Sd) UCL**	**48.89**

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
			1,1,1,2-Tetrachloroethane			1,1,1-Trichloroethane			1,1,2,2-Tetrachloroethane			1,1,2-Trichloroethane			1,1-Dichloroethane			1,1-Dichloroethene			1,1-Dichloropropene		
SB-06-04	04	ug/kg	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3
SB-07-08	08	ug/kg	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25
SB-09-03	03	ug/kg	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9
SB-10-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-11-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-12-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	6.7		6.7	< 6.4	<	3.2	< 6.4	<	3.2
SB-13-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-14-04	04	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-16-08	08	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-17-05	05	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-18-06	06	ug/kg	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55
SB-19-04	04	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-20-05	05	ug/kg	< 6.2	<	3.1	7.4		7.4	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-21-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-22-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-23-06	06	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-24-07	07	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-25-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-26-05	05	ug/kg	< 6.2	<	3.1	< 6.2		3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-29-05	05	ug/kg	< 6.3	<	3.15	267	<	267	< 6.3	<	3.15	< 6.3	<	3.15	676		676	12.7		12.7	< 6.3	<	3.15
SB-30-06	06	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-31-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
Region 6 Medium-Specific Screening Levels 2008 units = ug/kg			7,100 c			1,400,000 sat			900 c			1,900 c			2,300,000 sat			43,000 n			na		

< represents compound not-detected
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	1,2,3-Trichlorobenzene			1,2,3-Trichloropropane			1,2,4-Trichlorobenzene			1,2,4-Trimethylbenzene			1,2-Dibromo-3-Chloropropane			1,2-Dibromoethane			1,2-Dichlorobenzene		
			Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
SB-06-04	04	ug/kg	< 33	<	16.5	< 6.6	<	3.3	< 33	<	16.5	< 6.6	<	3.3	< 66	<	33	< 66	<	33	< 6.6	<	3.3
SB-07-08	08	ug/kg	< 32	<	16	< 6.5	<	3.25	< 32	<	16	< 6.5	<	3.25	< 65	<	32.5	< 65	<	32.5	< 6.5	<	3.25
SB-09-03	03	ug/kg	< 29	<	14.5	< 5.8	<	2.9	< 29	<	14.5	420		420	< 58	<	29	< 58	<	29	68.9		68.9
SB-10-05	05	ug/kg	< 32	<	16	< 6.3	<	3.15	< 32	<	16	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-11-08	08	ug/kg	< 32	<	16	< 6.4	<	3.2	< 32	<	16	6.6		6.6	< 64	<	32	< 64	<	32	< 6.4	<	3.2
SB-12-08	08	ug/kg	< 32	<	16	< 6.4	<	3.2	< 32	<	16	16.9		16.9	< 64	<	32	< 64	<	32	< 6.4	<	3.2
SB-13-08	08	ug/kg	< 32	<	16	< 6.4	<	3.2	< 32	<	16	< 6.4	<	3.2	< 64	<	32	< 64	<	32	< 6.4	<	3.2
SB-14-04	04	ug/kg	< 31	<	15.5	< 6.2	<	3.1	< 31	<	15.5	< 6.2	<	3.1	< 62	<	31	< 62	<	31	< 6.2	<	3.1
SB-16-08	08	ug/kg	< 31	<	15.5	< 6.3	<	3.15	< 31	<	15.5	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-17-05	05	ug/kg	< 32	<	16	< 6.4	<	3.2	< 32	<	16	< 6.4	<	3.2	< 64	<	32	< 64	<	32	< 6.4	<	3.2
SB-18-06	06	ug/kg	< 25	<	12.5	< 5.1	<	2.55	< 25	<	12.5	< 5.1	<	2.55	< 51	<	25.5	< 51	<	25.5	< 5.1	<	2.55
SB-19-04	04	ug/kg	< 32	<	16	< 6.3	<	3.15	< 32	<	16	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-20-05	05	ug/kg	< 31	<	15.5	< 6.2	<	3.1	< 31	<	15.5	< 6.2	<	3.1	< 62	<	31	< 62	<	31	< 6.2	<	3.1
SB-21-05	05	ug/kg	< 31	<	15.5	< 6.3	<	3.15	< 31	<	15.5	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-22-05	05	ug/kg	< 32	<	16	< 6.3	<	3.15	< 32	<	16	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-23-06	06	ug/kg	< 32	<	16	< 6.3	<	3.15	< 32	<	16	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-24-07	07	ug/kg	389		389	< 6.3	<	3.15	1250		1250	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	59.9		59.9
SB-25-08	08	ug/kg	1140		1140	< 6.4	<	3.2	2220		2220	< 6.4	<	3.2	< 64	<	32	< 64	<	32	135		135
SB-26-05	05	ug/kg	< 31	<	15.5	< 6.2	<	3.1	< 31	<	15.5	< 6.2	<	3.1	< 62	<	31	< 62	<	31	< 6.2	<	3.1
SB-29-05	05	ug/kg	< 32	<	16	< 6.3	<	3.15	80		80	247		247	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
SB-30-06	06	ug/kg	< 32	<	16	< 6.4	<	3.2	< 32	<	16	< 6.4	<	3.2	< 64	<	32	< 64	<	32	8.9		8.9
SB-31-05	05	ug/kg	< 31	<	15.5	< 6.3	<	3.15	< 31	<	15.5	< 6.3	<	3.15	< 63	<	31.5	< 63	<	31.5	< 6.3	<	3.15
Region 6 Medium-Specific Screening Levels 2008			na			1,600			24,000			20,000			18			65			370,000		
units = ug/kg						c			n			n			c			c			sat		

< represents compound not-d
at the noted detection limit

RED font indicates exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
			1,2-Dichloroethane			1,2-Dichloropropane			1,3,5-Trimethylbenzene			1,3-Dichlorobenzene			1,3-Dichloropropane			1,4-Dichlorobenzene			2,2-Dichloropropane		
SB-06-04	04	ug/kg	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 26	<	13
SB-07-08	08	ug/kg	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 26	<	13
SB-09-03	03	ug/kg	< 5.8	<	2.9	< 5.8	<	2.9	133		133	< 5.8	<	2.9	< 5.8	<	2.9	9		9	< 23	<	11.5
SB-10-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-11-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	8.5		8.5	< 26	<	13
SB-12-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13
SB-13-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13
SB-14-04	04	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5
SB-16-08	08	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-17-05	05	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13
SB-18-06	06	ug/kg	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 20	<	10
SB-19-04	04	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-20-05	05	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5
SB-21-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-22-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-23-06	06	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-24-07	07	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	178		178	< 6.3	<	3.15	284		284	< 25	<	12.5
SB-25-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	706		706	< 6.4	<	3.2	210		210	< 26	<	13
SB-26-05	05	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5
SB-29-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	86.2		86.2	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
SB-30-06	06	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 25	<	12.5
SB-31-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5
Region 6 Medium-Specific Screening Levels 2008			770			770			7,000			13,000			37,000			7,500			na		
units = ug/kg			c			c			n			n			n			c					

< represents compound not-de
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
			2-Chlorotoluene			4-Chlorotoluene			Acetone			Benzene			Bromobenzene			Bromochloromethane			Bromodichloromethane		
SB-06-04	**04**	**ug/kg**	< 6.6	<	3.3	< 6.6	<	3.3	< 66	<	33	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3
SB-07-08	**08**	**ug/kg**	< 6.5	<	3.25	< 6.5	<	3.25	< 65	<	32.5	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25
SB-09-03	**03**	**ug/kg**	< 5.8	<	2.9	< 5.8	<	2.9	< 58	<	29	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9
SB-10-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-11-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-12-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-13-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-14-04	**04**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-16-08	**08**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-17-05	**05**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-18-06	**06**	**ug/kg**	< 5.1	<	2.55	< 5.1	<	2.55	< 51	<	25.5	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55
SB-19-04	**04**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-20-05	**05**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-21-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-22-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-23-06	**06**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-24-07	**07**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-25-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-26-05	**05**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-29-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	1510		1510	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-30-06	**06**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	501		501	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-31-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
Region 6 Medium-Specific Screening Levels 2008			510,000			na			5,600,000			1,500			11,000			na			2,400		
units = ug/kg			sat						n			c			n						c		

< represents compound not-d
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

			Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
SAMP_ID	**Depth**	**Units**	**Bromoform**			**Bromomethane**			**Carbon Tetrachloride**			**Chlorobenzene**			**Chlorodibromomethane**			**Chloroethane**			**Chloroform**		
SB-06-04	**04**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 26	<	13	< 6.6	<	3.3
SB-07-08	**08**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 26	<	13	< 6.5	<	3.25
SB-09-03	**03**	**ug/kg**	< 12	<	6	< 23	<	11.5	< 5.8	<	2.9	< 5.8	<	2.9	< 5.8	<	2.9	< 23	<	11.5	< 5.8	<	2.9
SB-10-05	**05**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-11-08	**08**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13	< 6.4	<	3.2
SB-12-08	**08**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13	< 6.4	<	3.2
SB-13-08	**08**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13	< 6.4	<	3.2
SB-14-04	**04**	**ug/kg**	< 12	<	6	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5	< 6.2	<	3.1
SB-16-08	**08**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-17-05	**05**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 26	<	13	< 6.4	<	3.2
SB-18-06	**06**	**ug/kg**	< 10	<	5	< 20	<	10	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 20	<	10	< 5.1	<	2.55
SB-19-04	**04**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-20-05	**05**	**ug/kg**	< 12	<	6	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5	< 6.2	<	3.1
SB-21-05	**05**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-22-05	**05**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-23-06	**06**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-24-07	**07**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	25.6		25.6	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-25-08	**08**	**ug/kg**	< 13	<	6.5	< 26	<	13	< 6.4	<	3.2	41.5		41.5	< 6.4	<	3.2	< 26	<	13	< 6.4	<	3.2
SB-26-05	**05**	**ug/kg**	< 12	<	6	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 25	<	12.5	< 6.2	<	3.1
SB-29-05	**05**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
SB-30-06	**06**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 25	<	12.5	< 6.4	<	3.2
SB-31-05	**05**	**ug/kg**	< 13	<	6.5	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 25	<	12.5	< 6.3	<	3.15
Region 6 Medium-Specific																							
Screening Levels 2008			240,000			1,300			530			46,000			2,400			6,500			520		
units = ug/kg			c			n			c			n			c			c			c		

< represents compound not-de
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	Chloromethane			Cis-1,2-Dichloroethene			Cis-1,3-Dichloropropene			Dibromomethane			Dichlorodifluoromethane			Ethylbenzene			Hexachlorobutadiene		
			Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
SB-06-04	**04**	**ug/kg**	< 26	<	13	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 20	<	10	< 6.6	<	3.3	< 33	<	16.5
SB-07-08	**08**	**ug/kg**	< 26	<	13	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 19	<	9.5	< 6.5	<	3.25	< 32	<	16
SB-09-03	**03**	**ug/kg**	< 23	<	11.5	41.3		41.3	< 5.8	<	2.9	< 5.8	<	2.9	< 17	<	8.5	497		497	< 29	<	14.5
SB-10-05	**05**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 32	<	16
SB-11-08	**08**	**ug/kg**	< 26	<	13	12		12	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-12-08	**08**	**ug/kg**	< 26	<	13	203		203	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-13-08	**08**	**ug/kg**	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-14-04	**04**	**ug/kg**	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 19	<	9.5	< 6.2	<	3.1	< 31	<	15.5
SB-16-08	**08**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 31	<	15.5
SB-17-05	**05**	**ug/kg**	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-18-06	**06**	**ug/kg**	< 20	<	10	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 15	<	7.5	< 5.1	<	2.55	< 25	<	12.5
SB-19-04	**04**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 32	<	16
SB-20-05	**05**	**ug/kg**	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 19	<	9.5	< 6.2	<	3.1	< 31	<	15.5
SB-21-05	**05**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 31	<	15.5
SB-22-05	**05**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 32	<	16
SB-23-06	**06**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 32	<	16
SB-24-07	**07**	**ug/kg**	< 25	<	12.5	14.9		14.9	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 32	<	16
SB-25-08	**08**	**ug/kg**	< 26	<	13	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-26-05	**05**	**ug/kg**	< 25	<	12.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 19	<	9.5	< 6.2	<	3.1	< 31	<	15.5
SB-29-05	**05**	**ug/kg**	< 25	<	12.5	368		368	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	10		10	< 32	<	16
SB-30-06	**06**	**ug/kg**	< 25	<	12.5	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 19	<	9.5	< 6.4	<	3.2	< 32	<	16
SB-31-05	**05**	**ug/kg**	< 25	<	12.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 19	<	9.5	< 6.3	<	3.15	< 31	<	15.5
Region 6 Medium-Specific																							
Screening Levels 2008			16,000			15,000			1,600			55,000			31,000			230,000			25,000		
units = ug/kg			n			n			c			n			n			sat			c		

< represents compound not-de
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

SAMP_ID	Depth	Units	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
			Isopropylbenzene			Methyl Tert-Butyl Ether			Methylene Chloride			Naphthalene			N-Butylbenzene			N-Propylbenzene			P-Isopropyltoluene		
SB-06-04	04	ug/kg	< 6.6	<	3.3	< 6.6	<	3.3	< 66	<	33	< 33	<	16.5	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3
SB-07-08	08	ug/kg	< 6.5	<	3.25	< 6.5	<	3.25	< 65	<	32.5	< 32	<	16	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25
SB-09-03	03	ug/kg	35.1		35.1	< 5.8	<	2.9	< 58	<	29	< 29	<	14.5	15.4		15.4	48	<	48	< 5.8	<	2.9
SB-10-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 32	<	16	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-11-08	08	ug/kg	6.6		6.6	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-12-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-13-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-14-04	04	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 31	<	15.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-16-08	08	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 31	<	15.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-17-05	05	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-18-06	06	ug/kg	< 5.1	<	2.55	< 5.1	<	2.55	< 51	<	25.5	< 25	<	12.5	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55
SB-19-04	04	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 32	<	16	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-20-05	05	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 31	<	15.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-21-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 31	<	15.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-22-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 32	<	16	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-23-06	06	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 32	<	16	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-24-07	07	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 32	<	16	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-25-08	08	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-26-05	05	ug/kg	< 6.2	<	3.1	< 6.2	<	3.1	< 62	<	31	< 31	<	15.5	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-29-05	05	ug/kg	17.2		17.2	< 6.3	<	3.15	90		90	48		48	69.8		69.8	36.8	<	36.8	< 6.3	<	3.15
SB-30-06	06	ug/kg	< 6.4	<	3.2	< 6.4	<	3.2	< 64	<	32	< 32	<	16	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-31-05	05	ug/kg	< 6.3	<	3.15	< 6.3	<	3.15	< 63	<	31.5	< 31	<	15.5	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
Region 6 Medium-Specific																							
Screening Levels 2008			52,000			72,000			21,000			19,000			240,000			240,000			na		
units = ug/kg			n			c			c			n			sat			sat					

< represents compound not-de
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

			Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
SAMP_ID	**Depth**	**Units**	**Sec-Butylbenzene**			**Styrene**			**Tert-Butylbenzene**			**Tetrachloroethene**			**Toluene**			**Trans-1,2-Dichloroethene**			**Trans-1,3-Dichloropropene**		
SB-06-04	**04**	**ug/kg**	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3	< 6.6	<	3.3
SB-07-08	**08**	**ug/kg**	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25	< 6.5	<	3.25
SB-09-03	**03**	**ug/kg**	< 5.8	<	2.9	< 5.8	<	2.9	19.3		19.3	< 5.8	<	2.9	999		999	< 5.8	<	2.9	< 5.8	<	2.9
SB-10-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-11-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-12-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-13-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-14-04	**04**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-16-08	**08**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	33.9		33.9	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-17-05	**05**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	30.8		30.8	< 6.4	<	3.2	< 6.4	<	3.2
SB-18-06	**06**	**ug/kg**	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55	< 5.1	<	2.55
SB-19-04	**04**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-20-05	**05**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	15.9		15.9	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-21-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-22-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-23-06	**06**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-24-07	**07**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15
SB-25-08	**08**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-26-05	**05**	**ug/kg**	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1	< 6.2	<	3.1
SB-29-05	**05**	**ug/kg**	34.9		34.9	< 6.3	<	3.15	72.8		72.8	3460		3460	8.6		8.6	17.6		17.6	< 6.3	<	3.15
SB-30-06	**06**	**ug/kg**	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2	< 6.4	<	3.2
SB-31-05	**05**	**ug/kg**	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15	< 6.3	<	3.15

	Sec-Butylbenzene	Styrene	Tert-Butylbenzene	Tetrachloroethene	Toluene	Trans-1,2-Dichloroethene	Trans-1,3-Dichloropropene
Region 6 Medium-Specific Screening Levels 2008	22,000	17,000,000	390,000	**1,700**	520,000	18,000	1,600
units = ug/kg	sat	sat	sat	c	sat	n	c

< represents compound not-d
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Organics Screening

			Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
SAMP_ID	**Depth**	**Units**	**Trichloroethylene**			**Trichlorofluoromethane**			**Vinyl Chloride**			**Xylenes, Total**		
SB-06-04	**04**	**ug/kg**	< 6.6	<	3.3	< 26	<	13	< 20	<	10	< 20	<	10
SB-07-08	**08**	**ug/kg**	37.7		37.7	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-09-03	**03**	**ug/kg**	< 5.8	<	2.9	< 23	<	11.5	< 17	<	8.5	2333		2333
SB-10-05	**05**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-11-08	**08**	**ug/kg**	< 6.4	<	3.2	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-12-08	**08**	**ug/kg**	< 6.4	<	3.2	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-13-08	**08**	**ug/kg**	< 6.4	<	3.2	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-14-04	**04**	**ug/kg**	< 6.2	<	3.1	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-16-08	**08**	**ug/kg**	6.5		6.5	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-17-05	**05**	**ug/kg**	< 6.4	<	3.2	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-18-06	**06**	**ug/kg**	< 5.1	<	2.55	< 20	<	10	< 15	<	7.5	< 15	<	7.5
SB-19-04	**04**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-20-05	**05**	**ug/kg**	< 6.2	<	3.1	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-21-05	**05**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-22-05	**05**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-23-06	**06**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-24-07	**07**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-25-08	**08**	**ug/kg**	< 6.4	<	3.2	< 26	<	13	< 19	<	9.5	< 19	<	9.5
SB-26-05	**05**	**ug/kg**	< 6.2	<	3.1	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-29-05	**05**	**ug/kg**	1050		1050	< 25	<	12.5	< 19	<	9.5	71		71
SB-30-06	**06**	**ug/kg**	< 6.4	<	3.2	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
SB-31-05	**05**	**ug/kg**	< 6.3	<	3.15	< 25	<	12.5	< 19	<	9.5	< 19	<	9.5
Region 6 Medium-Specific Screening Levels 2008			**92**			130,000			860			210,000		
units = ug/kg			c			n			c			sat		

< represents compound not-d
at the noted detection limit

RED font indicates
exceedance

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - Tetrachloroethene

Data File P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\ProUCL-As-PCE-TCE.xls

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	10
Minimum	2.55
Maximum	3460
Mean	162.2386
Median	3.175
Standard Deviation	736.5983
Variance	542577.1
Coefficient of Variation	4.540215
Skewness	4.689726

Gamma Statistics	
k hat	0.211519
k star (bias corrected)	0.212978
Theta hat	767.0179
Theta star	761.7614
nu hat	9.306824
nu star	9.371045
Approx.Chi Square Value (.05)	3.551816
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	3.288295

Log-transformed Statistics	
Minimum of log data	0.936093
Maximum of log data	8.149024
Mean of log data	1.640258
Standard Deviation of log data	1.573618
Variance of log data	2.476273

RECOMMENDATION
Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.224713
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	432.4697

Gamma Distribution Test	
A-D Test Statistic	7.523911
A-D 5% Critical Value	0.886673
K-S Test Statistic	0.518774
K-S 5% Critical Value	0.205033
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	428.0473
Adjusted Gamma UCL	462.3508

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.395158
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	57.24759
95% Chebyshev (MVUE) UCL	44.39298
97.5% Chebyshev (MVUE) UCL	56.71059
99% Chebyshev (MVUE) UCL	80.90614

95% Non-parametric UCLs	
CLT UCL	420.5519
Adj-CLT UCL (Adjusted for skewness)	588.3302
Mod-t UCL (Adjusted for skewness)	458.6397
Jackknife UCL	432.4697
Standard Bootstrap UCL	417.3284
Bootstrap-t UCL	43101.36
Hall's Bootstrap UCL	42937.43
Percentile Bootstrap UCL	475.9205
BCA Bootstrap UCL	633.6318
95% Chebyshev (Mean, Sd) UCL	846.7744
97.5% Chebyshev (Mean, Sd) UCL	1142.974
99% Chebyshev (Mean, Sd) UCL	1724.8

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - Trichloroethene

Data File P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\ProUCL-As-PCE-TCE.xls

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	9
Minimum	2.55
Maximum	1050
Mean	52.43182
Median	3.15
Standard Deviation	222.9317
Variance	49698.52
Coefficient of Variation	4.251839
Skewness	4.682138

Gamma Statistics	
k hat	0.287885
k star (bias corrected)	0.278931
Theta hat	182.1278
Theta star	187.9743
nu hat	12.66693
nu star	12.27296
Approx.Chi Square Value (.05)	5.406327
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	5.068729

Log-transformed Statistics	
Minimum of log data	0.936093
Maximum of log data	6.956545
Mean of log data	1.548076
Standard Deviation of log data	1.326588
Variance of log data	1.759836

RECOMMENDATION
Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.232614
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	134.2173

Gamma Distribution Test	
A-D Test Statistic	7.387396
A-D 5% Critical Value	0.85295
K-S Test Statistic	0.514621
K-S 5% Critical Value	0.201673
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	119.026
Adjusted Gamma UCL	126.9536

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.388508
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	27.16354
95% Chebyshev (MVUE) UCL	26.06578
97.5% Chebyshev (MVUE) UCL	32.76274
99% Chebyshev (MVUE) UCL	45.91761

95% Non-parametric UCLs	
CLT UCL	130.6104
Adj-CLT UCL (Adjusted for skewness)	181.3064
Mod-t UCL (Adjusted for skewness)	142.1249
Jackknife UCL	134.2173
Standard Bootstrap UCL	128.0533
Bootstrap-t UCL	15259.08
Hall's Bootstrap UCL	15002.73
Percentile Bootstrap UCL	147.4614
BCA Bootstrap UCL	241.3364
95% Chebyshev (Mean, Sd) UCL	259.6067
97.5% Chebyshev (Mean, Sd) UCL	349.2515
99% Chebyshev (Mean, Sd) UCL	525.3413

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Inorganics Screening

SAMP_ID	Depth	Units	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs	Results	Stat	Half NDs
			Arsenic			Barium			Cadmium			Chromium			Lead			Mercury		
SB-06-04	04	ug/kg	20000		20000	171000		171000	3000		3000	21000		21000	15000		15000	54		54
SB-07-08	08	ug/kg	18000		18000	80000		80000	2700		2700	14000		14000	16000		16000	< 26	<	13
SB-09-03	03	ug/kg	22000		22000	36000		36000	< 3500	<	1750	11000		11000	< 17000	<	8500	< 23	<	11.5
SB-10-05	05	ug/kg	20000		20000	120000		120000	2900		2900	15000		15000	15000		15000	< 25	<	12.5
SB-11-08	08	ug/kg	15000		15000	193000		193000	2700		2700	19000		19000	15000		15000	36		36
SB-12-08	08	ug/kg	18000		18000	128000		128000	3200		3200	37000		37000	18000		18000	37		37
SB-13-08	08	ug/kg	23000		23000	154000		154000	2800		2800	17000		17000	14000		14000	30		30
SB-14-04	04	ug/kg	15000		15000	96000		96000	2100		2100	16000		16000	27000		27000	52		52
SB-16-08	08	ug/kg	20000		20000	151000		151000	3100		3100	19000		19000	15000		15000	< 25	<	12.5
SB-17-05	05	ug/kg	18000		18000	128000		128000	2600		2600	14000		14000	15000		15000	< 26	<	13
SB-18-06	06	ug/kg	< 4100	<	2050	15000		15000	< 1000	<	500	3700		3700	< 5100	<	2550	< 20	<	10
SB-19-04	04	ug/kg	22000		22000	152000		152000	2400		2400	18000		18000	12000		12000	< 25	<	12.5
SB-20-05	05	ug/kg	20000		20000	120000		120000	2500		2500	16000		16000	16000		16000	37		37
SB-21-05	05	ug/kg	6500		6500	110000		110000	1500		1500	11000		11000	10000		10000	< 25	<	12.5
SB-22-05	05	ug/kg	7600		7600	110000		110000	1600		1600	12000		12000	11000		11000	< 25	<	12.5
SB-23-06	06	ug/kg	18000		18000	178000		178000	2500		2500	15000		15000	14000		14000	28		28
SB-24-07	07	ug/kg	18000		18000	139000		139000	2800		2800	18000		18000	15000		15000	< 25	<	12.5
SB-25-08	08	ug/kg	10000		10000	128000		128000	1900		1900	14000		14000	13000		13000	27		27
SB-26-05	05	ug/kg	12000		12000	124000		124000	1600		1600	12000		12000	9800		9800	< 25	<	12.5
SB-29-05	05	ug/kg	18000		18000	81000		81000	2700		2700	23000		23000	8100		8100	< 25	<	12.5
SB-30-06	06	ug/kg	14000		14000	153000		153000	2300		2300	15000		15000	< 6400	<	3200	27		27
SB-31-05	05	ug/kg	16000		16000	201000		201000	2800		2800	18000		18000	18000		18000	30		30
Region 6 Medium-Specific																				
Screening Levels 2008			**1,800**			100,000,000			56,000			450,000			800,000			34,000		
units = ug/kg			c			max			nc			c						n		

< represents compound not-detected
at the noted detection limit

RED font indicates
exceedance

ACF Carter Carburetor Site
Miscellaneous Site-Wide
Soil Analytical Results
Inorganics Screening

SAMP_ID	Depth	Units	Results		Stat	Half NDs	Results		Stat	Half NDs
			Selenium				Silver			
SB-06-04	04	ug/kg	<	1300	<	650	<	1300	<	650
SB-07-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-09-03	03	ug/kg	<	1200	<	600	<	3500	<	1750
SB-10-05	05	ug/kg	<	1300	<	650	<	1300	<	650
SB-11-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-12-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-13-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-14-04	04	ug/kg	<	1200	<	600	<	1200	<	600
SB-16-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-17-05	05	ug/kg	<	1300	<	650	<	1300	<	650
SB-18-06	06	ug/kg	<	1000	<	500	<	1000	<	500
SB-19-04	04	ug/kg	<	1300	<	650	<	1300	<	650
SB-20-05	05	ug/kg	<	1200	<	600	<	1200	<	600
SB-21-05	05	ug/kg	<	1300	<	650	<	1300	<	650
SB-22-05	05	ug/kg	<	1300	<	650	<	1300	<	650
SB-23-06	06	ug/kg	<	1300	<	650	<	1300	<	650
SB-24-07	07	ug/kg	<	1300	<	650	<	1300	<	650
SB-25-08	08	ug/kg	<	1300	<	650	<	1300	<	650
SB-26-05	05	ug/kg	<	1200	<	600	<	1200	<	600
SB-29-05	05	ug/kg	<	1300	<	650	<	1300	<	650
SB-30-06	06	ug/kg	<	1300	<	650	<	1300	<	650
SB-31-05	05	ug/kg	<	1300	<	650	<	1300	<	650
Region 6 Medium-Specific Screening Levels 2008 units = ug/kg				570,000				570,000		
			n				n			

< represents compound not-c
at the noted detection limit

RED font indicates
exceedance

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Exterior to Building
Subsurface Soil Interval (0-10 ft) - Arsenic

Data File P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\ProUCL-As-PCE-TCE.xls

Raw Statistics	
Number of Valid Samples	22
Number of Unique Samples	12
Minimum	2050
Maximum	23000
Mean	16052.27
Median	18000
Standard Deviation	5443.88
Variance	29635828
Coefficient of Variation	0.339135
Skewness	-1.127718

Gamma Statistics	
k hat	5.176986
k star (bias corrected)	4.501336
Theta hat	3100.699
Theta star	3566.113
nu hat	227.7874
nu star	198.0588
Approx.Chi Square Value (.05)	166.4912
Adjusted Level of Significance	0.0386
Adjusted Chi Square Value	164.333

Log-transformed Statistics	
Minimum of log data	7.625595
Maximum of log data	10.04325
Mean of log data	9.583927
Standard Deviation of log data	0.549018
Variance of log data	0.301421

RECOMMENDATION
Data are Non-parametric (0.05)

Use 95% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.893418
Shapiro-Wilk 5% Critical Value	0.911
Data not normal at 5% significance level	

95% UCL (Assuming Normal Distribution)	
Student's-t UCL	18049.43

Gamma Distribution Test	
A-D Test Statistic	1.703984
A-D 5% Critical Value	0.746349
K-S Test Statistic	0.250505
K-S 5% Critical Value	0.185908
Data do not follow gamma distribution at 5% significance level	

95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	19095.86
Adjusted Gamma UCL	19346.65

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.705635
Shapiro-Wilk 5% Critical Value	0.911
Data not lognormal at 5% significance level	

95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	21538.09
95% Chebyshev (MVUE) UCL	25707.57
97.5% Chebyshev (MVUE) UCL	29578.11
99% Chebyshev (MVUE) UCL	37181.03

95% Non-parametric UCLs	
CLT UCL	17961.35
Adj-CLT UCL (Adjusted for skewness)	17663.18
Mod-t UCL (Adjusted for skewness)	18002.93
Jackknife UCL	18049.43
Standard Bootstrap UCL	17929.65
Bootstrap-t UCL	17883.48
Hall's Bootstrap UCL	17754.17
Percentile Bootstrap UCL	17797.73
BCA Bootstrap UCL	17750
95% Chebyshev (Mean, Sd) UCL	21111.38
97.5% Chebyshev (Mean, Sd) UCL	23300.46
99% Chebyshev (Mean, Sd) UCL	27600.49

Appendix A: Table A3
Carter Carburetor EE/CA
PCBs in Soil under the CBI Building - Surface Soil 0 to 1 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Under Building	0SS-F4-E5-01-01	1	mg/kg	ND	0.0165	ND	0.0165	ND	0.0165	ND	0.0165
Under Building	0SS-F7-E8-01-01	1	mg/kg	ND	0.0209	ND	0.0209	ND	0.0209	ND	0.0209
Under Building	0SS-F9-E10-01-01	1	mg/kg	ND	0.0201	ND	0.0201	ND	0.0201	ND	0.0201
Under Building	0SS-G4-F5-01-01	1	mg/kg	ND	0.0188	ND	0.0188	ND	0.0188		0.454
Under Building	0SS-H4-G5-01-01	1	mg/kg	ND	0.097	ND	0.097	ND	0.097		1.23
Under Building	0SS-H6-G7-01-01	1	mg/kg	ND	0.01645	ND	0.01645	ND	0.01645	ND	0.01645
Under Building	0SS-H9-G10-01-01	1	mg/kg	ND	0.02095		0.078	ND	0.02095	ND	0.02095
Under Building	1SS-A10-AA11-01-01	1	mg/kg	ND	0.01985	ND	0.01985	ND	0.01985	ND	0.01985
Under Building	1SS-A1-AA2-01-01	1	mg/kg	ND	0.0178	ND	0.0178	ND	0.0178	ND	0.0178
Under Building	1SS-A7-AA8-01-01	1	mg/kg	ND	0.01915	ND	0.01915	ND	0.01915	ND	0.01915
Under Building	1SS-C12-B13-01-01	1	mg/kg	ND	0.02055		0.0726	ND	0.02055	ND	0.02055
Under Building	1SS-C9-B10-01-01	1	mg/kg	ND	0.385		3.74	ND	0.385	ND	0.385
Under Building	1SS-CC12-DD13-01-01	1	mg/kg	ND	0.0203		0.3	ND	0.0203	ND	0.0203
Under Building	1SS-D6-C7-01-01	1	mg/kg	ND	0.01995	ND	0.01995	ND	0.01995	ND	0.01995
Under Building	1SS-DD8-EE9-01-01	1	mg/kg	ND	0.0165	ND	0.0165	ND	0.0165	ND	0.0165
Under Building	1SS-E11-D12-01-01	1	mg/kg	ND	0.02005		0.103	ND	0.02005	ND	0.02005
Under Building	1SS-E5-D6-01-01	1	mg/kg	ND	0.01925	ND	0.01925	ND	0.01925	ND	0.01925
Under Building	1SS-E8-D9-01-01	1	mg/kg	ND	0.0214	ND	0.0214	ND	0.0214	ND	0.0214
Under Building	1SS-F12-E13-01-01	1	mg/kg	ND	0.0196		0.0638	ND	0.0196	ND	0.0196
Under Building	1SS-FF5-GG6-01-01	1	mg/kg	ND	0.0198	ND	0.0198	ND	0.0198	ND	0.0198
Under Building	1SS-G10-F11-01-01	1	mg/kg	ND	0.0205		0.132	ND	0.0205	ND	0.0205
Under Building	1SS-H12-G13-01-01	1	mg/kg	ND	0.0165		0.193	ND	0.0165	ND	0.0165
Under Building	1SS-HH5-KK6-01-01	1	mg/kg	ND	0.01975	ND	0.01975	ND	0.01975	ND	0.01975
Under Building	1SS-J11-H12-01-01	1	mg/kg	ND	0.01985		0.237	ND	0.01985	ND	0.01985
Under Building	1SS-JJ11-KK12-01-01	1	mg/kg	ND	0.0208	ND	0.0208	ND	0.0208	ND	0.0208
Under Building	1SS-JJ8-KK9-01-01	1	mg/kg	ND	0.01935		0.132	ND	0.01935	ND	0.01935
Under Building	1SS-K3-J4-01-01	1	mg/kg	ND	0.0209	ND	0.0209	ND	0.0209	ND	0.0209
Under Building	1SS-K6-J7-01-01	1	mg/kg	ND	0.01995	ND	0.01995	ND	0.01995	ND	0.01995
Under Building	1SS-K9-J10-01-01	1	mg/kg	ND	0.01935	ND	0.01935	ND	0.01935	ND	0.01935
Under Building	1SS-KK7-LL8-01-01	1	mg/kg	ND	0.01875	ND	0.01875	ND	0.01875	ND	0.01875
Under Building	1SS-L12-J13-01-01	1	mg/kg	ND	0.0203		0.043	ND	0.0203	ND	0.0203
Under Building	1SS-L5-K6-01-01	1	mg/kg	ND	0.02	ND	0.02	ND	0.02	ND	0.02
Under Building	1SS-LL10-MM11-01-01	1	mg/kg	ND	0.02045	ND	0.02045	ND	0.02045	ND	0.02045
Under Building	1SS-M11-L12-01-01	1	mg/kg	ND	0.02025		0.0463	ND	0.02025	ND	0.02025
Under Building	1SS-MM6-NN7-01-01	1	mg/kg	ND	0.0192	ND	0.0192	ND	0.0192	ND	0.0192
Under Building	1SS-O12-N13-01-01	1	mg/kg	ND	0.0202	ND	0.0202	ND	0.0202	ND	0.0202
Under Building	1SS-O9-N10-01-01	1	mg/kg	ND	0.02045		0.648	ND	0.02045	ND	0.02045
Under Building	1SS-OO10-PP11-01-01	1	mg/kg	ND	0.0204		0.0712	ND	0.0204	ND	0.0204

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	38	38	38	38
	no. hits	0	14	0	2
	min-D	0	0.043	0	0.454
	max-D	0	3.74	0	1.23
	min-ND	0.0329	0.0329	0.0329	0.0329
	max-ND	0.77	0.194	0.77	0.77
	mean	0.031233	0.168492	0.031233	0.072501
	95% UCL	0.0739	1.147	0.0739	0.223

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are at 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Surface Soil Interval (0-1 ft) - PCB-1242 and 1254

User Selected Options			
From File	WorkSheet_a.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Observations	38	Number of Distinct Observations	30
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	0.385	Maximum of Log Data	-0.955
Mean	0.0312	Mean of log Data	-3.815
Median	0.02	SD of log Data	0.547
SD	0.0603		
Coefficient of Variation	1.93		
Skewness	5.797		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.226	Shapiro Wilk Test Statistic	0.352
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.0477	95% H-UCL	0.0305
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0359
95% Adjusted-CLT UCL	0.0571	97.5% Chebyshev (MVUE) UCL	0.0404
95% Modified-t UCL	0.0493	99% Chebyshev (MVUE) UCL	0.0492
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.473	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0212		
nu star	111.9		
Approximate Chi Square Value (.05)	88.5	Nonparametric Statistics	
Adjusted Level of Significance	0.0434	95% CLT UCL	0.0473
Adjusted Chi Square Value	87.64	95% Jackknife UCL	0.0477
		95% Standard Bootstrap UCL	0.0471
Anderson-Darling Test Statistic	11.64	95% Bootstrap-t UCL	0.599
Anderson-Darling 5% Critical Value	0.765	95% Hall's Bootstrap UCL	0.334
Kolmogorov-Smirnov Test Statistic	0.516	95% Percentile Bootstrap UCL	0.0488
Kolmogorov-Smirnov 5% Critical Value	0.146	95% BCA Bootstrap UCL	0.0622
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.0739
		97.5% Chebyshev(Mean, Sd) UCL	0.0923
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.129
95% Approximate Gamma UCL	0.0395		
95% Adjusted Gamma UCL	0.0399		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**0.0739**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Surface Soil Interval (0-1 ft) - PCB-1248

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	38	Number of Unique Samples	34
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	3.74	Maximum of Log Data	1.319
Mean	0.168	Mean of log Data	-3.147
Median	0.0206	SD of log Data	1.231
SD	0.606		
Coefficient of Variation	3.598		
Skewness	5.836		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.264	Shapiro Wilk Test Statistic	0.747
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.334	95% H-UCL	0.157
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.183
95% Adjusted-CLT UCL	0.43	97.5% Chebyshev (MVUE) UCL	0.224
95% Modified-t UCL	0.35	99% Chebyshev (MVUE) UCL	0.304
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.45	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.375		
nu star	34.19		
Approximate Chi Square Value (.05)	21.82	Nonparametric Statistics	
Adjusted Level of Significance	0.0434	95% CLT UCL	0.33
Adjusted Chi Square Value	21.41	95% Jackknife UCL	0.334
		95% Standard Bootstrap UCL	0.324
Anderson-Darling Test Statistic	6.074	95% Bootstrap-t UCL	1.289
Anderson-Darling 5% Critical Value	0.82	95% Hall's Bootstrap UCL	0.902
Kolmogorov-Smirnov Test Statistic	0.31	95% Percentile Bootstrap UCL	0.351
Kolmogorov-Smirnov 5% Critical Value	0.152	95% BCA Bootstrap UCL	0.467
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.597
		97.5% Chebyshev(Mean, Sd) UCL	0.783
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.147
95% Approximate Gamma UCL	0.264		
95% Adjusted Gamma UCL	0.269		
Potential UCL to Use		**Use 99% Chebyshev (Mean, Sd) UCL**	**1.147**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Surface Soil Interval (0-1 ft) - PCB-1260

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Samples	38	Number of Unique Samples	30
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	1.23	Maximum of Log Data	0.207
Mean	0.0725	Mean of log Data	-3.664
Median	0.02	SD of log Data	0.949
SD	0.213		
Coefficient of Variation	2.94		
Skewness	4.807		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.291	Shapiro Wilk Test Statistic	0.381
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.131	95% H-UCL	0.0578
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.07
95% Adjusted-CLT UCL	0.158	97.5% Chebyshev (MVUE) UCL	0.0832
95% Modified-t UCL	0.135	99% Chebyshev (MVUE) UCL	0.109
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.565	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.128		
nu star	42.97		
Approximate Chi Square Value (.05)	28.94	Nonparametric Statistics	
Adjusted Level of Significance	0.0434	95% CLT UCL	0.129
Adjusted Chi Square Value	28.46	95% Jackknife UCL	0.131
		95% Standard Bootstrap UCL	0.13
Anderson-Darling Test Statistic	12.28	95% Bootstrap-t UCL	0.229
Anderson-Darling 5% Critical Value	0.804	95% Hall's Bootstrap UCL	0.262
Kolmogorov-Smirnov Test Statistic	0.548	95% Percentile Bootstrap UCL	0.136
Kolmogorov-Smirnov 5% Critical Value	0.15	95% BCA Bootstrap UCL	0.169
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.223
		97.5% Chebyshev(Mean, Sd) UCL	0.288
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.417
95% Approximate Gamma UCL	0.108		
95% Adjusted Gamma UCL	0.109		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**0.223**

Appendix A: Table A4
Carter Carburetor EE/CA
PCBs in Soil under the CBI Building - Surface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242	PCB-1242	PCB-1248	PCB-1248	PCB-1254	PCB-1254	PCB-1260	PCB-1260
Under Building	0SS-F4-E5-01-01	1	mg/kg	ND	0.0165	ND	0.0165	ND	0.0165	ND	0.0165
Under Building	0SS-F4-E5-01-05	5	mg/kg	ND	0.01645		0.15	ND	0.01645	ND	0.01645
Under Building	0SS-F4-E5-01-09	9	mg/kg	ND	0.165		2.75	ND	0.165	ND	0.165
Under Building	0SS-F7-E8-01-01	1	mg/kg	ND	0.0209	ND	0.0209	ND	0.0209	ND	0.0209
Under Building	0SS-F9-E10-01-01	1	mg/kg	ND	0.0201	ND	0.0201	ND	0.0201	ND	0.0201
Under Building	0SS-G4-F5-01-01	1	mg/kg	ND	0.0188	ND	0.0188	ND	0.0188		0.454
Under Building	0SS-H4-G5-01-01	1	mg/kg	ND	0.097	ND	0.097	ND	0.097		1.23
Under Building	0SS-H6-G7-01-01	1	mg/kg	ND	0.01645	ND	0.01645	ND	0.01645	ND	0.01645
Under Building	0SS-H6-G7-01-05	5	mg/kg	ND	0.01645	ND	0.01645	ND	0.01645	ND	0.01645
Under Building	0SS-H6-G7-01-09	9	mg/kg	ND	0.0165	ND	0.0165	ND	0.0165	ND	0.0165
Under Building	0SS-H9-G10-01-01	1	mg/kg	ND	0.02095		0.078	ND	0.02095	ND	0.02095
Under Building	1SS-A10-AA11-01-01	1	mg/kg	ND	0.01985	ND	0.01985	ND	0.01985	ND	0.01985
Under Building	1SS-A1-AA2-01-01	1	mg/kg	ND	0.0178	ND	0.0178	ND	0.0178	ND	0.0178
Under Building	1SS-A7-AA8-01-01	1	mg/kg	ND	0.01915	ND	0.01915	ND	0.01915	ND	0.01915
Under Building	1SS-C12-B13-01-01	1	mg/kg	ND	0.02055		0.0726	ND	0.02055	ND	0.02055
Under Building	1SS-C9-B10-01-01	1	mg/kg	ND	0.385		3.74	ND	0.385	ND	0.385
Under Building	1SS-CC12-DD13-01-01	1	mg/kg	ND	0.0203		0.3	ND	0.0203	ND	0.0203
Under Building	1SS-D6-C7-01-01	1	mg/kg	ND	0.01995	ND	0.01995	ND	0.01995	ND	0.01995
Under Building	1SS-DD8-EE9-01-01	1	mg/kg	ND	0.0165	ND	0.0165	ND	0.0165	ND	0.0165
Under Building	1SS-E11-D12-01-01	1	mg/kg	ND	0.02005		0.103	ND	0.02005	ND	0.02005
Under Building	1SS-E5-D6-01-01	1	mg/kg	ND	0.01925	ND	0.01925	ND	0.01925	ND	0.01925
Under Building	1SS-E8-D9-01-01	1	mg/kg	ND	0.0214	ND	0.0214	ND	0.0214	ND	0.0214
Under Building	1SS-E8-D9-01-05	5	mg/kg	ND	0.02085		0.163	ND	0.02085	ND	0.02085
Under Building	1SS-F12-E13-01-01	1	mg/kg	ND	0.0196		0.0638	ND	0.0196	ND	0.0196
Under Building	1SS-FF5-GG6-01-01	1	mg/kg	ND	0.0198	ND	0.0198	ND	0.0198	ND	0.0198
Under Building	1SS-G10-F11-01-01	1	mg/kg	ND	0.0205		0.132	ND	0.0205	ND	0.0205
Under Building	1SS-H12-G13-01-01	1	mg/kg	ND	0.0165		0.193	ND	0.0165	ND	0.0165
Under Building	1SS-HH5-KK6-01-01	1	mg/kg	ND	0.01975	ND	0.01975	ND	0.01975	ND	0.01975
Under Building	1SS-J11-H12-01-01	1	mg/kg	ND	0.01985		0.237	ND	0.01985	ND	0.01985
Under Building	1SS-JJ11-KK12-01-01	1	mg/kg	ND	0.0208	ND	0.0208	ND	0.0208	ND	0.0208
Under Building	1SS-JJ8-KK9-01-01	1	mg/kg	ND	0.01935		0.132	ND	0.01935	ND	0.01935
Under Building	1SS-K3-J4-01-01	1	mg/kg	ND	0.0209	ND	0.0209	ND	0.0209	ND	0.0209
Under Building	1SS-K6-J7-01-01	1	mg/kg	ND	0.01995	ND	0.01995	ND	0.01995	ND	0.01995
Under Building	1SS-K9-J10-01-01	1	mg/kg	ND	0.01935	ND	0.01935	ND	0.01935	ND	0.01935
Under Building	1SS-KK7-LL8-01-01	1	mg/kg	ND	0.01875	ND	0.01875	ND	0.01875	ND	0.01875
Under Building	1SS-L12-J13-01-01	1	mg/kg	ND	0.0203		0.043	ND	0.0203	ND	0.0203
Under Building	1SS-L5-K6-01-01	1	mg/kg	ND	0.02	ND	0.02	ND	0.02	ND	0.02
Under Building	1SS-LL10-MM11-01-01	1	mg/kg	ND	0.02045	ND	0.02045	ND	0.02045	ND	0.02045
Under Building	1SS-M11-L12-01-01	1	mg/kg	ND	0.02025		0.0463	ND	0.02025	ND	0.02025
Under Building	1SS-MM6-NN7-01-01	1	mg/kg	ND	0.0192	ND	0.0192	ND	0.0192	ND	0.0192
Under Building	1SS-O12-N13-01-01	1	mg/kg	ND	0.0202	ND	0.0202	ND	0.0202	ND	0.0202

Appendix A: Table A4
Carter Carburetor EE/CA
PCBs in Soil under the CBI Building - Surface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242	PCB-1242	PCB-1248	PCB-1248	PCB-1254	PCB-1254	PCB-1260	PCB-1260
Under Building	1SS-O9-N10-01-01	1	mg/kg	ND	0.02045		0.648	ND	0.02045	ND	0.02045
Under Building	1SS-OO10-PP11-01-01	1	mg/kg	ND	0.0204		0.0712	ND	0.0204	ND	0.0204
		Summary Statistics:	no. samples		43		43		43		43
			no. hits		0		17		0		2
			min-D		0		0.043		0		0.454
			max-D		0		3.74		0		1.23
			min-ND		0.0329		0.0329		0.0329		0.0329
			max-ND		0.77		0.194		0.77		0.77
			mean		0.031136		0.220899		0.031136		0.072404
			95% UCL		0.0732		1.273		0.0732		0.203

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are at 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Surface Soil Interval (0-10 ft) - PCB-1242 and 1254

User Selected Options	
From File	WorkSheet_b.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	43	Number of Distinct Observations	32
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	0.385	Maximum of Log Data	-0.955
Mean	0.0331	Mean of log Data	-3.79
Median	0.02	SD of log Data	0.605
SD	0.0603		
Coefficient of Variation	1.825		
Skewness	5.232		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.28	Shapiro Wilk Test Statistic	0.41
Shapiro Wilk Critical Value	0.943	Shapiro Wilk Critical Value	0.943
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.0485	95% H-UCL	0.0326
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0386
95% Adjusted-CLT UCL	0.0561	97.5% Chebyshev (MVUE) UCL	0.0436
95% Modified-t UCL	0.0498	99% Chebyshev (MVUE) UCL	0.0535
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.371	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0241		
nu star	117.9		
Approximate Chi Square Value (.05)	93.86	Nonparametric Statistics	
Adjusted Level of Significance	0.0444	95% CLT UCL	0.0482
Adjusted Chi Square Value	93.11	95% Jackknife UCL	0.0485
		95% Standard Bootstrap UCL	0.0482
Anderson-Darling Test Statistic	12.37	95% Bootstrap-t UCL	0.094
Anderson-Darling 5% Critical Value	0.768	95% Hall's Bootstrap UCL	0.103
Kolmogorov-Smirnov Test Statistic	0.511	95% Percentile Bootstrap UCL	0.0501
Kolmogorov-Smirnov 5% Critical Value	0.137	95% BCA Bootstrap UCL	0.059
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.0732
		97.5% Chebyshev(Mean, Sd) UCL	0.0905
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.125
95% Approximate Gamma UCL	0.0416		
95% Adjusted Gamma UCL	0.0419		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**0.0732**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1248

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	43	Number of Unique Samples	37
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	3.74	Maximum of Log Data	1.319
Mean	0.221	Mean of log Data	-3.035
Median	0.0208	SD of log Data	1.363
SD	0.693		
Coefficient of Variation	3.139		
Skewness	4.464		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.325	Shapiro Wilk Test Statistic	0.757
Shapiro Wilk Critical Value	0.943	Shapiro Wilk Critical Value	0.943
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.399	95% H-UCL	0.218
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.252
95% Adjusted-CLT UCL	0.472	97.5% Chebyshev (MVUE) UCL	0.31
95% Modified-t UCL	0.411	99% Chebyshev (MVUE) UCL	0.424
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.413	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.535		
nu star	35.49		
Approximate Chi Square Value (.05)	22.86	Nonparametric Statistics	
Adjusted Level of Significance	0.0444	95% CLT UCL	0.395
Adjusted Chi Square Value	22.5	95% Jackknife UCL	0.399
		95% Standard Bootstrap UCL	0.39
Anderson-Darling Test Statistic	6.728	95% Bootstrap-t UCL	1.244
Anderson-Darling 5% Critical Value	0.83	95% Hall's Bootstrap UCL	1.219
Kolmogorov-Smirnov Test Statistic	0.295	95% Percentile Bootstrap UCL	0.412
Kolmogorov-Smirnov 5% Critical Value	0.144	95% BCA Bootstrap UCL	0.513
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.682
		97.5% Chebyshev(Mean, Sd) UCL	0.881
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.273
95% Approximate Gamma UCL	0.343		
95% Adjusted Gamma UCL	0.348		
Potential UCL to Use		**Use 99% Chebyshev (Mean, Sd) UCL**	**1.273**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Area Under Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1260

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	43	Number of Unique Samples	32
Raw Statistics		Log-transformed Statistics	
Minimum	0.0165	Minimum of Log Data	-4.107
Maximum	1.23	Maximum of Log Data	0.207
Mean	0.0695	Mean of log Data	-3.657
Median	0.02	SD of log Data	0.944
SD	0.201		
Coefficient of Variation	2.894		
Skewness	5.044		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.297	Shapiro Wilk Test Statistic	0.424
Shapiro Wilk Critical Value	0.943	Shapiro Wilk Critical Value	0.943
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.121	95% H-UCL	0.0563
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0685
95% Adjusted-CLT UCL	0.145	97.5% Chebyshev (MVUE) UCL	0.0809
95% Modified-t UCL	0.125	99% Chebyshev (MVUE) UCL	0.105
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.593	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.117		
nu star	50.97		
Approximate Chi Square Value (.05)	35.58	Nonparametric Statistics	
Adjusted Level of Significance	0.0444	95% CLT UCL	0.12
Adjusted Chi Square Value	35.13	95% Jackknife UCL	0.121
		95% Standard Bootstrap UCL	0.12
Anderson-Darling Test Statistic	12.97	95% Bootstrap-t UCL	0.22
Anderson-Darling 5% Critical Value	0.802	95% Hall's Bootstrap UCL	0.246
Kolmogorov-Smirnov Test Statistic	0.535	95% Percentile Bootstrap UCL	0.124
Kolmogorov-Smirnov 5% Critical Value	0.141	95% BCA Bootstrap UCL	0.163
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.203
		97.5% Chebyshev(Mean, Sd) UCL	0.261
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.375
95% Approximate Gamma UCL	0.0996		
95% Adjusted Gamma UCL	0.101		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**0.203**

Appendix A: Table A5
Carter Carburetor EE/CA
PCBs in Soil Die Cast Area - Surface Soil 0 to 1 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Die Cast	G-01-01-04	4	mg/kg	ND	0.295	ND	0.295	ND	0.295	ND	0.295
Die Cast	G-01-02-03	3	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-01-03-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-01-04-03	3	mg/kg		6600	ND	2750	ND	2750	ND	2750
Die Cast	G-01-05-03	3	mg/kg	ND	0.275	ND	0.275	ND	0.275	ND	0.275
Die Cast	G-02-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-02-02-04	4	mg/kg	ND	0.31	ND	0.31	ND	0.31		1.6
Die Cast	G-02-03-03	3	mg/kg		9200	ND	2950	ND	2950	ND	2950
Die Cast	G-02-04-03	3	mg/kg		29000	ND	3100	ND	3100	ND	3100
Die Cast	G-02-05-03	3	mg/kg		3.1	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-03-01-04	4	mg/kg		17	ND	2.95	ND	2.95	ND	2.95
Die Cast	G-03-02-04	4	mg/kg	ND	0.26		1.7	ND	0.26	ND	0.26
Die Cast	G-03-03-03	3	mg/kg		180	ND	16	ND	16	ND	16
Die Cast	G-03-04-03	3	mg/kg		180000	ND	30000	ND	30000	ND	30000
Die Cast	G-03-05-02	2	mg/kg	ND	0.295	ND	0.295	ND	0.295	ND	0.295
Die Cast	G-04-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-04-02-04	4	mg/kg		0.93	ND	0.305	ND	0.305		1.1
Die Cast	G-04-03-03	3	mg/kg		1300	ND	285	ND	285	ND	285
Die Cast	G-04-04-03	3	mg/kg		110000	ND	15500	ND	15500	ND	15500
Die Cast	G-04-05-04	4	mg/kg		33000	ND	2950	ND	2950	ND	2950
Die Cast	G-04-06-03	3	mg/kg		380	ND	28.5	ND	28.5	ND	28.5
Die Cast	G-04-07-03	3	mg/kg	ND	295		1000	ND	295	ND	295
Die Cast	G-05-01-04	4	mg/kg		6500	ND	2600	ND	2600	ND	2600
Die Cast	G-05-02-04	4	mg/kg	ND	0.3		1.5	ND	0.3	ND	0.3
Die Cast	G-05-03-04	4	mg/kg		17	ND	3	ND	3	ND	3
Die Cast	G-05-04-03	3	mg/kg		770	ND	285	ND	285	ND	285
Die Cast	G-05-05-02	2	mg/kg		2600	ND	305	ND	305	ND	305
Die Cast	G-06-01-04	4	mg/kg		940	ND	150	ND	150	ND	150
Die Cast	G-06-02-04	4	mg/kg	ND	0.29		1.1	ND	0.29	ND	0.29
Die Cast	G-06-03-04	4	mg/kg	ND	3.05		18	ND	3.05	ND	3.05
Die Cast	G-06-04-04	4	mg/kg		1100	ND	150	ND	150	ND	150
Die Cast	G-06-05-03	3	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-07-01-04	4	mg/kg	ND	0.265		1.1	ND	0.265	ND	0.265
Die Cast	G-07-02-04	4	mg/kg		0.89	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-07-03-04	4	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-07-04-03	3	mg/kg		39	ND	2.75	ND	2.75	ND	2.75
Die Cast	G-07-05-03	3	mg/kg	ND	0.275	ND	0.275	ND	0.275	ND	0.275
Die Cast	G-08-01-04	4	mg/kg		3400	ND	295	ND	295	ND	295
Die Cast	G-08-02-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-03-04	4	mg/kg		6	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-04-04	4	mg/kg		1400	ND	290	ND	290	ND	290
Die Cast	G-08-05-04	4	mg/kg		0.82	ND	0.28	ND	0.28	ND	0.28
Die Cast	G-09-01-04	4	mg/kg		310	ND	28	ND	28		46
Die Cast	G-09-02-04	4	mg/kg		5	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-09-03-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-04-04	4	mg/kg		20000	ND	2950	ND	2950	ND	2950
Die Cast	G-09-05-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-06-03	3	mg/kg		6800	ND	2850	ND	2850	ND	2850
Die Cast	G-09-07-03	3	mg/kg		2900	ND	260	ND	260	ND	260

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Die Cast	G-09-08-03	3	mg/kg		2100	ND	295	ND	295	ND	295
Die Cast	G-09-09-03	3	mg/kg		270000	ND	29500	ND	29500	ND	29500
Die Cast	G-09-10-03	3	mg/kg		3800	ND	305	ND	305	ND	305
Die Cast	G-09-11-04	4	mg/kg	ND	2450		48000	ND	2450	ND	2450
Die Cast	G-10-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-10-02-05	5	mg/kg		1.1	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-10-03-04	4	mg/kg		47	ND	30.5	ND	30.5		430
Die Cast	G-10-04-04	4	mg/kg		35	ND	2.5	ND	2.5		3.6
Die Cast	SB-09-03	3	mg/kg	ND	145		1189	ND	145	ND	145
Die Cast	SB-15-04	4	mg/kg	ND	750		6929	ND	750	ND	750

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	59	59	59	59
	no. hits	35	9	0	5
	min-D	0.82	1.1	0	1.1
	max-D	270000	48000	0	430
	min-ND	0.52	0.55	0.52	0.52
	max-ND	4900	60000	60000	60000
	mean	11798.33	2627.664	1720.931	1728.062
	95% UCL	61801	4610	3420	3433

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are at 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Surface Soil Interval (0-1 ft) - PCB-1242

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		

General Statistics			
Number of Valid Samples	59	Number of Unique Samples	47
Raw Statistics		Log-transformed Statistics	
Minimum	0.26	Minimum of Log Data	-1.347
Maximum	270000	Maximum of Log Data	12.51
Mean	11798	Mean of log Data	3.693
Median	35	SD of log Data	4.497
SD	43903		
Coefficient of Variation	3.721		
Skewness	4.822		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.427	Lilliefors Test Statistic	0.182
Lilliefors Critical Value	0.115	Lilliefors Critical Value	0.115
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	21352	95% H-UCL	62652762
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1251091
95% Adjusted-CLT UCL	25033	97.5% Chebyshev (MVUE) UCL	1682844
95% Modified-t UCL	21950	99% Chebyshev (MVUE) UCL	2530939
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.141	Data do not follow a Discernable Distribution (0.05)	
Theta Star	83466		
nu star	16.68		
Approximate Chi Square Value (.05)	8.444	Nonparametric Statistics	
Adjusted Level of Significance	0.0459	95% CLT UCL	21200
Adjusted Chi Square Value	8.297	95% Jackknife UCL	21352
		95% Standard Bootstrap UCL	21140
Anderson-Darling Test Statistic	3.999	95% Bootstrap-t UCL	54107
Anderson-Darling 5% Critical Value	0.956	95% Hall's Bootstrap UCL	61801
Kolmogorov-Smirnov Test Statistic	0.187	95% Percentile Bootstrap UCL	22230
Kolmogorov-Smirnov 5% Critical Value	0.131	95% BCA Bootstrap UCL	27175
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	36712
		97.5% Chebyshev(Mean, Sd) UCL	47493
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	68668
95% Approximate Gamma UCL	23306		
95% Adjusted Gamma UCL	23719		
Potential UCL to Use		**Use 95% Hall's Bootstrap UCL**	**61801**

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or
99% Chebyshev (Mean, Sd) UCL

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Surface Soil Interval (0-1 ft), PCB-1248

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	59	Number of Unique Samples	36
Raw Statistics		Log-transformed Statistics	
Minimum	0.275	Minimum of Log Data	-1.291
Maximum	48000	Maximum of Log Data	10.78
Mean	2628	Mean of log Data	2.872
Median	3	SD of log Data	4.045
SD	8322		
Coefficient of Variation	3.167		
Skewness	4.173		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.393	Lilliefors Test Statistic	0.214
Lilliefors Critical Value	0.115	Lilliefors Critical Value	0.115
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4439	95% H-UCL	1849880
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	113617
95% Adjusted-CLT UCL	5039	97.5% Chebyshev (MVUE) UCL	152312
95% Modified-t UCL	4537	99% Chebyshev (MVUE) UCL	228321
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.157	Data do not follow a Discernable Distribution (0.05)	
Theta Star	16769		
nu star	18.49		
Approximate Chi Square Value (.05)	9.746	Nonparametric Statistics	
Adjusted Level of Significance	0.0459	95% CLT UCL	4410
Adjusted Chi Square Value	9.587	95% Jackknife UCL	4439
		95% Standard Bootstrap UCL	4381
Anderson-Darling Test Statistic	4.533	95% Bootstrap-t UCL	6315
Anderson-Darling 5% Critical Value	0.944	95% Hall's Bootstrap UCL	4610
Kolmogorov-Smirnov Test Statistic	0.223	95% Percentile Bootstrap UCL	4696
Kolmogorov-Smirnov 5% Critical Value	0.13	95% BCA Bootstrap UCL	5216
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	7350
		97.5% Chebyshev(Mean, Sd) UCL	9393
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	13407
95% Approximate Gamma UCL	4985		
95% Adjusted Gamma UCL	5068		
Potential UCL to Use		**Use 95% Hall's Bootstrap UCL**	**4610**

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or
99% Chebyshev (Mean, Sd) UCL

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Surface Soil Interval (0-1 ft), PCB-1254

User Selected Options	
From File	WorkSheet_c.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	59	Number of Distinct Observations	35
Raw Statistics		Log-transformed Statistics	
Minimum	0.26	Minimum of Log Data	-1.347
Maximum	30000	Maximum of Log Data	10.31
Mean	1721	Mean of log Data	2.592
Median	3	SD of log Data	3.956
SD	5726		
Coefficient of Variation	3.327		
Skewness	4.418		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.394	Lilliefors Test Statistic	0.27
Lilliefors Critical Value	0.115	Lilliefors Critical Value	0.115
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2967	95% H-UCL	631331
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	63720
95% Adjusted-CLT UCL	3405	97.5% Chebyshev (MVUE) UCL	85349
95% Modified-t UCL	3038	99% Chebyshev (MVUE) UCL	127835
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.16	Data do not follow a Discernable Distribution (0.05)	
Theta Star	10728		
nu star	18.93		
Approximate Chi Square Value (.05)	10.07	Nonparametric Statistics	
Adjusted Level of Significance	0.0459	95% CLT UCL	2947
Adjusted Chi Square Value	9.903	95% Jackknife UCL	2967
		95% Standard Bootstrap UCL	2916
Anderson-Darling Test Statistic	4.89	95% Bootstrap-t UCL	4594
Anderson-Darling 5% Critical Value	0.941	95% Hall's Bootstrap UCL	9144
Kolmogorov-Smirnov Test Statistic	0.233	95% Percentile Bootstrap UCL	3044
Kolmogorov-Smirnov 5% Critical Value	0.13	95% BCA Bootstrap UCL	3318
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4970
		97.5% Chebyshev(Mean, Sd) UCL	6376
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9138
95% Approximate Gamma UCL	3236		
95% Adjusted Gamma UCL	3289		
Potential UCL to Use		**Use 95% Hall's Bootstrap UCL**	**9144**

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Surface Soil Interval (0-1 ft), PCB-1260

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	59	Number of Unique Samples	36
Raw Statistics		Log-transformed Statistics	
Minimum	0.26	Minimum of Log Data	-1.347
Maximum	30000	Maximum of Log Data	10.31
Mean	1728	Mean of log Data	2.701
Median	3.05	SD of log Data	3.941
SD	5724		
Coefficient of Variation	3.312		
Skewness	4.419		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.386	Lilliefors Test Statistic	0.245
Lilliefors Critical Value	0.115	Lilliefors Critical Value	0.115
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2974	95% H-UCL	875545
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	67448
95% Adjusted-CLT UCL	3412	97.5% Chebyshev (MVUE) UCL	90328
95% Modified-t UCL	3045	99% Chebyshev (MVUE) UCL	135272
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.163	Data do not follow a Discernable Distribution (0.05)	
Theta Star	10583		
nu star	19.27		
Approximate Chi Square Value (.05)	10.31	Nonparametric Statistics	
Adjusted Level of Significance	0.0459	95% CLT UCL	2954
Adjusted Chi Square Value	10.15	95% Jackknife UCL	2974
		95% Standard Bootstrap UCL	2945
Anderson-Darling Test Statistic	4.575	95% Bootstrap-t UCL	4680
Anderson-Darling 5% Critical Value	0.939	95% Hall's Bootstrap UCL	3433
Kolmogorov-Smirnov Test Statistic	0.227	95% Percentile Bootstrap UCL	3011
Kolmogorov-Smirnov 5% Critical Value	0.13	95% BCA Bootstrap UCL	3504
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4976
		97.5% Chebyshev(Mean, Sd) UCL	6382
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9142
95% Approximate Gamma UCL	3229		
95% Adjusted Gamma UCL	3281		
Potential UCL to Use		**Use 95% Hall's Bootstrap UCL**	**3433**

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or
99% Chebyshev (Mean, Sd) UCL

Appendix A: Table A6
Carter Carburetor EE/CA
PCBs in Soil Die Cast Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Die Cast	G-01-01-04	4	mg/kg	ND	0.295	ND	0.295	ND	0.295	ND	0.295
Die Cast	G-01-01-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-01-02-03	3	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-01-02-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-01-03-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-01-03-10	10	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-01-04-03	3	mg/kg		6600	ND	2750	ND	2750	ND	2750
Die Cast	G-01-04-08	8	mg/kg		11000	ND	1550	ND	1550	ND	1550
Die Cast	G-01-05-03	3	mg/kg	ND	0.275	ND	0.275	ND	0.275	ND	0.275
Die Cast	G-01-05-10	10	mg/kg		4.5	ND	0.295	ND	0.295	ND	0.295
Die Cast	G-02-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-02-01-10	10	mg/kg	ND	0.315	ND	0.315	ND	0.315	ND	0.315
Die Cast	G-02-02-04	4	mg/kg	ND	0.31	ND	0.31	ND	0.31		1.6
Die Cast	G-02-02-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-02-03-03	3	mg/kg		9200	ND	2950	ND	2950	ND	2950
Die Cast	G-02-03-08	8	mg/kg		200	ND	16	ND	16	ND	16
Die Cast	G-02-04-03	3	mg/kg		29000	ND	3100	ND	3100	ND	3100
Die Cast	G-02-04-08	8	mg/kg		16000	ND	2950	ND	2950	ND	2950
Die Cast	G-02-05-03	3	mg/kg		3.1	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-02-05-08	8	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-03-01-04	4	mg/kg		17	ND	2.95	ND	2.95	ND	2.95
Die Cast	G-03-01-08	8	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-03-01-12	12	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-03-02-04	4	mg/kg	ND	0.26		1.7	ND	0.26	ND	0.26
Die Cast	G-03-02-10	10	mg/kg	ND	0.315	ND	0.315	ND	0.315	ND	0.315
Die Cast	G-03-03-03	3	mg/kg		180	ND	16	ND	16	ND	16
Die Cast	G-03-03-08	8	mg/kg		250	ND	16	ND	16	ND	16
Die Cast	G-03-04-03	3	mg/kg		180000	ND	30000	ND	30000	ND	30000
Die Cast	G-03-04-08	8	mg/kg		22000	ND	2900	ND	2900	ND	2900
Die Cast	G-03-05-02	2	mg/kg	ND	0.295	ND	0.295	ND	0.295	ND	0.295
Die Cast	G-03-05-08	8	mg/kg	ND	0.305	ND	0.305		10	ND	0.305
Die Cast	G-04-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-04-01-08	8	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-04-02-04	4	mg/kg		0.93	ND	0.305	ND	0.305		1.1
Die Cast	G-04-02-10	10	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-04-03-03	3	mg/kg		1300	ND	285	ND	285	ND	285
Die Cast	G-04-03-10	10	mg/kg	ND	3100		13000	ND	3100	ND	3100
Die Cast	G-04-04-03	3	mg/kg		110000	ND	15500	ND	15500	ND	15500
Die Cast	G-04-04-10	10	mg/kg		39000	ND	3100	ND	3100	ND	3100
Die Cast	G-04-05-04	4	mg/kg		33000	ND	2950	ND	2950	ND	2950

Appendix A: Table A6
Carter Carburetor EE/CA
PCBs in Soil Die Cast Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Die Cast	G-04-05-09	9	mg/kg		10	ND	3.1	ND	3.1	ND	3.1
Die Cast	G-04-06-03	3	mg/kg		380	ND	28.5	ND	28.5	ND	28.5
Die Cast	G-04-06-08	8	mg/kg		0.9	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-04-07-03	3	mg/kg	ND	295		1000	ND	295	ND	295
Die Cast	G-04-07-11	11	mg/kg		88	ND	6	ND	6	ND	6
Die Cast	G-05-01-04	4	mg/kg		6500	ND	2600	ND	2600	ND	2600
Die Cast	G-05-01-08	8	mg/kg	ND	31500		200000	ND	31500	ND	31500
Die Cast	G-05-01-12	12	mg/kg		0.72	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-05-02-04	4	mg/kg	ND	0.3		1.5	ND	0.3	ND	0.3
Die Cast	G-05-02-08	8	mg/kg	ND	0.305		1.2	ND	0.305	ND	0.305
Die Cast	G-05-03-04	4	mg/kg		17	ND	3	ND	3	ND	3
Die Cast	G-05-03-10	10	mg/kg		0.82	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-05-04-03	3	mg/kg		770	ND	285	ND	285	ND	285
Die Cast	G-05-04-10	10	mg/kg		33000	ND	3050	ND	3050	ND	3050
Die Cast	G-05-05-02	2	mg/kg		2600	ND	305	ND	305	ND	305
Die Cast	G-05-05-08	8	mg/kg		990	ND	305	ND	305	ND	305
Die Cast	G-06-01-04	4	mg/kg		940	ND	150	ND	150	ND	150
Die Cast	G-06-01-08	8	mg/kg	ND	0.305		4	ND	0.305	ND	0.305
Die Cast	G-06-01-14	14	mg/kg	ND	0.33		3.3	ND	0.33	ND	0.33
Die Cast	G-06-02-04	4	mg/kg	ND	0.29		1.1	ND	0.29	ND	0.29
Die Cast	G-06-02-10	10	mg/kg		0.67	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-06-03-04	4	mg/kg	ND	3.05		18	ND	3.05	ND	3.05
Die Cast	G-06-03-10	10	mg/kg	ND	0.295		1.4	ND	0.295	ND	0.295
Die Cast	G-06-04-04	4	mg/kg		1100	ND	150	ND	150	ND	150
Die Cast	G-06-04-10	10	mg/kg		1400	ND	150	ND	150	ND	150
Die Cast	G-06-05-03	3	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-06-05-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-07-01-04	4	mg/kg	ND	0.265		1.1	ND	0.265	ND	0.265
Die Cast	G-07-01-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-07-02-04	4	mg/kg		0.89	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-07-02-10	10	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-07-03-04	4	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-07-03-08	8	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-07-04-03	3	mg/kg		39	ND	2.75	ND	2.75	ND	2.75
Die Cast	G-07-04-08	8	mg/kg		3600	ND	310	ND	310	ND	310
Die Cast	G-07-04-12	12	mg/kg		2100	ND	295	ND	295	ND	295
Die Cast	G-07-05-03	3	mg/kg	ND	0.275	ND	0.275	ND	0.275	ND	0.275
Die Cast	G-07-05-08	8	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-01-04	4	mg/kg		3400	ND	295	ND	295	ND	295
Die Cast	G-08-01-10	10	mg/kg		0.83	ND	0.31	ND	0.31	ND	0.31

Appendix A: Table A6
Carter Carburetor EE/CA
PCBs in Soil Die Cast Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit	PCB-1242		PCB-1248		PCB-1254		PCB-1260	
Die Cast	G-08-02-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-02-10	10	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-08-03-04	4	mg/kg		6	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-03-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-04-04	4	mg/kg		1400	ND	290	ND	290	ND	290
Die Cast	G-08-04-08	8	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-08-04-12	12	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-08-05-04	4	mg/kg		0.82	ND	0.28	ND	0.28	ND	0.28
Die Cast	G-08-05-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-01-04	4	mg/kg		310	ND	28	ND	28		46
Die Cast	G-09-01-08	8	mg/kg		1400	ND	295	ND	295	ND	295
Die Cast	G-09-01-12	12	mg/kg		3.6	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-02-04	4	mg/kg		5	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-09-02-11	11	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-03-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-03-11	11	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-04-04	4	mg/kg		20000	ND	2950	ND	2950	ND	2950
Die Cast	G-09-04-11	11	mg/kg		15000	ND	2850	ND	2850	ND	2850
Die Cast	G-09-05-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-05-10	10	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-06-03	3	mg/kg		6800	ND	2850	ND	2850	ND	2850
Die Cast	G-09-06-08	8	mg/kg		750	ND	150	ND	150	ND	150
Die Cast	G-09-07-03	3	mg/kg		2900	ND	260	ND	260	ND	260
Die Cast	G-09-07-08	8	mg/kg		13	ND	1.5	ND	1.5	ND	1.5
Die Cast	G-09-07-12	12	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-09-08-03	3	mg/kg		2100	ND	295	ND	295	ND	295
Die Cast	G-09-08-08	8	mg/kg		13000	ND	3000	ND	3000	ND	3000
Die Cast	G-09-09-03	3	mg/kg		270000	ND	29500	ND	29500	ND	29500
Die Cast	G-09-09-08	8	mg/kg		8700	ND	3100	ND	3100	ND	3100
Die Cast	G-09-10-03	3	mg/kg		3800	ND	305	ND	305	ND	305
Die Cast	G-09-10-08	8	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-09-10-12	12	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-09-11-04	4	mg/kg	ND	2450		48000	ND	2450	ND	2450
Die Cast	G-09-11-10	10	mg/kg	ND	0.3	ND	0.3	ND	0.3	ND	0.3
Die Cast	G-10-01-04	4	mg/kg	ND	0.305	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-10-01-10	10	mg/kg	ND	0.31	ND	0.31	ND	0.31	ND	0.31
Die Cast	G-10-02-05	5	mg/kg		1.1	ND	0.305	ND	0.305	ND	0.305
Die Cast	G-10-02-11	11	mg/kg	ND	0.315	ND	0.315	ND	0.315	ND	0.315
Die Cast	G-10-03-04	4	mg/kg		47	ND	30.5	ND	30.5		430
Die Cast	G-10-03-10	10	mg/kg		5.8	ND	0.6	ND	0.6		7.3

Appendix A: Table A6
Carter Carburetor EE/CA
PCBs in Soil Die Cast Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID	Samp_Depth	Results Unit		PCB-1242		PCB-1248		PCB-1254		PCB-1260
Die Cast	G-10-04-04	4	mg/kg		35	ND	2.5	ND	2.5		3.6
Die Cast	G-10-04-10	10	mg/kg		0.82	ND	0.305	ND	0.305	ND	0.305
Die Cast	SB-07-08	8	mg/kg	ND	0.16	ND	0.16	ND	0.16	ND	0.16
Die Cast	SB-09-03	3	mg/kg	ND	145		1189	ND	145	ND	145
Die Cast	SB-10-05	5	mg/kg	ND	1.6		4.44	ND	1.6	ND	1.6
Die Cast	SB-11-08	8	mg/kg	ND	80		416.7	ND	80	ND	80
Die Cast	SB-12-08	8	mg/kg	ND	650		3939	ND	650	ND	650
Die Cast	SB-15-04	4	mg/kg	ND	750		6929	ND	750	ND	750
Die Cast	SB-16-08	8	mg/kg	ND	80		191.1	ND	80	ND	80
Die Cast	SB-17-05	5	mg/kg	ND	0.16		0.82	ND	0.16	ND	0.16
Die Cast	SB-18-06	6	mg/kg	ND	0.125		0.88	ND	0.125	ND	0.125
Die Cast	SB-20-05	5	mg/kg	ND	0.155		0.42	ND	0.155	ND	0.155
Die Cast	SB-21-05	5	mg/kg	ND	0.155	ND	0.155	ND	0.155	ND	0.155
Die Cast	SB-22-05	5	mg/kg	ND	0.8	ND	0.8	ND	0.8	ND	0.8
Die Cast	SB-23-06	6	mg/kg	ND	1.6		6.3	ND	1.6	ND	1.6
Die Cast	SB-24-07	7	mg/kg	ND	0.16		0.34	ND	0.16		1.1
Die Cast	SB-25-08	8	mg/kg	ND	0.16		1.4	ND	0.16	ND	0.16
Die Cast	SB-26-05	5	mg/kg	ND	1.55	ND	1.55	ND	1.55	ND	1.55
Die Cast	SB-29-05	5	mg/kg	ND	320		2650	ND	320	ND	320
Die Cast	SB-29-07	7	mg/kg	ND	1.5	ND	1.5	ND	1.5	ND	1.5
Die Cast	SB-30-06	6	mg/kg	ND	1.6	ND	1.6	ND	1.6	ND	1.6

Summary Statistics: no. samples	141	141	141	141
no. hits	63	26	1	7
min-D	0.67	0.34	10	1.1
max-D	270000	200000	10	430
min-ND	0.25	0.31	0.25	0.25
max-ND	63000	60000	63000	63000
mean	6385.6143	2832.052	1144.296	1147.265
95% UCL	30838	17611	4997	4999

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are at 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1242

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C2

General Statistics			
Number of Valid Samples	141	Number of Unique Samples	82
Raw Statistics		Log-transformed Statistics	
Minimum	0.125	Minimum of Log Data	-2.079
Maximum	270000	Maximum of Log Data	12.51
Mean	6386	Mean of log Data	2.483
Median	0.93	SD of log Data	4.353
SD	29182		
Coefficient of Variation	4.57		
Skewness	7.215		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.413	Lilliefors Test Statistic	0.228
Lilliefors Critical Value	0.0746	Lilliefors Critical Value	0.0746
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	10455	95% H-UCL	1533364
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	376123
95% Adjusted-CLT UCL	12023	97.5% Chebyshev (MVUE) UCL	501870
95% Modified-t UCL	10704	99% Chebyshev (MVUE) UCL	748875
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.128	Data do not follow a Discernable Distribution (0.05)	
Theta Star	50049		
nu star	35.98		
Approximate Chi Square Value (.05)	23.25	Nonparametric Statistics	
Adjusted Level of Significance	0.0483	95% CLT UCL	10428
Adjusted Chi Square Value	23.15	95% Jackknife UCL	10455
		95% Standard Bootstrap UCL	10496
Anderson-Darling Test Statistic	15.22	95% Bootstrap-t UCL	16777
Anderson-Darling 5% Critical Value	1.018	95% Hall's Bootstrap UCL	23167
Kolmogorov-Smirnov Test Statistic	0.257	95% Percentile Bootstrap UCL	10772
Kolmogorov-Smirnov 5% Critical Value	0.0906	95% BCA Bootstrap UCL	12401
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	17098
		97.5% Chebyshev(Mean, Sd) UCL	21733
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	30838
95% Approximate Gamma UCL	9881		
95% Adjusted Gamma UCL	9926		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	30838

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1248

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C4

General Statistics			
Number of Valid Samples	141	Number of Unique Samples	66
Raw Statistics		Log-transformed Statistics	
Minimum	0.155	Minimum of Log Data	-1.864
Maximum	200000	Maximum of Log Data	12.21
Mean	2832	Mean of log Data	1.978
Median	1.1	SD of log Data	3.867
SD	17637		
Coefficient of Variation	6.228		
Skewness	10.3		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.437	Lilliefors Test Statistic	0.239
Lilliefors Critical Value	0.0746	Lilliefors Critical Value	0.0746
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	5291	95% H-UCL	78899
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	34427
95% Adjusted-CLT UCL	6651	97.5% Chebyshev (MVUE) UCL	45602
95% Modified-t UCL	5506	99% Chebyshev (MVUE) UCL	67553
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.133	Data do not follow a Discernable Distribution (0.05)	
Theta Star	21272		
nu star	37.54		
Approximate Chi Square Value (.05)	24.51	Nonparametric Statistics	
Adjusted Level of Significance	0.0483	95% CLT UCL	5275
Adjusted Chi Square Value	24.41	95% Jackknife UCL	5291
		95% Standard Bootstrap UCL	5268
Anderson-Darling Test Statistic	18.17	95% Bootstrap-t UCL	12062
Anderson-Darling 5% Critical Value	1.01	95% Hall's Bootstrap UCL	12882
Kolmogorov-Smirnov Test Statistic	0.275	95% Percentile Bootstrap UCL	5815
Kolmogorov-Smirnov 5% Critical Value	0.0903	95% BCA Bootstrap UCL	7670
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9306
		97.5% Chebyshev(Mean, Sd) UCL	12108
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17611
95% Approximate Gamma UCL	4337		
95% Adjusted Gamma UCL	4357		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	17611

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1254

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C6

General Statistics			
Number of Valid Samples	141	Number of Unique Samples	57
Raw Statistics		Log-transformed Statistics	
Minimum	0.125	Minimum of Log Data	-2.079
Maximum	31500	Maximum of Log Data	10.36
Mean	1144	Mean of log Data	1.691
Median	0.31	SD of log Data	3.76
SD	4598		
Coefficient of Variation	4.018		
Skewness	5.792		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.408	Lilliefors Test Statistic	0.304
Lilliefors Critical Value	0.0746	Lilliefors Critical Value	0.0746
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1785	95% H-UCL	35818
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	17410
95% Adjusted-CLT UCL	1983	97.5% Chebyshev (MVUE) UCL	23015
95% Modified-t UCL	1817	99% Chebyshev (MVUE) UCL	34025
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.146	Data do not follow a Discernable Distribution (0.05)	
Theta Star	7834		
nu star	41.19		
Approximate Chi Square Value (.05)	27.48	Nonparametric Statistics	
Adjusted Level of Significance	0.0483	95% CLT UCL	1781
Adjusted Chi Square Value	27.36	95% Jackknife UCL	1785
		95% Standard Bootstrap UCL	1776
Anderson-Darling Test Statistic	17.64	95% Bootstrap-t UCL	2202
Anderson-Darling 5% Critical Value	0.991	95% Hall's Bootstrap UCL	2099
Kolmogorov-Smirnov Test Statistic	0.287	95% Percentile Bootstrap UCL	1825
Kolmogorov-Smirnov 5% Critical Value	0.0898	95% BCA Bootstrap UCL	1992
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2832
		97.5% Chebyshev(Mean, Sd) UCL	3562
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4997
95% Approximate Gamma UCL	1715		
95% Adjusted Gamma UCL	1722		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	4997

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Former Die Cast Building
Subsurface Soil Sample Interval (0-10 ft) - PCB-1260

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C8

General Statistics			
Number of Valid Samples	141	Number of Unique Samples	57
Raw Statistics		Log-transformed Statistics	
Minimum	0.125	Minimum of Log Data	-2.079
Maximum	31500	Maximum of Log Data	10.36
Mean	1147	Mean of log Data	1.743
Median	0.315	SD of log Data	3.759
SD	4597		
Coefficient of Variation	4.007		
Skewness	5.792		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.401	Lilliefors Test Statistic	0.294
Lilliefors Critical Value	0.0746	Lilliefors Critical Value	0.0746
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1788	95% H-UCL	37416
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18220
95% Adjusted-CLT UCL	1986	97.5% Chebyshev (MVUE) UCL	24084
95% Modified-t UCL	1820	99% Chebyshev (MVUE) UCL	35605
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.147	Data do not follow a Discernable Distribution (0.05)	
Theta Star	7793		
nu star	41.52		
Approximate Chi Square Value (.05)	27.75	Nonparametric Statistics	
Adjusted Level of Significance	0.0483	95% CLT UCL	1784
Adjusted Chi Square Value	27.63	95% Jackknife UCL	1788
		95% Standard Bootstrap UCL	1781
Anderson-Darling Test Statistic	17.24	95% Bootstrap-t UCL	2263
Anderson-Darling 5% Critical Value	0.99	95% Hall's Bootstrap UCL	1987
Kolmogorov-Smirnov Test Statistic	0.282	95% Percentile Bootstrap UCL	1834
Kolmogorov-Smirnov 5% Critical Value	0.0897	95% BCA Bootstrap UCL	2033
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2835
		97.5% Chebyshev(Mean, Sd) UCL	3565
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4999
95% Approximate Gamma UCL	1717		
95% Adjusted Gamma UCL	1724		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	4999

Appendix A: Table A7
Carter Carburetor EE/CA
TCE Area - Surface Soil 0 to 1 ft

Exposure Unit	SAMPLE ID	Trichloroethene		Cis-1,2-Dichloroethene		Trans-1,2-Dichloroethene		Vinyl Chloride	
TCE	TCE-AA-1-1	ND	4.10	ND	4.10	ND	4.10	ND	4.10
TCE	TCE-C-10-1		3,800.00		68.00	ND	29.00	ND	29.00
TCE	TCE-C-14-1		12,800.00		615.00	ND	244.00	ND	244.00
TCE	TCE-G-8-1		64,900.00		633.00	ND	280.50	ND	280.50
TCE	TCE-G-11-1		495,000.00	ND	2,170.00	ND	2,170.00	ND	2,170.00
TCE	TCE-H-12-1		53,500.00	ND	1,140.00	ND	1,140.00	ND	1,140.00
TCE	TCE-HH-1-1	ND	2.65	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-J-7-0.5		27,100.00	J	1,050.00	ND	665.00	ND	665.00
TCE	TCE-J-14-0.5		292,000.00		5,050.00	ND	1,565.00	ND	1,565.00
TCE	TCE-J-15-1	ND	2.90	ND	2.90	ND	2.90	ND	2.90
TCE	TCE-K-11-1		402,000.00	ND	13,500.00	ND	13,500.00	ND	13,500.00
TCE	TCE-M-3-1		250.00	ND	34.00	ND	34.00	ND	34.00
TCE	TCE-M-7-1		81,900.00	J	1,180.00	ND	1,330.00	ND	1,330.00
TCE	TCE-M-8-1		182,000.00		4,020.00	ND	1,350.00	ND	1,350.00
TCE	TCE-M-10-1		258,000.00	ND	12,450.00	ND	12,450.00	ND	12,450.00
TCE	TCE-M-11-1		405,000.00	ND	8,450.00	ND	8,450.00	ND	16,900.00
TCE	TCE-M-15-1	ND	2.65	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-P-11-0.5		318,000.00	ND	1,415.00	ND	1,415.00	ND	1,415.00
TCE	TCE-Q-15-1	ND	2.55	ND	2.55	ND	2.55	ND	2.55
TCE	TCE-R-13-1		590.00	ND	132.50	ND	132.50	ND	132.50
TCE	TCE-S-15-1	J	0.90	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-T-15-1	ND	0.28	ND	0.28	ND	0.28	ND	0.28

	Trichloroethene	Cis-1,2-Dichloroethene	Trans-1,2-Dichloroethene	Vinyl Chloride
no. samples	22	22	22	22
no. hits	16	7	0	0
min-D	0.90	68	na	na
max-D	495,000	5,050	na	na
min-ND	0.55	0.55	0.55	0.55
max-ND	8.20	27,000	27,000	33,800
mean	118,038.91	2,360.24	2,035.13	2,419.22
95% UCL	369,552	6,002	5,249	6,381

Notes:
This worksheet contains only soil collected from 0 to 1 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Surface Soil Interval (0-1 ft) - TCE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C1

General Statistics			
Number of Valid Samples	22	Number of Unique Samples	21
Raw Statistics		Log-transformed Statistics	
Minimum	0.28	Minimum of Log Data	-1.273
Maximum	495000	Maximum of Log Data	13.11
Mean	118039	Mean of log Data	7.538
Median	19950	SD of log Data	5.281
SD	164011		
Coefficient of Variation	1.389		
Skewness	1.16		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.746	Shapiro Wilk Test Statistic	0.835
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	0.911
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	178209	95% H-UCL	2.18E+14
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.62E+08
95% Adjusted-CLT UCL	184797	97.5% Chebyshev (MVUE) UCL	2.19E+08
95% Modified-t UCL	179650	99% Chebyshev (MVUE) UCL	3.31E+08
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.186	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	633858		
nu star	8.194		
Approximate Chi Square Value (.05)	2.848	Nonparametric Statistics	
Adjusted Level of Significance	0.0386	95% CLT UCL	175555
Adjusted Chi Square Value	2.617	95% Jackknife UCL	178209
		95% Standard Bootstrap UCL	175194
Anderson-Darling Test Statistic	1.061	95% Bootstrap-t UCL	192781
Anderson-Darling 5% Critical Value	0.9	95% Hall's Bootstrap UCL	177802
Kolmogorov-Smirnov Test Statistic	0.194	95% Percentile Bootstrap UCL	175746
Kolmogorov-Smirnov 5% Critical Value	0.206	95% BCA Bootstrap UCL	183019
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	270458
		97.5% Chebyshev(Mean, Sd) UCL	336410
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	465960
95% Approximate Gamma UCL	339631		
95% Adjusted Gamma UCL	369552		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	**369552**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Surface Soil Interval (0-1 ft) - *cis-* DCE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

			20
C3			
General Statistics			-1.273
Number of Valid Samples	22	Number of Unique Samples	9.51
			5.063
Raw Statistics		Log-transformed Statistics	3.408
Minimum	0.28	Minimum of Log Data	
Maximum	13500	Maximum of Log Data	
Mean	2360	Mean of log Data	
Median	624	SD of log Data	
SD	4018		
Coefficient of Variation	1.702		
Skewness	2.03		0.898
			0.911
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.642	Shapiro Wilk Test Statistic	
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	7040817
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	78870
			105749
Assuming Normal Distribution		Assuming Lognormal Distribution	158548
95% Student's-t UCL	3834	95% H-UCL	
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	
95% Adjusted-CLT UCL	4166	97.5% Chebyshev (MVUE) UCL	
95% Modified-t UCL	3896	99% Chebyshev (MVUE) UCL	
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.256	Data appear Gamma Distributed at 5% Significance Lev	3769
Theta Star	9233		3834
nu star	11.25		3716
Approximate Chi Square Value (.05)	4.736	Nonparametric Statistics	4647
Adjusted Level of Significance	0.0386	95% CLT UCL	4096
Adjusted Chi Square Value	4.423	95% Jackknife UCL	3844
		95% Standard Bootstrap UCL	4190
Anderson-Darling Test Statistic	0.579	95% Bootstrap-t UCL	6094
Anderson-Darling 5% Critical Value	0.865	95% Hall's Bootstrap UCL	7710
Kolmogorov-Smirnov Test Statistic	0.17	95% Percentile Bootstrap UCL	10884
Kolmogorov-Smirnov 5% Critical Value	0.203	95% BCA Bootstrap UCL	
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	
		97.5% Chebyshev(Mean, Sd) UCL	
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	**6002**
95% Approximate Gamma UCL	5606		
95% Adjusted Gamma UCL	6002		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Surface Soil Interval (0-1 ft) - *trans-* DCE

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

			20
C0			
General Statistics			-1.273
Number of Valid Samples	22	Number of Unique Samples	9.51
			4.827
Raw Statistics		Log-transformed Statistics	3.294
Minimum	0.28	Minimum of Log Data	
Maximum	13500	Maximum of Log Data	
Mean	2035	Mean of log Data	
Median	262.3	SD of log Data	
SD	3977		
Coefficient of Variation	1.954		
Skewness	2.334		0.914
			0.911
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.556	Shapiro Wilk Test Statistic	
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	2789768
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	46921
			62842
Assuming Normal Distribution		Assuming Lognormal Distribution	94117
95% Student's-t UCL	3494	95% H-UCL	
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	
95% Adjusted-CLT UCL	3881	97.5% Chebyshev (MVUE) UCL	
95% Modified-t UCL	3565	99% Chebyshev (MVUE) UCL	
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.25	Data appear Gamma Distributed at 5% Significance Lev	3430
Theta Star	8156		3494
nu star	10.98		3355
Approximate Chi Square Value (.05)	4.562	Nonparametric Statistics	4545
Adjusted Level of Significance	0.0386	95% CLT UCL	3442
Adjusted Chi Square Value	4.257	95% Jackknife UCL	3535
		95% Standard Bootstrap UCL	3843
Anderson-Darling Test Statistic	0.677	95% Bootstrap-t UCL	5731
Anderson-Darling 5% Critical Value	0.868	95% Hall's Bootstrap UCL	7331
Kolmogorov-Smirnov Test Statistic	0.157	95% Percentile Bootstrap UCL	10472
Kolmogorov-Smirnov 5% Critical Value	0.203	95% BCA Bootstrap UCL	
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	
		97.5% Chebyshev(Mean, Sd) UCL	
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	**5249**
95% Approximate Gamma UCL	4897		
95% Adjusted Gamma UCL	5249		
Potential UCL to Use		**Use 95% Adjusted Gamma UCL**	

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Surface Soil Interval (0-1 ft) - Vinyl Chloride

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

			20
C0			
General Statistics			-1.273
Number of Valid Samples	22	Number of Unique Samples	9.735
			4.858
Raw Statistics		Log-transformed Statistics	3.34
Minimum	0.28	Minimum of Log Data	
Maximum	16900	Maximum of Log Data	
Mean	2419	Mean of log Data	
Median	262.3	SD of log Data	
SD	4922		
Coefficient of Variation	2.035		
Skewness	2.3		0.918
			0.911
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.536	Shapiro Wilk Test Statistic	
Shapiro Wilk Critical Value	0.911	Shapiro Wilk Critical Value	3780576
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	54196
			72619
Assuming Normal Distribution		Assuming Lognormal Distribution	108807
95% Student's-t UCL	4225	95% H-UCL	
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	
95% Adjusted-CLT UCL	4695	97.5% Chebyshev (MVUE) UCL	
95% Modified-t UCL	4311	99% Chebyshev (MVUE) UCL	
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.24	Data appear Gamma Distributed at 5% Significance Lev	4145
Theta Star	10064		4225
nu star	10.58		4083
Approximate Chi Square Value (.05)	4.306	Nonparametric Statistics	5084
Adjusted Level of Significance	0.0386	95% CLT UCL	3768
Adjusted Chi Square Value	4.01	95% Jackknife UCL	4281
		95% Standard Bootstrap UCL	4648
Anderson-Darling Test Statistic	0.76	95% Bootstrap-t UCL	6993
Anderson-Darling 5% Critical Value	0.873	95% Hall's Bootstrap UCL	8973
Kolmogorov-Smirnov Test Statistic	0.153	95% Percentile Bootstrap UCL	12860
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL	
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	
		97.5% Chebyshev(Mean, Sd) UCL	
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	**6381**
95% Approximate Gamma UCL	5943		
95% Adjusted Gamma UCL	6381		
Potential UCL to Use		**Use 95% Adjusted Gamma UCL**	

Appendix A: Table A8
Carter Carburetor EE/CA
TCE Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Vinyl Chloride
TCE	TCE-C-5-9	J	183.00	J	176.00	ND	167.00	ND	333.50
TCE	TCE-E-14-4		176,000.00	J	2,160.00	ND	1,360.00	ND	1,360.00
TCE	TCE-E-14-8		79,500.00	J	1,510.00	ND	1,245.00	ND	1,245.00
TCE	TCE-G-5-8		39,700.00	J	1,190.00	ND	745.00	ND	1,485.00
TCE	TCE-H-14-8		142,000.00	J	2,080.00	ND	1,400.00	ND	1,400.00
TCE	TCE-H-7-2		44,100.00	J	1,210.00	ND	1,485.00	ND	1,485.00
TCE	TCE-I-10-2		600,000.00	J	4,460.00	ND	8,450.00	ND	8,450.00
TCE	TCE-I-10-7		438,000.00	J	7,050.00	ND	8,950.00	ND	8,950.00
TCE	TCE-I-11-3		510,000.00	J	4,580.00	ND	3,015.00	ND	3,015.00
TCE	TCE-I-11-8		35,800.00	J	851.00	ND	650.00	ND	650.00
TCE	TCE-I-12-2		169,000.00	J	936.00	ND	1,035.00	ND	1,035.00
TCE	TCE-J-11-3		302,000.00	J	1,060.00	ND	790.00	ND	790.00
TCE	TCE-J-14-8		44,200.00	J	1,970.00	ND	1,365.00	ND	1,365.00
TCE	TCE-J-7-0.5		27,100.00	J	1,050.00	ND	665.00	ND	665.00
TCE	TCE-J-8-2		37,700.00	J	403.00	ND	730.00	ND	730.00
TCE	TCE-J-9-2		352,000.00	J	333.00	ND	795.00	ND	795.00
TCE	TCE-K-11-10		1,480,000.00	J	23,400.00	ND	27,750.00	ND	27,750.00
TCE	TCE-K-13-10		220,000.00	J	1,220.00	ND	1,325.00	ND	1,325.00
TCE	TCE-K-7-3		64,100.00	J	2,500.00	ND	1,270.00	ND	1,270.00
TCE	TCE-L-14-2		577,000.00	J	2,890.00	ND	1,495.00	ND	1,495.00
TCE	TCE-L-9-9		3,470,000.00	J	19,200.00	ND	38,400.00	ND	38,400.00
TCE	TCE-M-7-1		81,900.00	J	1,180.00	ND	1,330.00	ND	1,330.00
TCE	TCE-M-8-6		955,000.00	J	2,300.00	ND	1,260.00	ND	1,260.00
TCE	TCE-M-9-2		71,200.00	J	1,440.00	ND	1,305.00	ND	1,305.00
TCE	TCE-T-1-4		2,230.00	J	180.00	ND	142.50	ND	142.50
TCE	TCE-A-13-3		718.00	ND	132.00	ND	132.00	ND	132.00
TCE	TCE-A-5-4		2,930.00	ND	135.50	ND	135.50	ND	135.50
TCE	TCE-A-5-9	ND	2.60	ND	2.60	ND	2.60		**12.20**
TCE	TCE-AA-1-1	ND	4.10	ND	4.10	ND	4.10	ND	4.10
TCE	TCE-AA-2-2	ND	2.40	ND	2.40	ND	2.40	ND	2.40
TCE	TCE-AA-7-9	ND	2.70	ND	2.70	ND	2.70	ND	2.70
TCE	TCE-C-13-2		38,000.00	ND	235.00	ND	235.00	ND	235.00
TCE	TCE-C-13-8		93,000.00	ND	550.00	ND	550.00	ND	550.00
TCE	TCE-C-15-3		8.00	ND	2.45	ND	2.45		28.30
TCE	TCE-C-15-8		54.70	ND	2.55	ND	2.55		47.80
TCE	TCE-C-3-4		735.00	ND	197.00	ND	197.00	ND	393.50
TCE	TCE-C-5-2		3,950.00	ND	146.50	ND	146.50	ND	293.50
TCE	TCE-C-7-2		17,000.00	ND	80.00	ND	80.00	ND	80.00
TCE	TCE-C-7-9	ND	3.15	ND	3.15	ND	3.15		13.00
TCE	TCE-E-1-2		26.00	ND	1.75	ND	1.75	ND	1.75
TCE	TCE-E-13-2		23,000.00	ND	120.00	ND	120.00	ND	120.00
TCE	TCE-E-15-2	ND	2.55	ND	2.55	ND	2.55	ND	2.55
TCE	TCE-E-15-8		17.00	ND	2.60	ND	2.60	ND	2.60
TCE	TCE-E-1-8		39.00	ND	3.65	ND	3.65	ND	3.65
TCE	TCE-E-3-3		604.00	ND	146.00	ND	146.00	ND	292.00
TCE	TCE-E-3-9		66,400.00	ND	1,730.00	ND	1,730.00	ND	3,455.00
TCE	TCE-E-5-3		17,400.00	ND	304.50	ND	304.50	ND	610.00
TCE	TCE-E-5-8		1,750,000.00	ND	25,850.00	ND	25,850.00	ND	51,500.00

Appendix A: Table A8
Carter Carburetor EE/CA
TCE Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Vinyl Chloride
TCE	TCE-EE-1-4	ND	2.65	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-EE-1-8	ND	2.75	ND	2.75	ND	2.75	ND	2.75
TCE	TCE-G-10-2		226,000.00	ND	1,405.00	ND	1,405.00	ND	1,405.00
TCE	TCE-G-11-1		495,000.00	ND	2,170.00	ND	2,170.00	ND	2,170.00
TCE	TCE-G-11-10		662,000.00	ND	16,950.00	ND	16,950.00	ND	16,950.00
TCE	TCE-G-11-6		599,000.00	ND	8,000.00	ND	8,000.00	ND	8,000.00
TCE	TCE-G-12-2.5		138,000.00	ND	825.00	ND	825.00	ND	825.00
TCE	TCE-G-13-2		49,100.00	ND	760.00	ND	760.00	ND	760.00
TCE	TCE-G-3-3		1,230.00	ND	150.00	ND	150.00	ND	300.00
TCE	TCE-G-3-8		4,580.00	ND	150.50	ND	150.50	ND	301.50
TCE	TCE-G-5-3		2,420.00	ND	164.00	ND	164.00	ND	328.00
TCE	TCE-G-7-2		2,830.00	ND	77.00	ND	77.00	ND	77.00
TCE	TCE-G-8-6.5		115,000.00	ND	1,550.00	ND	1,550.00	ND	1,550.00
TCE	TCE-H-10-2		284,000.00	ND	19,800.00	ND	19,800.00	ND	19,800.00
TCE	TCE-H-11-2		652,000.00	ND	20,400.00	ND	20,400.00	ND	20,400.00
TCE	TCE-H-12-1		53,500.00	ND	1,140.00	ND	1,140.00	ND	1,140.00
TCE	TCE-H-13-2		184,000.00	ND	3,185.00	ND	3,185.00	ND	3,185.00
TCE	TCE-H-14-4		77,200.00	ND	1,780.00	ND	1,780.00	ND	1,780.00
TCE	TCE-H-8-3		22,200.00	ND	765.00	ND	765.00	ND	765.00
TCE	TCE-HH-1-1	ND	2.65	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-I-8-3		52,800.00	ND	745.00	ND	745.00	ND	745.00
TCE	TCE-I-9-2		60,300.00	ND	1,225.00	ND	1,225.00	ND	1,225.00
TCE	TCE-J-12-4		186,000.00	ND	3,700.00	ND	3,700.00	ND	3,700.00
TCE	TCE-J-12-7		756,000.00	ND	1,450.00	ND	1,450.00	ND	1,450.00
TCE	TCE-J-1-3		11,000.00	ND	75.00	ND	75.00	ND	75.00
TCE	TCE-J-13-4		402,000.00	ND	770.00	ND	770.00	ND	770.00
TCE	TCE-J-13-9		6,290,000.00	ND	108,500.00	ND	108,500.00	ND	108,500.00
TCE	TCE-J-15-1	ND	2.90	ND	2.90	ND	2.90	ND	2.90
TCE	TCE-J-3-4		2,600.00	ND	31.50	ND	31.50	ND	31.50
TCE	TCE-J-3-9		64,000.00	ND	280.00	ND	280.00	ND	280.00
TCE	TCE-J-5-3		5,430.00	ND	158.50	ND	158.50	ND	316.50
TCE	TCE-J-8-8		1,130,000.00	ND	27,850.00	ND	27,850.00	ND	27,850.00
TCE	TCE-K-10-2		399,000.00	ND	6,450.00	ND	6,450.00	ND	6,450.00
TCE	TCE-K-10-8		1,460,000.00	ND	28,150.00	ND	28,150.00	ND	28,150.00
TCE	TCE-K-11-1		402,000.00	ND	13,500.00	ND	13,500.00	ND	13,500.00
TCE	TCE-K-12-4		1,180,000.00	ND	7,600.00	ND	7,600.00	ND	7,600.00
TCE	TCE-K-13-4		45,400.00	ND	645.00	ND	645.00	ND	645.00
TCE	TCE-K-9-2		143,000.00	ND	695.00	ND	695.00	ND	695.00
TCE	TCE-L-10-2		145,000.00	ND	1,180.00	ND	1,180.00	ND	1,180.00
TCE	TCE-L-10-8		3,480,000.00	ND	17,750.00	ND	17,750.00	ND	17,750.00
TCE	TCE-L-11-10		9,400,000.00	ND	146,500.00	ND	146,500.00	ND	146,500.00
TCE	TCE-L-11-4		4,480,000.00	ND	35,250.00	ND	35,250.00	ND	35,250.00
TCE	TCE-L-12-2		504,000.00	ND	9,150.00	ND	9,150.00	ND	9,150.00
TCE	TCE-L-12-8		1,490,000.00	ND	27,600.00	ND	27,600.00	ND	27,600.00
TCE	TCE-L-13-10		285,000.00	ND	13,050.00	ND	13,050.00	ND	13,050.00
TCE	TCE-L-13-4		29,000.00	ND	1,220.00	ND	1,220.00	ND	1,220.00
TCE	TCE-L-14-8		37,600.00	ND	1,290.00	ND	1,290.00	ND	1,290.00
TCE	TCE-L-7-4		19,300.00	ND	670.00	ND	670.00	ND	670.00

Appendix A: Table A8
Carter Carburetor EE/CA
TCE Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID		Trichloroethene		cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Vinyl Chloride
TCE	TCE-L-8-6		1,330,000.00	ND	29,750.00	ND	29,750.00	ND	29,750.00
TCE	TCE-L-9-1.5		1,230,000.00	ND	27,800.00	ND	27,800.00	ND	2,800.00
TCE	TCE-M-10-1		258,000.00	ND	12,450.00	ND	12,450.00	ND	12,450.00
TCE	TCE-M-10-8		1,280,000.00	ND	14,750.00	ND	14,750.00	ND	14,750.00
TCE	TCE-M-11-1		405,000.00	ND	8,450.00	ND	8,450.00	ND	16,900.00
TCE	TCE-M-11-6		1,150,000.00	ND	17,250.00	ND	17,250.00	ND	34,550.00
TCE	TCE-M-12-2		539,000.00	ND	7,650.00	ND	7,650.00	ND	15,300.00
TCE	TCE-M-12-8		664,000.00	ND	8,900.00	ND	8,900.00	ND	17,800.00
TCE	TCE-M-13-3		296,000.00	ND	6,950.00	ND	6,950.00	ND	13,950.00
TCE	TCE-M-13-8		672,000.00	ND	16,350.00	ND	16,350.00	ND	32,750.00
TCE	TCE-M-15-1	ND	2.65	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-M-15-6	ND	2.70	ND	2.70	ND	2.70	ND	2.70
TCE	TCE-M-3-1		250.00	ND	34.00	ND	34.00	ND	34.00
TCE	TCE-M-5-2		27,800.00	ND	780.00	ND	780.00	ND	1,565.00
TCE	TCE-M-9-9		1,250,000.00	ND	31,050.00	ND	31,050.00	ND	31,050.00
TCE	TCE-MM-1-2		209.00	ND	2.80	ND	2.80	ND	2.80
TCE	TCE-P-11-0.5		318,000.00	ND	1,415.00	ND	1,415.00	ND	1,415.00
TCE	TCE-P-11-8		36,300.00	ND	1,560.00	ND	1,560.00	ND	1,560.00
TCE	TCE-P-13-3		13,700,000.00	ND	31,100.00	ND	31,100.00	ND	31,100.00
TCE	TCE-P-13-8		38,500.00	ND	1,385.00	ND	1,385.00	ND	1,385.00
TCE	TCE-P-14-2		242,000.00	ND	1,370.00	ND	1,370.00	ND	1,370.00
TCE	TCE-P-7-4		30,000.00	ND	155.00	ND	155.00	ND	155.00
TCE	TCE-P-7-6		930,000.00	ND	4,150.00	ND	4,150.00	ND	4,150.00
TCE	TCE-P-9-4		250,000.00	ND	1,250.00	ND	1,250.00	ND	1,250.00
TCE	TCE-P-9-8		1,900,000.00	ND	8,000.00	ND	8,000.00	ND	8,000.00
TCE	TCE-Q-11-4		118,000.00	ND	1,385.00	ND	1,385.00	ND	1,385.00
TCE	TCE-Q-11-8		57,100.00	ND	1,390.00	ND	1,390.00	ND	1,390.00
TCE	TCE-Q-13-5		27,900.00	ND	1,205.00	ND	1,205.00	ND	1,205.00
TCE	TCE-Q-13-8		9,330.00	ND	141.50	ND	141.50	ND	141.50
TCE	TCE-Q-15-1	ND	2.55	ND	2.55	ND	2.55	ND	2.55
TCE	TCE-Q-15-8	ND	2.30	ND	2.30	ND	2.30	ND	2.30
TCE	TCE-QQ-1-2	ND	2.85	ND	2.85	ND	2.85	ND	2.85
TCE	TCE-QQ-1-8	ND	2.55	ND	2.55	ND	2.55		14.30
TCE	TCE-R-13-1		590.00	ND	132.50	ND	132.50	ND	132.50
TCE	TCE-RR-1-2	ND	2.70	ND	2.70	ND	2.70	ND	2.70
TCE	TCE-RR-1-8	ND	2.90	ND	2.90	ND	2.90	ND	2.90
TCE	TCE-S-15-1	J	0.90	ND	2.65	ND	2.65	ND	2.65
TCE	TCE-S-15-8	ND	2.60	ND	2.60	ND	2.60	ND	2.60
TCE	TCE-T-15-1	ND	0.28	ND	0.28	ND	0.28	ND	0.28
TCE	TCE-T-15-10		9.40	ND	2.70	ND	2.70	ND	2.70
TCE	TCE-T-9-2		83,000.00	ND	550.00	ND	550.00	ND	550.00
TCE	TCE-A-10-3		63,000.00		780.00	ND	240.00	ND	240.00
TCE	TCE-A-10-9		200,000.00		7,200.00	ND	950.00	ND	950.00
TCE	TCE-A-13-10		1,150.00		67,400.00	J	1,820.00		259.00
TCE	TCE-A-13-2		34,000.00		510.00	ND	245.00	ND	245.00
TCE	TCE-A-13-8		86,000.00		3,600.00	ND	315.00	ND	315.00
TCE	TCE-AA-12-2		120,000.00		1,560.00	ND	147.00	ND	147.00
TCE	TCE-AA-2-8	ND	3.15		10.40	ND	3.15	ND	3.15

Appendix A: Table A8
Carter Carburetor EE/CA
TCE Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID		Trichloroethene	cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Vinyl Chloride
TCE	TCE-AA-7-4		76.30	6.70	ND	2.70	ND	2.70
TCE	TCE-C-10-1		3,800.00	68.00	ND	29.00	ND	29.00
TCE	TCE-C-10-8		250,000.00	4,300.00	ND	1,200.00	ND	1,200.00
TCE	TCE-C-14-1		12,800.00	615.00	ND	244.00	ND	244.00
TCE	TCE-C-14-8		51,400.00	7,100.00	ND	126.00	ND	126.00
TCE	TCE-C-3-10	ND	164.50	1,470.00	ND	164.50	ND	329.00
TCE	TCE-E-10-10		290,000.00	9,400.00	ND	850.00	ND	850.00
TCE	TCE-E-10-4		190,000.00	2,200.00	ND	650.00	ND	650.00
TCE	TCE-E-13-8		61,000.00	1,000.00	ND	375.00	ND	375.00
TCE	TCE-E-7-2		33,000.00	500.00	ND	155.00	ND	155.00
TCE	TCE-E-7-9		64,000.00	27,000.00	ND	280.00	ND	280.00
TCE	TCE-G-10-10		1,840.00	44,700.00	ND	760.00		49,600.00
TCE	TCE-G-10-7		1,840,000.00	76,900.00	ND	8,700.00	ND	8,700.00
TCE	TCE-G-7-6.5		187,000.00	9,370.00	ND	835.00	ND	835.00
TCE	TCE-G-8-1		64,900.00	633.00	ND	280.50	ND	280.50
TCE	TCE-G-9-1.8		339,000.00	3,640.00	ND	1,210.00	ND	1,210.00
TCE	TCE-G-9-7		102,000.00	3,830.00	ND	1,400.00	ND	1,400.00
TCE	TCE-H-10-7		2,670,000.00	98,700.00	ND	18,300.00	ND	18,300.00
TCE	TCE-H-11-7		7,240,000.00	134,000.00	ND	21,450.00	ND	21,450.00
TCE	TCE-H-7-6.5		598,000.00	26,200.00	ND	1,475.00	ND	1,475.00
TCE	TCE-H-8-8		437,000.00	14,100.00	ND	1,130.00	ND	1,130.00
TCE	TCE-H-9-10		1,070,000.00	262,000.00	ND	3,905.00	ND	3,905.00
TCE	TCE-H-9-2		392,000.00	5,520.00	ND	1,160.00	ND	1,160.00
TCE	TCE-H-9-6		332,000.00	9,220.00	ND	925.00	ND	925.00
TCE	TCE-I-12-10		2,770,000.00	393,000.00	ND	13,350.00	ND	13,350.00
TCE	TCE-I-13-10		1,860,000.00	29,300.00	ND	1,070.00	ND	1,070.00
TCE	TCE-I-13-2.5		312,000.00	2,620.00	ND	880.00	ND	880.00
TCE	TCE-I-7-3		48,100.00	2,420.00	ND	760.00	ND	760.00
TCE	TCE-I-7-8		1,730,000.00	182,000.00	ND	10,400.00	ND	10,400.00
TCE	TCE-I-8-6.5		51,000.00	3,220.00	ND	1,475.00	ND	1,475.00
TCE	TCE-I-9-7		687,000.00	34,900.00	ND	1,430.00	ND	1,430.00
TCE	TCE-J-10-3		298,000.00	3,500.00	ND	955.00	ND	955.00
TCE	TCE-J-11-10		811,000.00	3,910.00	ND	725.00	ND	725.00
TCE	TCE-J-14-0.5		292,000.00	5,050.00	ND	1,565.00	ND	1,565.00
TCE	TCE-J-5-8		645.00	6,030.00	ND	214.00		14,500.00
TCE	TCE-J-7-10		166,000.00	33,100.00		2,030.00	ND	765.00
TCE	TCE-J-9-8		351,000.00	4,960.00	ND	1,920.00	ND	1,920.00
TCE	TCE-K-12-9		760,000.00	25,100.00	ND	1,360.00	ND	1,360.00
TCE	TCE-K-7-8		449,000.00	19,000.00	ND	2,260.00	ND	2,260.00
TCE	TCE-K-8-9		5,580,000.00	71,500.00	ND	2,275.00	ND	2,275.00
TCE	TCE-K-9-10		2,150,000.00	20,800.00	ND	1,005.00	ND	1,005.00
TCE	TCE-L-7-8		780,000.00	14,900.00	ND	1,565.00	ND	1,565.00
TCE	TCE-L-8-2		156,000.00	2,480.00	ND	1,235.00	ND	1,235.00
TCE	TCE-M-1-2		170.00	**6.50**	ND	2.60	ND	2.60
TCE	TCE-M-3-10		220,000.00	15,000.00	ND	800.00	ND	800.00
TCE	TCE-M-5-8		232,000.00	62,200.00	ND	4,630.00	ND	9,250.00
TCE	TCE-M-7-8		12,200,000.00	75,200.00	ND	35,350.00	ND	35,350.00
TCE	TCE-M-8-1		182,000.00	4,020.00	ND	1,350.00	ND	1,350.00

Appendix A: Table A8
Carter Carburetor EE/CA
TCE Area - Subsurface Soil 0 to 10 ft

Exposure Unit	SAMPLE ID		Trichloroethene	cis-1,2-Dichloroethene		trans-1,2-Dichloroethene		Vinyl Chloride
TCE	TCE-P-14-8		18,400.00	446.00	ND	144.50	ND	144.50
TCE	TCE-P-5-8		460,000.00	19,000.00	ND	2,650.00	ND	2,650.00
TCE	TCE-Q-1-4		97,900.00	29,400.00		662.00	ND	121.50
TCE	TCE-T-13-10	E	310.00	14.00	ND	2.50	ND	2.50
TCE	TCE-T-13-2		210.00	10.00	ND	2.60	ND	2.60
TCE	TCE-T-3-10		75,000.00	20,000.00	ND	320.00	ND	320.00
TCE	TCE-T-3-3		240,000.00	30,000.00	ND	850.00	ND	850.00
TCE	TCE-T-5-3		300,000.00	12,000.00	ND	1,500.00	ND	1,500.00
TCE	TCE-T-5-9		84,000.00	16,000.00	ND	650.00	ND	650.00
TCE	TCE-T-7-10		550,000.00	11,000.00	ND	1,650.00	ND	1,650.00
TCE	TCE-T-7-2		180,000.00	11,000.00	ND	750.00	ND	750.00
TCE	TCE-T-9-10		290,000.00	6,100.00	ND	1,100.00	ND	1,100.00
TCE	TCE-V-13-4		2,570.00	593.00	ND	133.50	ND	133.50
TCE	TCE-V-7-3		1,140.00	422.00	ND	165.50	ND	165.50

	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride
no. samples	206	206	206	206
no. hits	184	94	3	8
min-D	0.90	6.50	662	12.20
max-D	13,700,000	393,000	2,030	49,600
min-ND	0.55	0.55	0.55	0.55
max-ND	329	293,000	293,000	293,000
mean	611,912.13	14,015.55	5,229.92	5,884.98
95% UCL	158081	41659	15355	16569

Notes:
This worksheet contains only soil collected from 0 to 10 ft depth.
All duplicate samples removed.
ND = non-detect
All ND values are 1/2 the dl.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Subsurface Soil Interval (0-10 ft) - TCE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operatio	2000

C0

General Statistics			
Number of Valid Samples	206	Number of Unique Samples	0.0617
Raw Statistics		Log-transformed Statistics	
Minimum	0.28	Minimum of Log Data	
Maximum	13700000	Maximum of Log Data	1089000000
Mean	611275	Mean of log Data	526100000
Median	85000	SD of log Data	697000000
SD	1685979		1033000000
Coefficient of Variation	2.758		
Skewness	5.335		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.358	Lilliefors Test Statistic	
Lilliefors Critical Value	0.0617	Lilliefors Critical Value	804493
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	805370
			805178
Assuming Normal Distribution		Assuming Lognormal Distribution	889370
95% Student's-t UCL	805370	95% H-UCL	853064
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	813365
95% Adjusted-CLT UCL	851144	97.5% Chebyshev (MVUE) UCL	858937
95% Modified-t UCL	812646	99% Chebyshev (MVUE) UCL	1123305
			1344861
Gamma Distribution Test		Data Distribution	1780065
k star (bias corrected)	0.226	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2701446		
nu star	93.23		
Approximate Chi Square Value (.05)	71.96	Nonparametric Statistics	1780065
Adjusted Level of Significance	0.0488	95% CLT UCL	65689
Adjusted Chi Square Value	71.83	95% Jackknife UCL	65756
		95% Standard Bootstrap UCL	65696
Anderson-Darling Test Statistic	1.881	95% Bootstrap-t UCL	79090
Anderson-Darling 5% Critical Value	0.902	95% Hall's Bootstrap UCL	101724
Kolmogorov-Smirnov Test Statistic	0.0757	95% Percentile Bootstrap UCL	68351
Kolmogorov-Smirnov 5% Critical Value	0.0694	95% BCA Bootstrap UCL	70881
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	95882
		97.5% Chebyshev(Mean, Sd) UCL	116865
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	158081
95% Approximate Gamma UCL	791933		
95% Adjusted Gamma UCL	793375		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	158081

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Subsurface Soil Interval (0-10 ft) - cis-1,2-Dichloroethene

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operatio	2000

C0

General Statistics			
Number of Valid Samples	206	Number of Unique Samples	185
Raw Statistics		Log-transformed Statistics	
Minimum	0.28	Minimum of Log Data	1.273
Maximum	393000	Maximum of Log Data	12.88
Mean	13985	Mean of log Data	6.932
Median	1490	SD of log Data	3.136
SD	39919		
Coefficient of Variation	2.854		
Skewness	6.248		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.363	Lilliefors Test Statistic	0.116
Lilliefors Critical Value	0.0617	Lilliefors Critical Value	0.0617
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	18580	95% H-UCL	375327
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	369493
95% Adjusted-CLT UCL	19853	97.5% Chebyshev (MVUE) UCL	476271
95% Modified-t UCL	18782	99% Chebyshev (MVUE) UCL	686015
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.268	Data do not follow a Discernable Distribution (0.05)	
Theta Star	52193		
nu star	110.4		
Approximate Chi Square Value (.05)	87.14	Nonparametric Statistics	
Adjusted Level of Significance	0.0488	95% CLT UCL	18560
Adjusted Chi Square Value	87	95% Jackknife UCL	18580
		95% Standard Bootstrap UCL	18547
Anderson-Darling Test Statistic	2.656	95% Bootstrap-t UCL	20846
Anderson-Darling 5% Critical Value	0.883	95% Hall's Bootstrap UCL	22010
Kolmogorov-Smirnov Test Statistic	0.0904	95% Percentile Bootstrap UCL	18909
Kolmogorov-Smirnov 5% Critical Value	0.0688	95% BCA Bootstrap UCL	19699
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	26108
		97.5% Chebyshev(Mean, Sd) UCL	31354
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	41659
95% Approximate Gamma UCL	17716		
95% Adjusted Gamma UCL	17746		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	41659

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Subsurface Soil Interval (0-10 ft) - trans-1,2-Dichloroethene

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operatio	2000

C0

General Statistics			
Number of Valid Samples	206	Number of Unique Samples	174
Raw Statistics		Log-transformed Statistics	
Minimum	0.28	Minimum of Log Data	1.273
Maximum	146500	Maximum of Log Data	11.89
Mean	5230	Mean of log Data	6.223
Median	937.5	SD of log Data	2.809
SD	14605		
Coefficient of Variation	2.792		
Skewness	6.537		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.36	Lilliefors Test Statistic	0.171
Lilliefors Critical Value	0.0617	Lilliefors Critical Value	0.0617
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	6912	95% H-UCL	58129
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	64283
95% Adjusted-CLT UCL	7399	97.5% Chebyshev (MVUE) UCL	81803
95% Modified-t UCL	6989	99% Chebyshev (MVUE) UCL	116217
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.294	Data do not follow a Discernable Distribution (0.05)	
Theta Star	17762		
nu star	121.3		
Approximate Chi Square Value (.05)	96.88	Nonparametric Statistics	
Adjusted Level of Significance	0.0488	95% CLT UCL	6904
Adjusted Chi Square Value	96.73	95% Jackknife UCL	6912
		95% Standard Bootstrap UCL	6948
Anderson-Darling Test Statistic	5.989	95% Bootstrap-t UCL	7869
Anderson-Darling 5% Critical Value	0.871	95% Hall's Bootstrap UCL	9576
Kolmogorov-Smirnov Test Statistic	0.195	95% Percentile Bootstrap UCL	7000
Kolmogorov-Smirnov 5% Critical Value	0.0684	95% BCA Bootstrap UCL	7530
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9666
		97.5% Chebyshev(Mean, Sd) UCL	11585
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	15355
95% Approximate Gamma UCL	6549		
95% Adjusted Gamma UCL	6560		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	15355

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
TCE Investigation Area
Subsurface Soil Interval (0-10 ft) - Vinyl Chloride

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operatio	2000

C0

General Statistics			
Number of Valid Samples	206	Number of Unique Samples	178
Raw Statistics		Log-transformed Statistics	
Minimum	0.28	Minimum of Log Data	1.273
Maximum	146500	Maximum of Log Data	11.89
Mean	5890	Mean of log Data	6.35
Median	980	SD of log Data	2.775
SD	15406		
Coefficient of Variation	2.616		
Skewness	5.731		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.351	Lilliefors Test Statistic	0.148
Lilliefors Critical Value	0.0617	Lilliefors Critical Value	0.0617
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	7663	95% H-UCL	59007
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	65885
95% Adjusted-CLT UCL	8113	97.5% Chebyshev (MVUE) UCL	83718
95% Modified-t UCL	7735	99% Chebyshev (MVUE) UCL	118747
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.295	Data do not follow a Discernable Distribution (0.05)	
Theta Star	19943		
nu star	121.7		
Approximate Chi Square Value (.05)	97.2	Nonparametric Statistics	
Adjusted Level of Significance	0.0488	95% CLT UCL	7655
Adjusted Chi Square Value	97.05	95% Jackknife UCL	7663
		95% Standard Bootstrap UCL	7696
Anderson-Darling Test Statistic	6.21	95% Bootstrap-t UCL	8517
Anderson-Darling 5% Critical Value	0.871	95% Hall's Bootstrap UCL	9005
Kolmogorov-Smirnov Test Statistic	0.213	95% Percentile Bootstrap UCL	7845
Kolmogorov-Smirnov 5% Critical Value	0.0684	95% BCA Bootstrap UCL	7949
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	10568
		97.5% Chebyshev(Mean, Sd) UCL	12593
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	16569
95% Approximate Gamma UCL	7373		
95% Adjusted Gamma UCL	7384		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	16569

Appendix A: Table A9
Carter Carburetor EE/CA
PCBs in Dust - First Floor CBI Building

Area#	Area Name		PCB-1242		PCB-1248		PCB-1254		PCB-1260	
		SAMPLE ID	qual	result	qual	result	qual	result	qual	result
1	Main Building 1st floor	1RSW-J10-F13-H11	ND	5		48.3	ND	5		18.8
1	Main Building 1st floor	1RSW-J1-F4-H4	ND	0.5		1.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RSW-J4-H10-H8	ND	0.5		3.1	ND	0.5		1.1
1	Main Building 1st floor	1RSW-M10-J13-K11	ND	0.5		10	ND	0.5		1.7
1	Main Building 1st floor	1RSW-M1-J4-K1	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RSW-M4-J7-K6	ND	0.5		4.8	ND	0.5	ND	0.5
1	Main Building 1st floor	1RSW-M7-J10-L10	ND	5		52.3	ND	5	ND	5
1	Main Building 1st floor	1RSW-P10-M13-N10	ND	5		27.6	ND	5	ND	5
1	Main Building 1st floor	1RSW-P1-M4-O2	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RSW-P4-M7-M7	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RSW-P7-M10-O9	ND	5		45.4	ND	5	ND	5
1	Main Building 1st floor	1RWS-AA10-DD13-AA12	ND	0.5		5.5	ND	0.5		1.2
1	Main Building 1st floor	1RWS-AA1-DD4-CC2	ND	0.5		5.6	ND	0.5		1
1	Main Building 1st floor	1RWS-AA4-DD7-AA5	ND	0.5		5.6	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-AA7-DD10-CC7	ND	0.5		9.5	ND	0.5		3
1	Main Building 1st floor	1RWS-C10-AA13-C11	ND	0.5		10.4	ND	0.5		1.3
1	Main Building 1st floor	1RWS-C1-AA4-C2	ND	0.5		4.2	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-C4-AA7-B6	ND	0.5		5.3	ND	0.5		1.5
1	Main Building 1st floor	1RWS-C7-AA10-A8	ND	5		16	ND	5	ND	5
1	Main Building 1st floor	1RWS-DD10-GG13-FF11	ND	5		28.7	ND	5	ND	5
1	Main Building 1st floor	1RWS-DD1-GG4-EE2	ND	0.5		3.4	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-DD4-GG7-EE5	ND	0.5		9.8	ND	0.5		2.8
1	Main Building 1st floor	1RWS-DD7-GG10-FF9	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-E4-C7-D4	ND	0.5		2.4	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-E7-C10-C7	ND	0.5		4.1	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-F10-C13-D10	ND	0.5	ND	0.5	ND	0.5	ND	1.5
1	Main Building 1st floor	1RWS-F1-C4-D1	ND	0.5		3.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-GG10-LL13-LL10	ND	5		21.6	ND	5	ND	5
1	Main Building 1st floor	1RWS-GG1-LL7-GG1	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-GG7-LL10-KK10	ND	5		20.5	ND	5	ND	5
1	Main Building 1st floor	1RWS-H4-E10-F10	ND	5		24	ND	5	ND	5
1	Main Building 1st floor	1RWS-LL10-OO13-NN13	ND	0.5		1.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-LL1-OO4-MM3	ND	0.5		3	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-LL4-OO7-MM7	ND	0.5		2.6	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-LL7-OO10-OO9	ND	0.5		4.8	ND	0.5		1
1	Main Building 1st floor	1RWS-OO10-RR13-PP13	ND	0.5		13.4	ND	0.5		3.1

Appendix A: Table A9
Carter Carburetor EE/CA
PCBs in Dust - First Floor CBI Building

Area#	Area Name		PCB-1242		PCB-1248		PCB-1254		PCB-1260	
		SAMPLE ID	qual	result	qual	result	qual	result	qual	result
1	Main Building 1st floor	1RWS-OO2-SS4-RR4	ND	0.5		5.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-OO4-RR7-PP4	ND	0.5		4.7	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-OO7-RR10-PP8	ND	0.5		2.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1RWS-RR4-SS13-SS8	ND	0.5		1.9	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-A13-AA13-01-W	ND	0.5		2.2	ND	0.5		1
1	Main Building 1st floor	1WP-AA13-BB13-01-W	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-DD4-DD5-01-N	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-E11-D11-01-W	ND	0.5		1.8	ND	0.5		1.2
1	Main Building 1st floor	1WP-EE4-FF4-01-E	ND	0.5		4.6	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV01-01-01-01	ND	0.5		4.3	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV02-01-01-01	ND	0.5		5.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV03-01-01-01	ND	0.5		3.8	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV04-01-01-01	ND	0.5		2	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV05-01-01-01	ND	0.5		10.3	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-ELV06-01-01-01	ND	0.5		3	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-FF6-GG6-01-W	ND	0.5		3.4	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-HVAC-A5-AA6-01-01	ND	0.5		7.2	ND	0.5	ND	5
1	Main Building 1st floor	1WP-HVAC-H3-G4-01-01	ND	0.5		4.3	ND	0.5		2.4
1	Main Building 1st floor	1WP-HVAC-J3-H4-01-01	ND	0.5		5.2	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-J7-H7-01-E	ND	1		25.1	ND	1	ND	1
1	Main Building 1st floor	1WP-K8-J8-01-W	ND	10		256	ND	10		86.7
1	Main Building 1st floor	1WP-KK9-LL9-01-W	ND	0.5		10.7	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-MM8-NN8-01-W	ND	0.5	ND	0.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-NN13-OO13-01-W	ND	0.5		4.5	ND	0.5	ND	0.5
1	Main Building 1st floor	1WP-OO2-PP2-01-E	ND	0.5		8.2	ND	0.5	ND	0.5
1	Main Building 1st floor	WB-E10-E11-01-NE	ND	0.5		7.9	ND	0.5	ND	0.5
1	Main Building 1st floor	WB-E10-E11-01-SW	ND	0.5		7.3	ND	0.5		1.6
1	Main Building 1st floor	WB-PP4-QQ4-01-NE	ND	5		49.2	ND	5	ND	5
1	Main Building 1st floor	WB-PP4-QQ4-01-SW	ND	50		495	ND	50		101
1	Main Building 1st floor	WC-B11-A12-01-NE	ND	50		457	ND	50	ND	50
1	Main Building 1st floor	WC-B11-A12-01-SW	ND	50		463	ND	50	ND	50
1	Main Building 1st floor	WC-B11-A12-02-NE	ND	50		54.1	ND	50	ND	50
1	Main Building 1st floor	WC-B11-A12-02-SW	ND	50		44.4	ND	50	ND	50
1	Main Building 1st floor	WC-E10-E11-02-NE	ND	5		25.6	ND	5		8.5
1	Main Building 1st floor	WC-E10-E11-02-SW	ND	0.5		3.7	ND	0.5		3.6
1	Main Building 1st floor	WC-I11-J12-01-NE	ND	250		4840	ND	250		871

Appendix A: Table A9
Carter Carburetor EE/CA
PCBs in Dust - First Floor CBI Building

Area#	Area Name	SAMPLE ID	PCB-1242 qual	PCB-1242 result	PCB-1248 qual	PCB-1248 result	PCB-1254 qual	PCB-1254 result	PCB-1260 qual	PCB-1260 result
1	Main Building 1st floor	WC-I11-J12-01-SW	ND	50		1220	ND	50		261
1	Main Building 1st floor	WC-I11-J12-02-NE	ND	50		81.5	ND	50		157
1	Main Building 1st floor	WC-I11-J12-02-SW	ND	50		201	ND	50		322
1	Main Building 1st floor	WC-M12-L13-01-NE	ND	5		42	ND	5		5
1	Main Building 1st floor	WC-M12-L13-01-SW	ND	5		84.6	ND	5		17.4
1	Main Building 1st floor	WC-M12-L13-02-NE	ND	0.5		2.5	ND	0.5		2.1
1	Main Building 1st floor	WC-M12-L13-02-SW	ND	0.5		6.4	ND	0.5		4.6
1	Main Building 1st floor	WC-P12-013-02-NE	ND	50		43	ND	50		152
1	Main Building 1st floor	WC-P12-013-02-SW	ND	5		11.5	ND	5		22.6
1	Main Building 1st floor	WC-P12-O13-01-NE	ND	50		752	ND	50		152
1	Main Building 1st floor	WC-P12-O13-01-SW	ND	25		298	ND	25		74.8

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	83	83	83	83
	no. hits	0	74	0	31
	min-D	na	1.5	na	1
	max-D	na	4840	na	871
	min-ND	1.0	1.0	1.0	1.0
	max-ND	500.0	1.0	500.0	100.0
	mean	10.64458	120.112	10.64458	30.77711
	95% UCL	31.95	500	31.95	104.9
	distribution type	non-p	non-p	non-p	non-p

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit concentration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - First Floor
PCB-1242 and PCB-1254

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
C7			
General Statistics			
Number of Valid Samples	81	Number of Unique Samples	7
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	250	Maximum of Log Data	5.521
Mean	10.64	Mean of log Data	0.417
Median	0.5	SD of log Data	1.737
SD	31.08		
Coefficient of Variation	2.919		
Skewness	5.94		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.415	Lilliefors Test Statistic	0.401
Lilliefors Critical Value	0.0973	Lilliefors Critical Value	0.0973
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	16.32	95% H-UCL	12.27
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	14.53
95% Adjusted-CLT UCL	18.63	97.5% Chebyshev (MVUE) UCL	17.98
95% Modified-t UCL	16.69	99% Chebyshev (MVUE) UCL	24.75
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.341	Data do not follow a Discernable Distribution (0.05)	
Theta Star	31.19		
nu star	56.66		
Approximate Chi Square Value (.05)	40.36	Nonparametric Statistics	
Adjusted Level of Significance	0.0471	95% CLT UCL	16.26
Adjusted Chi Square Value	40.11	95% Jackknife UCL	16.32
		95% Standard Bootstrap UCL	16.25
Anderson-Darling Test Statistic	14.44	95% Bootstrap-t UCL	22.12
Anderson-Darling 5% Critical Value	0.855	95% Hall's Bootstrap UCL	38.77
Kolmogorov-Smirnov Test Statistic	0.394	95% Percentile Bootstrap UCL	16.81
Kolmogorov-Smirnov 5% Critical Value	0.106	95% BCA Bootstrap UCL	19.65
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	25.51
		97.5% Chebyshev(Mean, Sd) UCL	31.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	44.58
95% Approximate Gamma UCL	14.94		
95% Adjusted Gamma UCL	15.03		
Potential UCL to Use		Use 97.5% Chebyshev (Mean, Sd) UCL	31.95

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - First Floor
PCB-1248

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\ProUCL-Wipes-FirstFloor.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PCB-1248

General Statistics

Number of Valid Samples	81	Number of Detected Data	72
Number of Unique Samples	63	Number of Non-Detect Data	9
		Percent Non-Detects	11.11%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	1.5	Minimum Detected	0.405
Maximum Detected	4840	Maximum Detected	8.485
Mean of Detected	130.8	Mean of Detected	2.543
SD of Detected	592.2	SD of Detected	1.728
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.42	Lilliefors Test Statistic	0.165
5% Lilliefors Critical Value	0.104	5% Lilliefors Critical Value	0.104
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	116.4	Mean	2.183
SD	559.4	SD	1.923
95% DL/2 (t) UCL	219.8	95% H-Stat (DL/2) UCL	100.3
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	66.2	Mean in Log Scale	2.114
SD	595.2	SD in Log Scale	2.046
95% MLE (t) UCL	176.2	Mean in Original Scale	116.3
95% MLE (Tiku) UCL	167.7	SD in Original Scale	559.4
		95% Percentile Bootstrap UCL	231.6
		95% BCA Bootstrap UCL	316.8
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.293	Data do not follow a Discernable Distribution (0.05)	
Theta Star	446.1		
nu star	42.24		
A-D Test Statistic	10.1	**Nonparametric Statistics**	
5% A-D Critical Value	0.867	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.867	Mean	116.5
5% K-S Critical Value	0.114	SD	555.9
Data not Gamma Distributed at 5% Significance Level		SE of Mean	62.2
		95% KM (t) UCL	220
Assuming Gamma Distribution		95% KM (z) UCL	218.8
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	219.9
Minimum	0	95% KM (bootstrap t) UCL	538
Maximum	4840	95% KM (BCA) UCL	251.8
Mean	116.3	95% KM (Percentile Bootstrap) UCL	239.4
Median	5.5	95% KM (Chebyshev) UCL	387.6
SD	559.4	97.5% KM (Chebyshev) UCL	504.9
k star	0.161	99% KM (Chebyshev) UCL	735.4
Theta star	721.5		
Nu star	26.11	Potential UCLs to Use	
AppChi2	15.47	97.5% KM (Chebyshev) UCL	504.9
95% Gamma Approximate UCL	196.4		
95% Adjusted Gamma UCL	198.3		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - First Floor
PCB-1260

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\ProUCL-Wipes-FirstFloor.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

PCB-1260

General Statistics

Number of Valid Samples	81	Number of Detected Data	30
Number of Unique Samples	26	Number of Non-Detect Data	51
		Percent Non-Detects	62.96%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	871	Maximum Detected	6.77
Mean of Detected	72.77	Mean of Detected	2.149
SD of Detected	171.9	SD of Detected	2.113
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	100	Maximum Non-Detect	4.605

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	75
Number treated as Detected	6
Single DL Non-Detect Percentage	92.59%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.481	Lilliefors Test Statistic	0.855
5% Lilliefors Critical Value	0.927	5% Lilliefors Critical Value	0.927
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	30.23	Mean	0.865
SD	109.1	SD	1.967
95% DL/2 (t) UCL	50.4	95% H-Stat (DL/2) UCL	37.48
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	460.2	Mean in Log Scale	-1.256
SD	255	SD in Log Scale	3.434
95% MLE (t) UCL	507.4	Mean in Original Scale	27.12
95% MLE (Tiku) UCL	627.6	SD in Original Scale	109.3
		95% Percentile Bootstrap UCL	48.8
		95% BCA Bootstrap UCL	59.05

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.309	Data do not follow a Discernable Distribution (0.05)	
Theta Star	235.1		
nu star	18.57		
A-D Test Statistic	2.69	**Nonparametric Statistics**	
5% A-D Critical Value	0.85	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.85	Mean	27.81
5% K-S Critical Value	0.173	SD	108.5
Data not Gamma Distributed at 5% Significance Level		SE of Mean	12.27
		95% KM (t) UCL	48.23
Assuming Gamma Distribution		95% KM (z) UCL	47.99
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	48.01
Minimum	0	95% KM (bootstrap t) UCL	75.44
Maximum	2452	95% KM (BCA) UCL	48.92
Mean	226.6	95% KM (Percentile Bootstrap) UCL	49.9
Median	22.6	95% KM (Chebyshev) UCL	81.29
SD	441.7	97.5% KM (Chebyshev) UCL	104.4
k star	0.123	99% KM (Chebyshev) UCL	149.9
Theta star	1849		
Nu star	19.85	**Potential UCLs to Use**	
AppChi2	10.74	97.5% KM (Chebyshev) UCL	104.4
95% Gamma Approximate UCL	418.8		
95% Adjusted Gamma UCL	423.6		

Note: DL/2 is not a recommended method.

Appendix A: Table A10
Carter Carburetor EE/CA
PCBs in Dust - Second Floor CBI Building

Area#	Area Name	SAMPLE ID	PCB-1242 qual	PCB-1242 result	PCB-1248 qual	PCB-1248 result	PCB-1254 qual	PCB-1254 result	PCB-1260 qual	PCB-1260 result
2	Main Building 2nd floor	2RWS-BB1-DD13-DD13	ND	0.5		1.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-C1-BB7-AA2	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-C7-BB13-AA11	ND	0.5		3	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-DD1-HH7-EE6	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-EE7-HH13-GG7	ND	0.5		2.6	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-G1-C8-D4	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-H8-C13-D11	ND	0.5		12.6	ND	0.5		3.4
2	Main Building 2nd floor	2RWS-HH4-OO8-MM4	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-KK8-OO13-MM10	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-L1-F8-G7	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-N9-H13-L12	ND	0.5		2.8	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-OO2-Q13-PP12	ND	0.5		2.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-P1-J7-L6	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-P4-N10-P5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2RWS-QQ2-SS13-RR3	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-A12-AA12-01-E	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-EE9-EE10-01-S	ND	0.5		3.4	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-ELV01-02-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-ELV02-02-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-ELV03-02-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-ELV04-02-01-01	ND	0.5		1.1	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-ELV05-02-01-01	ND	0.5		1.6	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-KK13-LL13-01-W	ND	0.5	ND	0.5	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-L9-K9-01-E	ND	0.5		2.7	ND	0.5	ND	0.5
2	Main Building 2nd floor	2WP-SS12-SS13-01-N	ND	0.5	ND	0.5	ND	0.5		1.6

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	25	25	25	25
	no. hits	0	10	0	2
	min-D	na	1.1	na	1.6
	max-D	na	12.6	na	3.4
	min-ND	1.0	1.0	1.0	1.0
	max-ND	1.0	1.0	1.0	1.0
	mean	0.5	1.652	0.5	0.66
	95% UCL	na	3.824	na	0.887
	distribution type	na	non-p	na	normal

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit concentration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Second Floor
PCB-1248

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C2

General Statistics			
Number of Valid Samples	25	Number of Unique Samples	11
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	12.6	Maximum of Log Data	2.534
Mean	1.652	Mean of log Data	-0.027
Median	0.5	SD of log Data	0.924
SD	2.492		
Coefficient of Variation	1.508		
Skewness	3.809		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.499	Shapiro Wilk Test Statistic	0.733
Shapiro Wilk Critical Value	0.918	Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.505	95% H-UCL	2.352
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.774
95% Adjusted-CLT UCL	2.877	97.5% Chebyshev (MVUE) UCL	3.344
95% Modified-t UCL	2.568	99% Chebyshev (MVUE) UCL	4.462
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.978	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.689		
nu star	48.91		
Approximate Chi Square Value (.05)	33.86	Nonparametric Statistics	
Adjusted Level of Significance	0.0395	95% CLT UCL	2.472
Adjusted Chi Square Value	33	95% Jackknife UCL	2.505
		95% Standard Bootstrap UCL	2.476
Anderson-Darling Test Statistic	3.014	95% Bootstrap-t UCL	3.59
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL	5.499
Kolmogorov-Smirnov Test Statistic	0.356	95% Percentile Bootstrap UCL	2.54
Kolmogorov-Smirnov 5% Critical Value	0.179	95% BCA Bootstrap UCL	2.98
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3.824
		97.5% Chebyshev(Mean, Sd) UCL	4.764
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6.61
95% Approximate Gamma UCL	2.387		
95% Adjusted Gamma UCL	2.448		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	3.824

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Second Floor
PCB-1260

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C6

General Statistics			
Number of Valid Samples	25	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	3.4	Maximum of Log Data	1.224
Mean	0.66	Mean of log Data	-0.57
Median	0.5	SD of log Data	0.44
SD	0.612		
Coefficient of Variation	0.927		
Skewness	4.216		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.295	Shapiro Wilk Test Statistic	0.315
Shapiro Wilk Critical Value	0.918	Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.869	95% H-UCL	0.74
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.866
95% Adjusted-CLT UCL	0.971	97.5% Chebyshev (MVUE) UCL	0.972
95% Modified-t UCL	0.887	99% Chebyshev (MVUE) UCL	1.181
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.015	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.219		
nu star	150.7		
Approximate Chi Square Value (.05)	123.4	Nonparametric Statistics	
Adjusted Level of Significance	0.0395	95% CLT UCL	0.861
Adjusted Chi Square Value	121.7	95% Jackknife UCL	0.869
		95% Standard Bootstrap UCL	0.848
Anderson-Darling Test Statistic	8.311	95% Bootstrap-t UCL	0.983
Anderson-Darling 5% Critical Value	0.75	95% Hall's Bootstrap UCL	0.849
Kolmogorov-Smirnov Test Statistic	0.539	95% Percentile Bootstrap UCL	0.892
Kolmogorov-Smirnov 5% Critical Value	0.176	95% BCA Bootstrap UCL	0.892
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.193
		97.5% Chebyshev(Mean, Sd) UCL	1.424
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.877
95% Approximate Gamma UCL	0.806		
95% Adjusted Gamma UCL	0.818		
Potential UCL to Use		Use 95% Student's-t UCL	0.869
		or 95% Modified-t UCL	0.887

Appendix A: Table A11
Carter Carburetor EE/CA
PCBs in Dust - Third Floor CBI Building

Area#	Area Name		PCB-1242		PCB-1248		PCB-1254		PCB-1260	
		SAMPLE ID	qual	result	qual	result	qual	result	qual	result
3	Main Building 3rd floor	3RWS-AA10-DD13-CC11	ND	0.5		2.4	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-AA4-CC7-AA5	ND	0.5		1.5	ND	0.5		3.1
3	Main Building 3rd floor	3RWS-AA7-DD11-DD11	ND	0.5		1.1	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-C1-CC4-AA4	ND	0.5	ND	0.5	ND	0.5		1.3
3	Main Building 3rd floor	3RWS-CC1-FF4-DD3	ND	0.5		1.1	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-D4-A7-A4	ND	0.5		1.7	ND	0.5		2.1
3	Main Building 3rd floor	3RWS-D6-A10-B7	ND	5	ND	5	ND	5	ND	0.5
3	Main Building 3rd floor	3RWS-DD10-HH13-FF12	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-E11-A13-D13	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-EE4-GG7-EE6	ND	0.5	ND	0.5	ND	0.5		1.2
3	Main Building 3rd floor	3RWS-EE7-HH11-FF9	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-H1-C4-F2	ND	0.5		2.7	ND	0.5		4.5
3	Main Building 3rd floor	3RWS-H2-E6-F5	ND	0.5		2.1	ND	0.5		1.9
3	Main Building 3rd floor	3RWS-H6-E10-F9	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-H9-E13-F10	ND	0.5		5	ND	0.5		2.7
3	Main Building 3rd floor	3RWS-HH10-MM13-KK12	ND	0.5		1.7		5.1	ND	0.5
3	Main Building 3rd floor	3RWS-HH4-NN7-NN6	ND	0.5		3.4	ND	0.5		3.6
3	Main Building 3rd floor	3RWS-K9-H13-L12	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-KK7-NN11-NN7	ND	0.5		1.3	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-M1-H4-M2	ND	0.5		5	ND	0.5		1.8
3	Main Building 3rd floor	3RWS-M3-J7-M5	ND	0.5		3.7	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-MM11-QQ13-OO10	ND	0.5		3.4	ND	0.5		2.7
3	Main Building 3rd floor	3RWS-MM3-PP7-MM3	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-N9-L13-K11	ND	0.5		3.5	ND	0.5		1.3
3	Main Building 3rd floor	3RWS-OO7-SS9-RR8	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-P1-M4-N1	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-P5-N9-O6	ND	0.5		3.6	ND	0.5		2.1
3	Main Building 3rd floor	3RWS-P8-N13-O12	ND	0.5		2	ND	0.5		1.7
3	Main Building 3rd floor	3RWS-PP20-SS13-QQ12	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3RWS-QQ3-SS7-QQ4	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-AA1-BB1-01-E	ND	0.5		4.8	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-D5-D6-01-S	ND	0.5		1.7	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-E5-E6-01-N	ND	0.5		4	ND	0.5		1.6
3	Main Building 3rd floor	3WP-ELV01-03-01-01	ND	0.5		1.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-ELV02-03-01-01	ND	0.5		1	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-ELV03-03-01-01	ND	0.5		1.6	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-ELV04-03-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-G13-F13-01-W	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-J4-J5-01-N	ND	0.5		2.3	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-J9-H9-01-E	ND	0.5	ND	0.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-JJ10-KK10-01-S	ND	0.5		1.3	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-L7-K7-01-W	ND	0.5		1.8	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-MM3-NN3-01-E	ND	0.5		4.5	ND	0.5	ND	0.5
3	Main Building 3rd floor	3WP-NN13-OO13-01-W	ND	0.5	ND	0.5	ND	0.5	ND	0.5

			PCB-1242	PCB-1248	PCB-1254	PCB-1260
	Summary Statistics:	no. samples	44	44	44	44
		no. hits	0	27	1	14
		min-D	na	1.0	5.1	0.5
		max-D	na	5.0	5.1	4.5
		min-ND	1.0	1.0	1.0	1.0
		max-ND	10.0	10.0	10.0	1.0
		mean	0.602273	1.879545	0.706818	1.059091
		95% UCL	0.966	2.869	na	1.705
		distribution type	norm	non-p	na	non-p

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit conce ntration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Third Floor
PCB-1242

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Samples	44	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5.1	Maximum of Log Data	1.629
Mean	0.707	Mean of log Data	-0.588
Median	0.5	SD of log Data	0.487
SD	0.959		
Coefficient of Variation	1.356		
Skewness	4.521		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.225	Shapiro Wilk Test Statistic	0.224
Shapiro Wilk Critical Value	0.944	Shapiro Wilk Critical Value	0.944
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.95	95% H-UCL	0.719
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.833
95% Adjusted-CLT UCL	1.05	97.5% Chebyshev (MVUE) UCL	0.923
95% Modified-t UCL	0.966	99% Chebyshev (MVUE) UCL	1.101
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.09	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.338		
nu star	183.9		
Approximate Chi Square Value (.05)	153.5	Nonparametric Statistics	
Adjusted Level of Significance	0.0445	95% CLT UCL	0.945
Adjusted Chi Square Value	152.6	95% Jackknife UCL	0.95
		95% Standard Bootstrap UCL	0.921
Anderson-Darling Test Statistic	16.34	95% Bootstrap-t UCL	0.855
Anderson-Darling 5% Critical Value	0.759	95% Hall's Bootstrap UCL	0.822
Kolmogorov-Smirnov Test Statistic	0.556	95% Percentile Bootstrap UCL	1.016
Kolmogorov-Smirnov 5% Critical Value	0.135	95% BCA Bootstrap UCL	0.914
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.337
		97.5% Chebyshev(Mean, Sd) UCL	1.609
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.145
95% Approximate Gamma UCL	0.847		
95% Adjusted Gamma UCL	0.852		
Potential UCL to Use		**Use 95% Student's-t UCL**	**0.95**
		or 95% Modified-t UCL	**0.966**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Third Floor
PCB-1248

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	44	Number of Unique Samples	21
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.88	Mean of log Data	0.291
Median	1.5	SD of log Data	0.858
SD	1.505		
Coefficient of Variation	0.801		
Skewness	0.876		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.823	Shapiro Wilk Test Statistic	0.844
Shapiro Wilk Critical Value	0.944	Shapiro Wilk Critical Value	0.944
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.261	95% H-UCL	2.578
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.131
95% Adjusted-CLT UCL	2.285	97.5% Chebyshev (MVUE) UCL	3.659
95% Modified-t UCL	2.266	99% Chebyshev (MVUE) UCL	4.696
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.521	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.235		
nu star	133.9		
Approximate Chi Square Value (.05)	108.2	Nonparametric Statistics	
Adjusted Level of Significance	0.0445	95% CLT UCL	2.253
Adjusted Chi Square Value	107.4	95% Jackknife UCL	2.261
		95% Standard Bootstrap UCL	2.25
Anderson-Darling Test Statistic	1.953	95% Bootstrap-t UCL	2.305
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL	2.272
Kolmogorov-Smirnov Test Statistic	0.227	95% Percentile Bootstrap UCL	2.234
Kolmogorov-Smirnov 5% Critical Value	0.136	95% BCA Bootstrap UCL	2.298
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2.869
		97.5% Chebyshev(Mean, Sd) UCL	3.296
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4.137
95% Approximate Gamma UCL	2.327		
95% Adjusted Gamma UCL	2.344		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**2.869**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Third Floor
PCB-1254

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	44	Number of Distinct Observations	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5.1	Maximum of Log Data	1.629
Mean	0.707	Mean of log Data	-0.588
Median	0.5	SD of log Data	0.487
SD	0.959		
Coefficient of Variation	1.356		
Skewness	4.521		

Warning: There are only 3 Distinct Values in this data
There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.225	Shapiro Wilk Test Statistic	0.224
Shapiro Wilk Critical Value	0.944	Shapiro Wilk Critical Value	0.944
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.95	95% H-UCL	0.719
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.833
95% Adjusted-CLT UCL	1.05	97.5% Chebyshev (MVUE) UCL	0.923
95% Modified-t UCL	0.966	99% Chebyshev (MVUE) UCL	1.101
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.09	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.338		
nu star	183.9		
Approximate Chi Square Value (.05)	153.5	Nonparametric Statistics	
Adjusted Level of Significance	0.0445	95% CLT UCL	0.945
Adjusted Chi Square Value	152.6	95% Jackknife UCL	0.95
		95% Standard Bootstrap UCL	N/A
Anderson-Darling Test Statistic	16.34	95% Bootstrap-t UCL	N/A
Anderson-Darling 5% Critical Value	0.759	95% Hall's Bootstrap UCL	N/A
Kolmogorov-Smirnov Test Statistic	0.556	95% Percentile Bootstrap UCL	N/A
Kolmogorov-Smirnov 5% Critical Value	0.135	95% BCA Bootstrap UCL	N/A
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.337
		97.5% Chebyshev(Mean, Sd) UCL	1.609
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.145
95% Approximate Gamma UCL	0.847		
95% Adjusted Gamma UCL	0.852		
Potential UCL to Use		**Use 95% Student's-t UCL**	**0.95**
		or 95% Modified-t UCL	**0.966**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Third Floor
PCB-1260

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	44	Number of Unique Samples	12
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	4.5	Maximum of Log Data	1.504
Mean	1.059	Mean of log Data	-0.238
Median	0.5	SD of log Data	0.709
SD	0.982		
Coefficient of Variation	0.927		
Skewness	1.875		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.646	Shapiro Wilk Test Statistic	0.662
Shapiro Wilk Critical Value	0.944	Shapiro Wilk Critical Value	0.944
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.308	95% H-UCL	1.266
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.519
95% Adjusted-CLT UCL	1.347	97.5% Chebyshev (MVUE) UCL	1.741
95% Modified-t UCL	1.315	99% Chebyshev (MVUE) UCL	2.177
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.731	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.612		
nu star	152.4		
Approximate Chi Square Value (.05)	124.8	Nonparametric Statistics	
Adjusted Level of Significance	0.0445	95% CLT UCL	1.303
Adjusted Chi Square Value	124	95% Jackknife UCL	1.308
		95% Standard Bootstrap UCL	1.295
Anderson-Darling Test Statistic	7.021	95% Bootstrap-t UCL	1.346
Anderson-Darling 5% Critical Value	0.763	95% Hall's Bootstrap UCL	1.33
Kolmogorov-Smirnov Test Statistic	0.423	95% Percentile Bootstrap UCL	1.305
Kolmogorov-Smirnov 5% Critical Value	0.135	95% BCA Bootstrap UCL	1.339
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.705
		97.5% Chebyshev(Mean, Sd) UCL	1.984
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.532
95% Approximate Gamma UCL	1.293		
95% Adjusted Gamma UCL	1.301		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UCL**	**1.705**

Appendix A: Table A12
Carter Carburetor EE/CA
PCBs in Dust - Fourth Floor CBI Building

Area#	Area Name	SAMPLE ID	PCB-1242 qual	PCB-1242 result	PCB-1248 qual	PCB-1248 result	PCB-1254 qual	PCB-1254 result	PCB-1260 qual	PCB-1260 result
12	Main Building 4th floor	3WP-P10-P11-01-S	ND	0.5		2.3	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-005-RR10-SS4	ND	0.5	ND	0.5	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-AA7-FF13-CC11	ND	0.5		1.4	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-C2-CC7-BB6	ND	0.5		2.5	ND	0.5		1.7
12	Main Building 4th floor	4RWS-CC2-HH7-HH6	ND	0.5		16.6	ND	0.5		6.7
12	Main Building 4th floor	4RWS-D7-BB13-AA12	ND	0.5	ND	0.5	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-FF7-LL13-KK13	ND	0.5		1.9	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-H2-C7-G3	ND	0.5		1.2	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-H7-D13-F7	ND	0.5	ND	0.5	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-HH4-NN10-MM5	ND	0.5	ND	0.5	ND	0.5	ND	0.5
12	Main Building 4th floor	4RWS-LL10-SS13-PP10	ND	0.5	ND	0.5	ND	0.5	ND	0.5
12	Main Building 4th floor	4WP-ELV01-04-01-01	ND	0.5		2.2	ND	0.5	ND	0.5
12	Main Building 4th floor	4WP-ELV02-04-01-01	ND	0.5		2.8	ND	0.5	ND	0.5
12	Main Building 4th floor	4WP-ELV03-04-01-01	ND	0.5		4.7	ND	0.5	ND	0.5
12	Main Building 4th floor	4WP-HVAC-L7-K8-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5

		PCB-1242	PCB-1248	PCB-1254	PCB-1260
Summary Statistics:	no. samples	15	15	15	15
	no. hits	0	9	0	2
	min-D	na	1.2	na	1.7
	max-D	na	16.6	na	6.7
	min-ND	1.0	1.0	1.0	1.0
	max-ND	1.0	1.0	1.0	1.0
	mean	0.5	2.573333	0.5	0.993333
	95% UCL	na	4.662	na	2.804
	distribution type	na	gamma	na	non-p

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit conce ntration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Fourth Floor
PCB-1248

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Samples	15	Number of Unique Samples	10
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	16.6	Maximum of Log Data	2.809
Mean	2.573	Mean of log Data	0.328
Median	1.4	SD of log Data	1.046
SD	4.062		
Coefficient of Variation	1.579		
Skewness	3.333		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.529	Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4.421	95% H-UCL	5.279
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.228
95% Adjusted-CLT UCL	5.263	97.5% Chebyshev (MVUE) UCL	6.504
95% Modified-t UCL	4.571	99% Chebyshev (MVUE) UCL	9.01
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.798	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	3.223		
nu star	23.95		
Approximate Chi Square Value (.05)	13.81	Nonparametric Statistics	
Adjusted Level of Significance	0.0324	95% CLT UCL	4.299
Adjusted Chi Square Value	12.87	95% Jackknife UCL	4.421
		95% Standard Bootstrap UCL	4.246
Anderson-Darling Test Statistic	1.085	95% Bootstrap-t UCL	8.987
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL	11.47
Kolmogorov-Smirnov Test Statistic	0.211	95% Percentile Bootstrap UCL	4.453
Kolmogorov-Smirnov 5% Critical Value	0.228	95% BCA Bootstrap UCL	5.333
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	7.145
		97.5% Chebyshev(Mean, Sd) UCL	9.124
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	13.01
95% Approximate Gamma UCL	4.462		
95% Adjusted Gamma UCL	4.789		
Potential UCL to Use		**Use 95% Approximate Gamma UCL**	**4.462**

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Fourth Floor
PCB-1260

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	15	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	6.7	Maximum of Log Data	1.902
Mean	0.993	Mean of log Data	-0.439
Median	0.5	SD of log Data	0.72
SD	1.609		
Coefficient of Variation	1.619		
Skewness	3.655		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.356	Shapiro Wilk Test Statistic	0.418
Shapiro Wilk Critical Value	0.881	Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.725	95% H-UCL	1.31
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.52
95% Adjusted-CLT UCL	2.095	97.5% Chebyshev (MVUE) UCL	1.823
95% Modified-t UCL	1.79	99% Chebyshev (MVUE) UCL	2.419
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.084	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.917		
nu star	32.51		
Approximate Chi Square Value (.05)	20.48	Nonparametric Statistics	
Adjusted Level of Significance	0.0324	95% CLT UCL	1.677
Adjusted Chi Square Value	19.31	95% Jackknife UCL	1.725
		95% Standard Bootstrap UCL	1.633
Anderson-Darling Test Statistic	4.427	95% Bootstrap-t UCL	3.139
Anderson-Darling 5% Critical Value	0.758	95% Hall's Bootstrap UCL	3.358
Kolmogorov-Smirnov Test Statistic	0.52	95% Percentile Bootstrap UCL	1.82
Kolmogorov-Smirnov 5% Critical Value	0.226	95% BCA Bootstrap UCL	2.153
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2.804
		97.5% Chebyshev(Mean, Sd) UCL	3.587
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	5.126
95% Approximate Gamma UCL	1.577		
95% Adjusted Gamma UCL	1.673		
Potential UCL to Use		**Use 95% Chebyshev (Mean, Sd) UC**	**2.804**

Appendix A: Table A13
Carter Carburetor EE/CA
PCBs in Dust - Roof, CBI Building

Area#	Area Name		PCB-1242		PCB-1248		PCB-1254		PCB-1260	
		SAMPLE ID	qual	result	qual	result	qual	result	qual	result
15	Stairwell	5WP-ST01-12-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST01-23-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST01-34-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST02-12-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST02-23-01-01	ND	0.5		7.1	ND	0.5	ND	0.5
15	Stairwell	5WP-ST02-34-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST03-12-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST03-23-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST03-34-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST04-12-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST04-23-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST05-12-01-01	ND	0.5		3.8	ND	0.5	ND	0.5
15	Stairwell	5WP-ST05-23-01-01	ND	0.5		7.5	ND	0.5		3.9
15	Stairwell	5WP-ST05-34-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST06-12-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST06-23-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
15	Stairwell	5WP-ST06-34-01-01	ND	0.5	ND	0.5	ND	0.5	ND	0.5
Summary Statistics:		no. samples		17		17		17		17
		no. hits		0		3		0		1
		min-D		na		3.8		na		3.9
		max-D		na		7.5		na		3.9
		min-ND		1.0		1.0		1.0		1.0
		max-ND		1.0		1.0		1.0		1.0
		mean		0.5		1.494118		0.5		0.7
		95% UCL		na		3.954		na		na
		distribution type		na		non-p		na		na

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit concentration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Stairwell
PCB-1248

User Selected Options			
From File	WorkSheet.wst		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
General Statistics			
Number of Valid Samples	17	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	7.5	Maximum of Log Data	2.015
Mean	1.494	Mean of log Data	-0.258
Median	0.5	SD of log Data	0.977
SD	2.327		
Coefficient of Variation	1.558		
Skewness	2.199		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.484	Shapiro Wilk Test Statistic	0.488
Shapiro Wilk Critical Value	0.892	Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.48	95% H-UCL	2.377
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2.56
95% Adjusted-CLT UCL	2.744	97.5% Chebyshev (MVUE) UCL	3.149
95% Modified-t UCL	2.53	99% Chebyshev (MVUE) UCL	4.307
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.77	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.941		
nu star	26.18		
Approximate Chi Square Value (.05)	15.52	Nonparametric Statistics	
Adjusted Level of Significance	0.0346	95% CLT UCL	2.422
Adjusted Chi Square Value	14.66	95% Jackknife UCL	2.48
		95% Standard Bootstrap UCL	2.358
Anderson-Darling Test Statistic	4.591	95% Bootstrap-t UCL	2.781
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL	2.183
Kolmogorov-Smirnov Test Statistic	0.513	95% Percentile Bootstrap UCL	2.512
Kolmogorov-Smirnov 5% Critical Value	0.216	95% BCA Bootstrap UCL	2.682
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	3.954
		97.5% Chebyshev(Mean, Sd) UCL	5.019
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	7.11
95% Approximate Gamma UCL	2.521		
95% Adjusted Gamma UCL	2.668		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	3.954

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Stairwell
PCB-1260

User Selected Options	
From File	WorkSheet_a.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Observations	17	Number of Distinct Observations	2
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	3.9	Maximum of Log Data	1.361
Mean	0.7	Mean of log Data	-0.572
Median	0.5	SD of log Data	0.498
SD	0.825		
Coefficient of Variation	1.178		
Skewness	4.123		

Warning: There are only 2 Distinct Values in this data
There are insufficient Distinct Values to perform some GOF tests and bootstrap methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values to compute bootstrap methods.
It is recommended to have 10-15 or more observations for accurate and meaningful bootstrap results.

Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.262	Shapiro Wilk Test Statistic	0.262
Shapiro Wilk Critical Value	0.892	Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1.049	95% H-UCL	0.823
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.978
95% Adjusted-CLT UCL	1.243	97.5% Chebyshev (MVUE) UCL	1.127
95% Modified-t UCL	1.083	99% Chebyshev (MVUE) UCL	1.42
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.075	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.337		
nu star	70.57		
Approximate Chi Square Value (.05)	52.23	Nonparametric Statistics	
Adjusted Level of Significance	0.0346	95% CLT UCL	1.029
Adjusted Chi Square Value	50.57	95% Jackknife UCL	N/A
		95% Standard Bootstrap UCL	N/A
Anderson-Darling Test Statistic	6.158	95% Bootstrap-t UCL	N/A
Anderson-Darling 5% Critical Value	0.748	95% Hall's Bootstrap UCL	N/A
Kolmogorov-Smirnov Test Statistic	0.552	95% Percentile Bootstrap UCL	N/A
Kolmogorov-Smirnov 5% Critical Value	0.211	95% BCA Bootstrap UCL	N/A
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.572
		97.5% Chebyshev(Mean, Sd) UCL	1.949
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.69
95% Approximate Gamma UCL	0.946		
95% Adjusted Gamma UCL	0.977		
Potential UCL to Use		**Use 95% Student's-t UCL**	**1.049**
		or 95% Modified-t UCL	**1.083**

Appendix A: Table A14
Carter Carburetor EE/CA
PCBs in Dust - Pump Room, CBI Building

Area#	Area Name		PCB-1242		PCB-1248		PCB-1254		PCB-1260	
		SAMPLE ID	qual	result	qual	result	qual	result	qual	result
13	Pump Room	0WP-E4-E5-01-S	ND	1		22.6	ND	1		33
13	Pump Room	0WP-F10-E10-01-W	ND	0.5		12.6	ND	0.5	ND	0.5
13	Pump Room	0WP-H4-H5-01-S	ND	0.5	ND	0.5	ND	0.5		1.4

Summary Statistics:		PCB-1242	PCB-1248	PCB-1254	PCB-1260
	no. samples	3	3	3	3
	no. hits	0	2	0	2
	min-D	na	12.6	na	1.4
	max-D	na	22.6	na	33
	min-ND	1.0	1.0	1.0	1.0
	max-ND	2.0	1.0	2.0	1.0
	mean	0.666667	11.9	0.666667	11.63333
	95% UCL	na	30.56	na	42.84
	distribution type	na	normal	na	normal

Note: All non-detected concentrations (labeled as ND) are presented at 1/2 of the detection limit concentration.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Pump Room
PCB-1248

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	3	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	22.6	Maximum of Log Data	3.118
Mean	11.9	Mean of log Data	1.653
Median	12.6	SD of log Data	2.053
SD	11.07		
Coefficient of Variation	0.93		
Skewness	-0.284		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.997	Shapiro Wilk Test Statistic	0.862
Shapiro Wilk Critical Value	0.767	Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	30.56	95% H-UCL	3.493E,18
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	70.89
95% Adjusted-CLT UCL	21.29	97.5% Chebyshev (MVUE) UCL	94.83
95% Modified-t UCL	30.38	99% Chebyshev (MVUE) UCL	141.9
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
Approximate Chi Square Value (.05)	N/A	Nonparametric Statistics	
Adjusted Level of Significance	N/A	95% CLT UCL	22.41
Adjusted Chi Square Value	N/A	95% Jackknife UCL	30.56
		95% Standard Bootstrap UCL	19.1
Anderson-Darling Test Statistic	0.382	95% Bootstrap-t UCL	23.57
Anderson-Darling 5% Critical Value	N/A	95% Hall's Bootstrap UCL	19.2
Kolmogorov-Smirnov Test Statistic	0.338	95% Percentile Bootstrap UCL	19.27
Kolmogorov-Smirnov 5% Critical Value	N/A	95% BCA Bootstrap UCL	15.93
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	39.75
		97.5% Chebyshev(Mean, Sd) UCL	51.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	75.47
95% Approximate Gamma UCL	N/A		
95% Adjusted Gamma UCL	N/A		
Potential UCL to Use		**Use 95% Student's-t UCL**	**30.56**
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Wipe Samples - Pump Room
PCB-1260

User Selected Options

From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

General Statistics			
Number of Valid Samples	3	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	33	Maximum of Log Data	3.497
Mean	11.63	Mean of log Data	1.047
Median	1.4	SD of log Data	2.183
SD	18.51		
Coefficient of Variation	1.591		
Skewness	1.727		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.771	Shapiro Wilk Test Statistic	0.921
Shapiro Wilk Critical Value	0.767	Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	42.84	95% H-UCL	4.204E,20
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	44.27
95% Adjusted-CLT UCL	40.6	97.5% Chebyshev (MVUE) UCL	59.3
95% Modified-t UCL	44.61	99% Chebyshev (MVUE) UCL	88.83
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level	
Theta Star	N/A		
nu star	N/A		
Approximate Chi Square Value (.05)	N/A	Nonparametric Statistics	
Adjusted Level of Significance	N/A	95% CLT UCL	29.21
Adjusted Chi Square Value	N/A	95% Jackknife UCL	42.84
		95% Standard Bootstrap UCL	24.06
Anderson-Darling Test Statistic	0.425	95% Bootstrap-t UCL	397.5
Anderson-Darling 5% Critical Value	N/A	95% Hall's Bootstrap UCL	451.7
Kolmogorov-Smirnov Test Statistic	0.372	95% Percentile Bootstrap UCL	22.47
Kolmogorov-Smirnov 5% Critical Value	N/A	95% BCA Bootstrap UCL	22.47
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	58.21
		97.5% Chebyshev(Mean, Sd) UCL	78.37
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	118
95% Approximate Gamma UCL	N/A		
95% Adjusted Gamma UCL	N/A		
Potential UCL to Use		**Use 95% Student's-t UCL**	**42.84**
Recommended UCL exceeds the maximum observation			

All Chemical Data from the Analysis Groundwater Samples
ACF Carter Carburetor Site, St. Louis, MO

Chemical (all units µg/L)	PZ-01W (UST 02)	PZ-02W (N&S Die Cast)	PZ-04W (N&S Die Cast)	UST-01W	UST-03W	UST-04W	UST-06W	UST-07W	UST-08W	UST-9-06W	UST-9-07W	UST-9-11W
Well depth:	13.35	16.95	16.00	10.70	10.44	10.46	10.85	9.58	12.33	13.30		
Volatile Organic Compounds (VOCs)												
1,1,1,2-TETRACHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,1,1-TRICHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,1,2,2-TETRACHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,1,2-TRICHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,1-DICHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,1-DICHLOROETHENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	**21.4**	--	--	--
1,1-DICHLOROPROPENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,2,3-TRICHLOROBENZENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,2,3-TRICHLOROPROPANE	< 2.5	< 2.5	< 25	< 2.5	< 2.5	< 2.5	< 250	< 2.5	< 25			
1,2,4-TRICHLOROBENZENE	< 1	< 1	**520**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2,4-TRIMETHYLBENZENE	< 1	**1.7**	< 10	< 1	< 1	**8.6**	**102**	< 1	< 10	--	--	--
1,2-DIBROMO-3-CHLOROPROPANE	< 2.5	< 2.5	< 25	< 2.5	< 2.5	< 2.5	< 250	< 2.5	< 25			
1,2-DIBROMOETHANE (EDB)	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,2-DICHLOROBENZENE	< 1	< 1	**33.7**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2-DICHLOROETHANE	< 1	< 1	< 10	**4**	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2-DICHLOROETHENE (TOTAL)	**15**	**34.2**	**85.3**	**1.9**	< 1	< 1	**14,200**	**2.9**	**532**	--	--	--
1,2-DICHLOROPROPANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,3,5-TRIMETHYLBENZENE	< 1	< 1	< 10	< 1	**4.2**	**2.9**	< 100	< 1	< 10	--	--	--
1,3-DICHLOROBENZENE	< 1	< 1	**1,120**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,3-DICHLOROPROPANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
1,4-DICHLOROBENZENE	< 1	< 1	**207**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
2,2-DICHLOROPROPANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
2-BUTANONE (MEK)	< 10	< 10	< 100	< 10	< 10	< 10	< 1000	< 10	< 100			
2-CHLOROTOLUENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
2-HEXANONE	< 10	< 10	< 100	< 10	< 10	< 10	< 1000	< 10	< 100			
4-CHLOROTOLUENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
4-METHYL-2-PENTANONE (MIBK)	< 10	< 10	< 100	< 10	< 10	< 10	< 1000	< 10	< 100			
ACETONE	< 10	< 10	< 100	< 10	< 10	< 10	< 1000	< 10	< 100			
BENZENE	< 1	< 1	**24.3**	< 1	**44**	< 1	< 100	< 1	< 10	< 1	< 1	< 1
BROMOBENZENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
BROMOCHLOROMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
BROMODICHLOROMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
BROMOFORM	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
BROMOMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
CARBON DISULFIDE	< 5	< 5	< 50	< 5	< 5	< 5	< 500	< 5	< 50			
CARBON TETRACHLORIDE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
CHLOROBENZENE	< 1	< 1	**269**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
CHLOROETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
CHLOROFORM	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
CHLOROMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
CIS-1,2-DICHLOROETHENE	**14.8**	**33.9**	**85.3**	**1.9**	< 1	< 1	**14,100**	**2.9**	**526**	--	--	--
CIS-1,3-DICHLOROPROPENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
DIBROMOCHLOROMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			

All Chemical Data from the Analysis Groundwater Samples
ACF Carter Carburetor Site, St. Louis, MO

Chemical (all units µg/L)	PZ-01W (UST 02)	PZ-02W (N&S Die Cast)	PZ-04W (N&S Die Cast)	UST-01W	UST-03W	UST-04W	UST-06W	UST-07W	UST-08W	UST-9-06W	UST-9-07W	UST-9-11W
Well depth:	13.35	16.95	16.00	10.70	10.44	10.46	10.85	9.58	12.33	13.30		
Volatile Organic Compounds (VOCs)												
DIBROMOMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
DICHLORODIFLUOROMETHANE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
ETHYLBENZENE	< 1	< 1	< 10	< 1	**1.6**	< 1	< 100	< 1	< 10	< 1	< 1	< 1
HEXACHLORO-1,3-BUTADIENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
ISOPROPYLBENZENE (CUMENE)	< 1	< 1	**19.8**	< 1	**14.5**	< 1	< 100	< 1	< 10	--	--	--
METHYLENE CHLORIDE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
METHYL-TERT-BUTYL ETHER	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10	< 1		**5.5**
NAPHTHALENE	< 10	< 10	< 100	< 10	< 10	< 10	< 1000	< 10	< 100	< 10	< 10	< 10
N-BUTYLBENZENE	< 1	< 1	< 10	< 1	**8.3**	**8.7**	< 100	< 1	< 10	--	--	--
N-PROPYLBENZENE	< 1	< 1	**18.1**	< 1	**20**	**1**	< 100	< 1	< 10	--	--	--
P-ISOPROPYLTOLUENE	< 1	< 1	< 10	< 1	**6.1**	**5.3**	< 100	< 1	< 10	--	--	--
SEC-BUTYLBENZENE	< 1	< 1	**20.7**	< 1	**4.4**	**3.5**	< 100	< 1	< 10	--	--	--
STYRENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
TERT-BUTYLBENZENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
TETRACHLOROETHENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	**2.4**	< 10	--	--	--
TOLUENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10	< 1	< 1	< 1
TRANS-1,2-DICHLOROETHENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
TRANS-1,3-DICHLOROPROPENE	< 1	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10			
TRICHLOROETHENE	**9**	**3.1**	< 10	< 1	**2.6**	< 1	**3,430**	**21.9**	**303**	--	--	--
TRICHLOROFLUOROMETHANE	**1.4**	< 1	< 10	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
VINYL CHLORIDE	< 1	< 1	**356**	< 1	< 1	< 1	**1,110**	**2.5**	**154**	--	--	--
XYLENE (TOTAL)	< 3	< 3	< 30	< 3	< 3	< 3	< 300	< 3	< 30	< 3	< 3	< 3
Total Petroleum Hydrocarbons (TPH)												
TPH-DRO	< 1,000	< 1,000	**445000**	**3,400**	**1,300**	**351,000**	**4,000**	< 1,000	**3,000**	< 1.8	**35.6**	< 1.1
TPH-GRO	< 500	< 500	**J 4,110**	< 500	**1,330**	**517**	**12,000**	< 500	**914**	< 500	< 500	< 500
TPH-ORO	< 1,000	< 1,000	**145000**	**4,600**	**2,400**	**30,800**	**7,500**	< 1,000	**6,900**	< 1.8	< 1.1	< 1.1
Semi-Volatile Organic Compounds (SVOCs)												
ACENAPHTHENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
ACENAPHTHYLENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
ANTHRACENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
BENZO(A)ANTHRACENE	**2.1**	< 1	< 10	< 1	< 1	< 10	**1.2**	< 1	< 1	--	--	--
BENZO(A)PYRENE	**1.9**	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1	--	--	--
BENZO(B)FLUORANTHENE	**4.3**	< 1	< 10	< 1	< 1	< 10	**1.8**	< 1	< 1	--	--	--
BENZO(G,H,I)PERYLENE	**1.8**	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1	--	--	--
BENZO(K)FLUORANTHENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
CHRYSENE	**2**	< 1	**11.1**	< 1	< 1	< 10	**1.3**	< 1	< 1	--	--	--
DIBENZ(A,H)ANTHRACENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
FLUORANTHENE	**5.5**	< 1	< 10	< 1	< 1	< 10	**2.3**	< 1	< 1	--	--	--
FLUORENE	< 1	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1			
INDENO(1,2,3-CD)PYRENE	**1.3**	< 1	< 10	< 1	< 1	< 10	< 1	< 1	< 1	--	--	--
PHENANTHRENE	**3**	< 1	< 10	< 1	< 1	< 10	**1.2**	< 1	< 1	--	--	--
PYRENE	**5**	< 1	**15.9**	< 1	**1.4**	< 10	**2.6**	< 1	< 1	--	--	--
Metals												

All Chemical Data from the Analysis Groundwater Samples
ACF Carter Carburetor Site, St. Louis, MO

Chemical (all units µg/L)	PZ-01W (UST 02)	PZ-02W (N&S Die Cast)	PZ-04W (N&S Die Cast)	UST-01W	UST-03W	UST-04W	UST-06W	UST-07W	UST-08W	UST-9-06W	UST-9-07W	UST-9-11W
Well depth:	13.35	16.95	16.00	10.70	10.44	10.46	10.85	9.58	12.33	13.30		
Volatile Organic Compounds (VOCs)												
ARSENIC	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10			
BARIUM	**56.1**	**89**	**137**	**169**	**170**	**25.9**	**193**	**61.4**	**50.6**	--	--	--
CADMIUM	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
CHROMIUM	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
LEAD	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5			
MERCURY	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2			
SELENIUM	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15	< 15			
SILVER	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7			

Notes:

< - constituent not detected above this value

Bold - Detection

J - estimated value

-- - not analyzd or not applicable

Chemical Analytical Results - Groundwater
Chemicals with at Least One Detection - For Evaluation of Dermal Contact to Construction Workers
ACF Carter Carburetor Site, St. Louis, MO

Chemical (all units µg/L)	PZ-02W (Die Cast)	PZ-04W (Die Cast)	UST-01W	PZ-01W (UST 02)	UST-03W	UST-04W	UST-06W	UST-07W	UST-08W	UST-9-06W	UST-9-07W	UST-9-11W
Well depth:	16.95	16.00	10.70	13.35	10.44	10.46	10.85	9.58	12.33	13.30		
Volatile Organic Compounds (VOCs)												
1,1-DICHLOROETHENE	< 1	< 10	< 1	< 1	< 1	< 1	< 100	< 1	**21.4**	--	--	--
1,2,4-TRICHLOROBENZENE	< 1	**520**	< 1	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2,4-TRIMETHYLBENZENE	**1.7**	< 10	< 1	< 1	< 1	**8.6**	**102**	< 1	< 10	--	--	--
1,2-DICHLOROBENZENE	< 1	**33.7**	< 1	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2-DICHLOROETHANE	< 1	< 10	**4**	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,2-DICHLOROETHENE (TOTAL)	**34.2**	**85.3**	**1.9**	**15**	< 1	< 1	**14,200**	**2.9**	**532**	--	--	--
1,3,5-TRIMETHYLBENZENE	< 1	< 10	< 1	< 1	**4.2**	**2.9**	< 100	< 1	< 10	--	--	--
1,3-DICHLOROBENZENE	< 1	**1,120**	< 1	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
1,4-DICHLOROBENZENE	< 1	**207**	< 1	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
BENZENE	< 1	**24.3**	< 1	< 1	**44**	< 1	< 100	< 1	< 10	< 1	< 1	< 1
CHLOROBENZENE	< 1	**269**	< 1	< 1	< 1	< 1	< 100	< 1	< 10	--	--	--
CIS-1,2-DICHLOROETHENE	**33.9**	**85.3**	**1.9**	**14.8**	< 1	< 1	**14,100**	**2.9**	**526**	--	--	--
ETHYLBENZENE	< 1	< 10	< 1	< 1	**1.6**	< 1	< 100	< 1	< 10	< 1	< 1	< 1
ISOPROPYLBENZENE (CUMENE)	< 1	**19.8**	< 1	< 1	**14.5**	< 1	< 100	< 1	< 10	--	--	--
METHYL-TERT-BUTYL ETHER	< 1	< 10	< 1	< 1	< 1	< 1	< 100	< 1	< 10	< 1		**5.5**
N-BUTYLBENZENE	< 1	< 10	< 1	< 1	**8.3**	**8.7**	< 100	< 1	< 10	--	--	--
N-PROPYLBENZENE	< 1	**18.1**	< 1	< 1	**20**	**1**	< 100	< 1	< 10	--	--	--
P-ISOPROPYLTOLUENE	< 1	< 10	< 1	< 1	**6.1**	**5.3**	< 100	< 1	< 10	--	--	--
SEC-BUTYLBENZENE	< 1	**20.7**	< 1	< 1	**4.4**	**3.5**	< 100	< 1	< 10	--	--	--
TETRACHLOROETHENE	< 1	< 10	< 1	< 1	< 1	< 1	< 100	**2.4**	< 10	--	--	--
TRICHLOROETHENE	**3.1**	< 10	< 1	**9**	**2.6**	< 1	**3,430**	**21.9**	**303**	--	--	--
TRICHLOROFLUOROMETHANE	< 1	< 10	< 1	**1.4**	< 1	< 1	< 100	< 1	< 10	--	--	--
VINYL CHLORIDE	< 1	**356**	< 1	< 1	< 1	< 1	**1,110**	**2.5**	**154**	--	--	--
Semi-Volatile Organic Compounds (SVOCs)												
BENZO(A)ANTHRACENE	< 1	< 10	< 1	**2.1**	< 1	< 10	**1.2**	< 1	< 1	--	--	--
BENZO(A)PYRENE	< 1	< 10	< 1	**1.9**	< 1	< 10	< 1	< 1	< 1	--	--	--
BENZO(B)FLUORANTHENE	< 1	< 10	< 1	**4.3**	< 1	< 10	**1.8**	< 1	< 1	--	--	--
BENZO(G,H,I)PERYLENE	< 1	< 10	< 1	**1.8**	< 1	< 10	< 1	< 1	< 1	--	--	--
CHRYSENE	< 1	**11.1**	< 1	**2**	< 1	< 10	**1.3**	< 1	< 1	--	--	--
FLUORANTHENE	< 1	< 10	< 1	**5.5**	< 1	< 10	**2.3**	< 1	< 1	--	--	--
INDENO(1,2,3-CD)PYRENE	< 1	< 10	< 1	**1.3**	< 1	< 10	< 1	< 1	< 1	--	--	--
PHENANTHRENE	< 1	< 10	< 1	**3**	< 1	< 10	**1.2**	< 1	< 1	--	--	--
PYRENE	< 1	**15.9**	< 1	**5**	**1.4**	< 10	**2.6**	< 1	< 1	--	--	--
Metals												
BARIUM	**89**	**137**	**169**	**56.1**	**170**	**25.9**	**193**	**61.4**	**50.6**	--	--	--

Notes:

< - constituent not detected above this value

Bold - Detection

J - estimated value

-- - not analyzd or not applicable

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,1-DICHLOROETHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C0

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	8.822	Mean of log Data	0.492
Median	0.5	SD of log Data	1.87
SD	16.9		
Coefficient of Variation	1.915		
Skewness	2.275		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.593	Shapiro Wilk Test Statistic	0.687
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	19.3	95% H-UCL	357.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24.11
95% Adjusted-CLT UCL	22.65	97.5% Chebyshev (MVUE) UCL	31.76
95% Modified-t UCL	20.01	99% Chebyshev (MVUE) UCL	46.77
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.335	Data do not follow a Discernable Distribution (0.05)	
Theta Star	26.32		
nu star	6.034		
Approximate Chi Square Value (.05)	1.657	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	18.09
Adjusted Chi Square Value	1.221	95% Jackknife UCL	19.3
		95% Standard Bootstrap UCL	17.55
Anderson-Darling Test Statistic	1.471	95% Bootstrap-t UCL	71.17
Anderson-Darling 5% Critical Value	0.79	95% Hall's Bootstrap UCL	58.23
Kolmogorov-Smirnov Test Statistic	0.415	95% Percentile Bootstrap UCL	19.32
Kolmogorov-Smirnov 5% Critical Value	0.298	95% BCA Bootstrap UCL	20.82
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.37
		97.5% Chebyshev(Mean, Sd) UCL	44
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	64.86
95% Approximate Gamma UCL	32.12		
95% Adjusted Gamma UCL	43.59		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	64.86
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,2,4-TRICHLOROBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C1

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	520	Maximum of Log Data	6.254
Mean	64.22	Mean of log Data	0.846
Median	0.5	SD of log Data	2.585
SD	171.7		
Coefficient of Variation	2.673		
Skewness	2.951		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.442	Shapiro Wilk Test Statistic	0.682
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	170.6	95% H-UCL	58093
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	116.3
95% Adjusted-CLT UCL	218.5	97.5% Chebyshev (MVUE) UCL	155.3
95% Modified-t UCL	180	99% Chebyshev (MVUE) UCL	232
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.22	Data do not follow a Discernable Distribution (0.05)	
Theta Star	292		
nu star	3.959		
Approximate Chi Square Value (.05)	0.706	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	158.4
Adjusted Chi Square Value	0.47	95% Jackknife UCL	170.6
		95% Standard Bootstrap UCL	153.1
Anderson-Darling Test Statistic	1.685	95% Bootstrap-t UCL	5491
Anderson-Darling 5% Critical Value	0.838	95% Hall's Bootstrap UCL	3664
Kolmogorov-Smirnov Test Statistic	0.395	95% Percentile Bootstrap UCL	174.7
Kolmogorov-Smirnov 5% Critical Value	0.306	95% BCA Bootstrap UCL	185.2
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	313.7
		97.5% Chebyshev(Mean, Sd) UCL	421.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	633.6
95% Approximate Gamma UCL	360.4		
95% Adjusted Gamma UCL	541.5		
Potential UCL to Use			0

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,2,4-TRIMETHYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C2

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	102	Maximum of Log Data	4.625
Mean	13.81	Mean of log Data	0.862
Median	1.7	SD of log Data	1.828
SD	33.19		
Coefficient of Variation	2.403		
Skewness	2.958		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.46	Shapiro Wilk Test Statistic	0.836
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	34.39	95% H-UCL	408.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	32.55
95% Adjusted-CLT UCL	43.67	97.5% Chebyshev (MVUE) UCL	42.81
95% Modified-t UCL	36.21	99% Chebyshev (MVUE) UCL	62.97
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.325	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	42.47		
nu star	5.854		
Approximate Chi Square Value (.05)	1.565	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	32.01
Adjusted Chi Square Value	1.146	95% Jackknife UCL	34.39
		95% Standard Bootstrap UCL	31.04
Anderson-Darling Test Statistic	1.109	95% Bootstrap-t UCL	195.6
Anderson-Darling 5% Critical Value	0.793	95% Hall's Bootstrap UCL	136.8
Kolmogorov-Smirnov Test Statistic	0.276	95% Percentile Bootstrap UCL	35.33
Kolmogorov-Smirnov 5% Critical Value	0.299	95% BCA Bootstrap UCL	46.24
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	62.04
		97.5% Chebyshev(Mean, Sd) UCL	82.91
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	123.9
95% Approximate Gamma UCL	51.64		
95% Adjusted Gamma UCL	70.55		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	70.55

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,2-DICHLOROBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C3

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	10.19	Mean of log Data	0.542
Median	0.5	SD of log Data	1.953
SD	18.47		
Coefficient of Variation	1.812		
Skewness	1.799		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.61	Shapiro Wilk Test Statistic	0.673
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	21.63	95% H-UCL	600.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	29.06
95% Adjusted-CLT UCL	24.26	97.5% Chebyshev (MVUE) UCL	38.35
95% Modified-t UCL	22.25	99% Chebyshev (MVUE) UCL	56.62
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.323	Data do not follow a Discernable Distribution (0.05)	
Theta Star	31.51		
nu star	5.82		
Approximate Chi Square Value (.05)	1.549	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	20.31
Adjusted Chi Square Value	1.132	95% Jackknife UCL	21.63
		95% Standard Bootstrap UCL	19.46
Anderson-Darling Test Statistic	1.544	95% Bootstrap-t UCL	91.05
Anderson-Darling 5% Critical Value	0.794	95% Hall's Bootstrap UCL	85.07
Kolmogorov-Smirnov Test Statistic	0.416	95% Percentile Bootstrap UCL	20.76
Kolmogorov-Smirnov 5% Critical Value	0.299	95% BCA Bootstrap UCL	22.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	37.02
		97.5% Chebyshev(Mean, Sd) UCL	48.63
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	71.43
95% Approximate Gamma UCL	38.29		
95% Adjusted Gamma UCL	52.37		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	71.43
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,2-DICHLOROETHANE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C4

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	7.389	Mean of log Data	0.561
Median	0.5	SD of log Data	1.657
SD	16.11		
Coefficient of Variation	2.18		
Skewness	2.909		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.488	Shapiro Wilk Test Statistic	0.769
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	17.37	95% H-UCL	125.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	18.3
95% Adjusted-CLT UCL	21.79	97.5% Chebyshev (MVUE) UCL	23.93
95% Modified-t UCL	18.24	99% Chebyshev (MVUE) UCL	35
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.373	Data do not follow a Discernable Distribution (0.05)	
Theta Star	19.79		
nu star	6.721		
Approximate Chi Square Value (.05)	2.019	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	16.22
Adjusted Chi Square Value	1.522	95% Jackknife UCL	17.37
		95% Standard Bootstrap UCL	15.74
Anderson-Darling Test Statistic	1.22	95% Bootstrap-t UCL	61.64
Anderson-Darling 5% Critical Value	0.78	95% Hall's Bootstrap UCL	56.43
Kolmogorov-Smirnov Test Statistic	0.323	95% Percentile Bootstrap UCL	17.89
Kolmogorov-Smirnov 5% Critical Value	0.296	95% BCA Bootstrap UCL	22.89
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.79
		97.5% Chebyshev(Mean, Sd) UCL	40.92
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	60.81
95% Approximate Gamma UCL	24.6		
95% Adjusted Gamma UCL	32.64		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	60.81
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,2-DICHLOROETHENE (TOTAL)

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C5

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	8
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	14200	Maximum of Log Data	9.561
Mean	1652	Mean of log Data	2.983
Median	15	SD of log Data	3.406
SD	4708		
Coefficient of Variation	2.849		
Skewness	2.992		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.412	Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4571	95% H-UCL	7.493E,8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4403
95% Adjusted-CLT UCL	5907	97.5% Chebyshev (MVUE) UCL	5924
95% Modified-t UCL	4832	99% Chebyshev (MVUE) UCL	8910
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.188	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	8806		
nu star	3.378		
Approximate Chi Square Value (.05)	0.493	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	4234
Adjusted Chi Square Value	0.316	95% Jackknife UCL	4571
		95% Standard Bootstrap UCL	4105
Anderson-Darling Test Statistic	1.015	95% Bootstrap-t UCL	274997
Anderson-Darling 5% Critical Value	0.856	95% Hall's Bootstrap UCL	201340
Kolmogorov-Smirnov Test Statistic	0.297	95% Percentile Bootstrap UCL	4757
Kolmogorov-Smirnov 5% Critical Value	0.309	95% BCA Bootstrap UCL	6373
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	8494
		97.5% Chebyshev(Mean, Sd) UCL	11454
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17269
95% Approximate Gamma UCL	11331		
95% Adjusted Gamma UCL	17649		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	17649
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,3,5-TRIMETHYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C6

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	7.678	Mean of log Data	0.762
Median	2.9	SD of log Data	1.596
SD	15.99		
Coefficient of Variation	2.083		
Skewness	2.912		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.496	Shapiro Wilk Test Statistic	0.831
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	17.59	95% H-UCL	113.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	20.28
95% Adjusted-CLT UCL	21.98	97.5% Chebyshev (MVUE) UCL	26.46
95% Modified-t UCL	18.45	99% Chebyshev (MVUE) UCL	38.6
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.406	Data appear Lognormal at 5% Significance Level	
Theta Star	18.91		
nu star	7.309		
Approximate Chi Square Value (.05)	2.342	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	16.45
Adjusted Chi Square Value	1.794	95% Jackknife UCL	17.59
		95% Standard Bootstrap UCL	15.94
Anderson-Darling Test Statistic	0.982	95% Bootstrap-t UCL	59.71
Anderson-Darling 5% Critical Value	0.771	95% Hall's Bootstrap UCL	59.45
Kolmogorov-Smirnov Test Statistic	0.308	95% Percentile Bootstrap UCL	17.91
Kolmogorov-Smirnov 5% Critical Value	0.294	95% BCA Bootstrap UCL	23.77
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.92
		97.5% Chebyshev(Mean, Sd) UCL	40.97
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	60.72
95% Approximate Gamma UCL	23.96		
95% Adjusted Gamma UCL	31.28		
Potential UCL to Use		Use 99% Chebyshev (MVUE) UCL	38.6

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,3-DICHLOROBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C7

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	1120	Maximum of Log Data	7.021
Mean	130.9	Mean of log Data	0.932
Median	0.5	SD of log Data	2.79
SD	371.3		
Coefficient of Variation	2.837		
Skewness	2.989		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.415	Shapiro Wilk Test Statistic	0.677
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	361	95% H-UCL	326456
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	182.4
95% Adjusted-CLT UCL	466.2	97.5% Chebyshev (MVUE) UCL	244.3
95% Modified-t UCL	381.6	99% Chebyshev (MVUE) UCL	365.7
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.2	Data do not follow a Discernable Distribution (0.05)	
Theta Star	655.5		
nu star	3.594		
Approximate Chi Square Value (.05)	0.568	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	334.5
Adjusted Chi Square Value	0.37	95% Jackknife UCL	361
		95% Standard Bootstrap UCL	321.2
Anderson-Darling Test Statistic	1.798	95% Bootstrap-t UCL	24340
Anderson-Darling 5% Critical Value	0.849	95% Hall's Bootstrap UCL	16138
Kolmogorov-Smirnov Test Statistic	0.389	95% Percentile Bootstrap UCL	374.2
Kolmogorov-Smirnov 5% Critical Value	0.308	95% BCA Bootstrap UCL	498.6
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	670.3
		97.5% Chebyshev(Mean, Sd) UCL	903.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1362
95% Approximate Gamma UCL	827.9		
95% Adjusted Gamma UCL	1273		
Potential UCL to Use			0

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
1,4-DICHLOROBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C8

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	207	Maximum of Log Data	5.333
Mean	29.44	Mean of log Data	0.744
Median	0.5	SD of log Data	2.351
SD	68.53		
Coefficient of Variation	2.327		
Skewness	2.719		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.511	Shapiro Wilk Test Statistic	0.683
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	71.92	95% H-UCL	9450
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	69.86
95% Adjusted-CLT UCL	89.15	97.5% Chebyshev (MVUE) UCL	93
95% Modified-t UCL	75.37	99% Chebyshev (MVUE) UCL	138.4
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.252	Data do not follow a Discernable Distribution (0.05)	
Theta Star	117		
nu star	4.531		
Approximate Chi Square Value (.05)	0.942	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	67.02
Adjusted Chi Square Value	0.648	95% Jackknife UCL	71.92
		95% Standard Bootstrap UCL	63.56
Anderson-Darling Test Statistic	1.576	95% Bootstrap-t UCL	994.6
Anderson-Darling 5% Critical Value	0.82	95% Hall's Bootstrap UCL	698.7
Kolmogorov-Smirnov Test Statistic	0.404	95% Percentile Bootstrap UCL	69.83
Kolmogorov-Smirnov 5% Critical Value	0.303	95% BCA Bootstrap UCL	80.33
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	129
		97.5% Chebyshev(Mean, Sd) UCL	172.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	256.7
95% Approximate Gamma UCL	141.6		
95% Adjusted Gamma UCL	205.7		
Potential UCL to Use			0

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C9

General Statistics			
Number of Valid Samples	12	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	10.61	Mean of log Data	0.579
Median	0.5	SD of log Data	1.959
SD	18.35		
Coefficient of Variation	1.73		
Skewness	1.633		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.619	Shapiro Wilk Test Statistic	0.662
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	20.12	95% H-UCL	216.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	31.67
95% Adjusted-CLT UCL	21.99	97.5% Chebyshev (MVUE) UCL	41.65
95% Modified-t UCL	20.54	99% Chebyshev (MVUE) UCL	61.24
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.336	Data do not follow a Discernable Distribution (0.05)	
Theta Star	31.61		
nu star	8.053		
Approximate Chi Square Value (.05)	2.766	Nonparametric Statistics	
Adjusted Level of Significance	0.029	95% CLT UCL	19.32
Adjusted Chi Square Value	2.315	95% Jackknife UCL	20.12
		95% Standard Bootstrap UCL	18.67
Anderson-Darling Test Statistic	2.019	95% Bootstrap-t UCL	31.29
Anderson-Darling 5% Critical Value	0.81	95% Hall's Bootstrap UCL	18.33
Kolmogorov-Smirnov Test Statistic	0.419	95% Percentile Bootstrap UCL	19.97
Kolmogorov-Smirnov 5% Critical Value	0.263	95% BCA Bootstrap UCL	20.84
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.7
		97.5% Chebyshev(Mean, Sd) UCL	43.69
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	63.31
95% Approximate Gamma UCL	30.89		
95% Adjusted Gamma UCL	36.9		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	63.31
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
CHLOROBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C10

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	269	Maximum of Log Data	5.595
Mean	36.33	Mean of log Data	0.773
Median	0.5	SD of log Data	2.416
SD	88.75		
Coefficient of Variation	2.443		
Skewness	2.826		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.486	Shapiro Wilk Test Statistic	0.684
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	91.34	95% H-UCL	15395
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	80.45
95% Adjusted-CLT UCL	114.8	97.5% Chebyshev (MVUE) UCL	107.2
95% Modified-t UCL	95.99	99% Chebyshev (MVUE) UCL	159.8
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.242	Data do not follow a Discernable Distribution (0.05)	
Theta Star	150.2		
nu star	4.353		
Approximate Chi Square Value (.05)	0.866	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	84.99
Adjusted Chi Square Value	0.59	95% Jackknife UCL	91.34
		95% Standard Bootstrap UCL	82.2
Anderson-Darling Test Statistic	1.6	95% Bootstrap-t UCL	1594
Anderson-Darling 5% Critical Value	0.826	95% Hall's Bootstrap UCL	1092
Kolmogorov-Smirnov Test Statistic	0.402	95% Percentile Bootstrap UCL	90.5
Kolmogorov-Smirnov 5% Critical Value	0.304	95% BCA Bootstrap UCL	101.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	165.3
		97.5% Chebyshev(Mean, Sd) UCL	221.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	330.7
95% Approximate Gamma UCL	182.7		
95% Adjusted Gamma UCL	268		
Potential UCL to Use			0

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
CIS-1,2-DICHLOROETHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C11

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	8
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	14100	Maximum of Log Data	9.554
Mean	1641	Mean of log Data	2.978
Median	14.8	SD of log Data	3.403
SD	4675		
Coefficient of Variation	2.85		
Skewness	2.993		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.412	Shapiro Wilk Test Statistic	0.929
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4539	95% H-UCL	7.227E,8
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4358
95% Adjusted-CLT UCL	5865	97.5% Chebyshev (MVUE) UCL	5862
95% Modified-t UCL	4798	99% Chebyshev (MVUE) UCL	8818
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.188	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	8740		
nu star	3.379		
Approximate Chi Square Value (.05)	0.493	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	4204
Adjusted Chi Square Value	0.317	95% Jackknife UCL	4539
		95% Standard Bootstrap UCL	4102
Anderson-Darling Test Statistic	1.016	95% Bootstrap-t UCL	270770
Anderson-Darling 5% Critical Value	0.856	95% Hall's Bootstrap UCL	197457
Kolmogorov-Smirnov Test Statistic	0.296	95% Percentile Bootstrap UCL	4721
Kolmogorov-Smirnov 5% Critical Value	0.309	95% BCA Bootstrap UCL	6336
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	8434
		97.5% Chebyshev(Mean, Sd) UCL	11373
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	17147
95% Approximate Gamma UCL	11245		
95% Adjusted Gamma UCL	17514		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	17514
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
ETHYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C12

General Statistics			
Number of Valid Samples	12	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	5.467	Mean of log Data	0.171
Median	0.5	SD of log Data	1.483
SD	14.13		
Coefficient of Variation	2.585		
Skewness	3.376		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.405	Shapiro Wilk Test Statistic	0.665
Shapiro Wilk Critical Value	0.859	Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	12.79	95% H-UCL	20.04
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.261
95% Adjusted-CLT UCL	16.42	97.5% Chebyshev (MVUE) UCL	11.95
95% Modified-t UCL	13.45	99% Chebyshev (MVUE) UCL	17.24
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.375	Data do not follow a Discernable Distribution (0.05)	
Theta Star	14.56		
nu star	9.009		
Approximate Chi Square Value (.05)	3.332	Nonparametric Statistics	
Adjusted Level of Significance	0.029	95% CLT UCL	12.18
Adjusted Chi Square Value	2.827	95% Jackknife UCL	12.79
		95% Standard Bootstrap UCL	12.04
Anderson-Darling Test Statistic	2.302	95% Bootstrap-t UCL	54.04
Anderson-Darling 5% Critical Value	0.799	95% Hall's Bootstrap UCL	51.66
Kolmogorov-Smirnov Test Statistic	0.387	95% Percentile Bootstrap UCL	13.34
Kolmogorov-Smirnov 5% Critical Value	0.261	95% BCA Bootstrap UCL	17.38
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	23.25
		97.5% Chebyshev(Mean, Sd) UCL	30.94
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	46.05
95% Approximate Gamma UCL	14.78		
95% Adjusted Gamma UCL	17.42		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	46.05

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
ISOPROPYLBENZENE (CUMENE)

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C13

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	10.2	Mean of log Data	0.857
Median	0.5	SD of log Data	1.928
SD	16.55		
Coefficient of Variation	1.623		
Skewness	2.101		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.68	Shapiro Wilk Test Statistic	0.771
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	20.46	95% H-UCL	714.7
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	38.24
95% Adjusted-CLT UCL	23.41	97.5% Chebyshev (MVUE) UCL	50.45
95% Modified-t UCL	21.1	99% Chebyshev (MVUE) UCL	74.42
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.369	Data do not follow a Discernable Distribution (0.05)	
Theta Star	27.66		
nu star	6.638		
Approximate Chi Square Value (.05)	1.974	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	19.28
Adjusted Chi Square Value	1.484	95% Jackknife UCL	20.46
		95% Standard Bootstrap UCL	18.97
Anderson-Darling Test Statistic	0.953	95% Bootstrap-t UCL	35.29
Anderson-Darling 5% Critical Value	0.781	95% Hall's Bootstrap UCL	48.69
Kolmogorov-Smirnov Test Statistic	0.349	95% Percentile Bootstrap UCL	19.56
Kolmogorov-Smirnov 5% Critical Value	0.296	95% BCA Bootstrap UCL	23.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34.25
		97.5% Chebyshev(Mean, Sd) UCL	44.66
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	65.1
95% Approximate Gamma UCL	34.3		
95% Adjusted Gamma UCL	45.62		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	65.1
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
METHYL-TERT-BUTYL ETHER

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C14

General Statistics			
Number of Valid Samples	11	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	6.273	Mean of log Data	0.362
Median	0.5	SD of log Data	1.591
SD	14.66		
Coefficient of Variation	2.337		
Skewness	3.191		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.448	Shapiro Wilk Test Statistic	0.705
Shapiro Wilk Critical Value	0.85	Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	14.28	95% H-UCL	43.24
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	13.46
95% Adjusted-CLT UCL	18.09	97.5% Chebyshev (MVUE) UCL	17.49
95% Modified-t UCL	14.99	99% Chebyshev (MVUE) UCL	25.42
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.38	Data do not follow a Discernable Distribution (0.05)	
Theta Star	16.49		
nu star	8.368		
Approximate Chi Square Value (.05)	2.95	Nonparametric Statistics	
Adjusted Level of Significance	0.0278	95% CLT UCL	13.54
Adjusted Chi Square Value	2.451	95% Jackknife UCL	14.28
		95% Standard Bootstrap UCL	13.31
Anderson-Darling Test Statistic	1.775	95% Bootstrap-t UCL	46.17
Anderson-Darling 5% Critical Value	0.793	95% Hall's Bootstrap UCL	41.46
Kolmogorov-Smirnov Test Statistic	0.38	95% Percentile Bootstrap UCL	14.86
Kolmogorov-Smirnov 5% Critical Value	0.271	95% BCA Bootstrap UCL	18.95
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	25.54
		97.5% Chebyshev(Mean, Sd) UCL	33.88
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	50.25
95% Approximate Gamma UCL	17.79		
95% Adjusted Gamma UCL	21.42		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	50.25
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
N-BUTYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C15

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	8.778	Mean of log Data	0.96
Median	5	SD of log Data	1.706
SD	15.82		
Coefficient of Variation	1.802		
Skewness	2.747		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.57	Shapiro Wilk Test Statistic	0.836
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	18.58	95% H-UCL	237.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	29.46
95% Adjusted-CLT UCL	22.61	97.5% Chebyshev (MVUE) UCL	38.59
95% Modified-t UCL	19.39	99% Chebyshev (MVUE) UCL	56.54
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.421	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	20.84		
nu star	7.581		
Approximate Chi Square Value (.05)	2.495	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	17.45
Adjusted Chi Square Value	1.924	95% Jackknife UCL	18.58
		95% Standard Bootstrap UCL	16.94
Anderson-Darling Test Statistic	0.749	95% Bootstrap-t UCL	43.07
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL	51.26
Kolmogorov-Smirnov Test Statistic	0.266	95% Percentile Bootstrap UCL	18.87
Kolmogorov-Smirnov 5% Critical Value	0.294	95% BCA Bootstrap UCL	23.41
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.76
		97.5% Chebyshev(Mean, Sd) UCL	41.71
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	61.25
95% Approximate Gamma UCL	26.67		
95% Adjusted Gamma UCL	34.58		
Potential UCL to Use		Use 95% Approximate Gamma UCL	26.67

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
N-PROPYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C16

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	6
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	10.68	Mean of log Data	0.96
Median	1	SD of log Data	1.9
SD	16.69		
Coefficient of Variation	1.563		
Skewness	1.961		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.696	Shapiro Wilk Test Statistic	0.81
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	21.02	95% H-UCL	674.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	40.45
95% Adjusted-CLT UCL	23.71	97.5% Chebyshev (MVUE) UCL	53.32
95% Modified-t UCL	21.63	99% Chebyshev (MVUE) UCL	78.59
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.379	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	28.17		
nu star	6.822		
Approximate Chi Square Value (.05)	2.074	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	19.83
Adjusted Chi Square Value	1.568	95% Jackknife UCL	21.02
		95% Standard Bootstrap UCL	19.24
Anderson-Darling Test Statistic	0.833	95% Bootstrap-t UCL	31.36
Anderson-Darling 5% Critical Value	0.778	95% Hall's Bootstrap UCL	27.02
Kolmogorov-Smirnov Test Statistic	0.292	95% Percentile Bootstrap UCL	20.24
Kolmogorov-Smirnov 5% Critical Value	0.296	95% BCA Bootstrap UCL	23
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	34.93
		97.5% Chebyshev(Mean, Sd) UCL	45.42
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	66.03
95% Approximate Gamma UCL	35.13		
95% Adjusted Gamma UCL	46.47		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	46.47

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
P-ISOPROPYLTOLUENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C17

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	8.156	Mean of log Data	0.87
Median	5	SD of log Data	1.645
SD	15.88		
Coefficient of Variation	1.947		
Skewness	2.864		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.518	Shapiro Wilk Test Statistic	0.818
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	18	95% H-UCL	160.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24.43
95% Adjusted-CLT UCL	22.26	97.5% Chebyshev (MVUE) UCL	31.93
95% Modified-t UCL	18.84	99% Chebyshev (MVUE) UCL	46.67
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.417	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	19.54		
nu star	7.511		
Approximate Chi Square Value (.05)	2.455	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	16.86
Adjusted Chi Square Value	1.891	95% Jackknife UCL	18
		95% Standard Bootstrap UCL	16.39
Anderson-Darling Test Statistic	0.938	95% Bootstrap-t UCL	50.4
Anderson-Darling 5% Critical Value	0.77	95% Hall's Bootstrap UCL	57.74
Kolmogorov-Smirnov Test Statistic	0.28	95% Percentile Bootstrap UCL	18.53
Kolmogorov-Smirnov 5% Critical Value	0.294	95% BCA Bootstrap UCL	20.31
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	31.23
		97.5% Chebyshev(Mean, Sd) UCL	41.21
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	60.83
95% Approximate Gamma UCL	24.95		
95% Adjusted Gamma UCL	32.4		
Potential UCL to Use		Use 95% Approximate Gamma UCL	24.95

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
SEC-BUTYLBENZENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C18

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	6
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	9.511	Mean of log Data	0.946
Median	3.5	SD of log Data	1.757
SD	16.48		
Coefficient of Variation	1.732		
Skewness	2.314		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.629	Shapiro Wilk Test Statistic	0.849
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	19.72	95% H-UCL	305.9
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	31.59
95% Adjusted-CLT UCL	23.07	97.5% Chebyshev (MVUE) UCL	41.46
95% Modified-t UCL	20.43	99% Chebyshev (MVUE) UCL	60.84
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.399	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	23.81		
nu star	7.189		
Approximate Chi Square Value (.05)	2.275	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	18.55
Adjusted Chi Square Value	1.737	95% Jackknife UCL	19.72
		95% Standard Bootstrap UCL	17.91
Anderson-Darling Test Statistic	0.738	95% Bootstrap-t UCL	70.74
Anderson-Darling 5% Critical Value	0.773	95% Hall's Bootstrap UCL	66.49
Kolmogorov-Smirnov Test Statistic	0.257	95% Percentile Bootstrap UCL	18.57
Kolmogorov-Smirnov 5% Critical Value	0.295	95% BCA Bootstrap UCL	22.32
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.45
		97.5% Chebyshev(Mean, Sd) UCL	43.81
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	64.16
95% Approximate Gamma UCL	30.06		
95% Adjusted Gamma UCL	39.36		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	39.36

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
TETRACHLOROETHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C19

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	7.211	Mean of log Data	0.505
Median	0.5	SD of log Data	1.634
SD	16.16		
Coefficient of Variation	2.241		
Skewness	2.921		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.48	Shapiro Wilk Test Statistic	0.772
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	17.23	95% H-UCL	105.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	16.66
95% Adjusted-CLT UCL	21.68	97.5% Chebyshev (MVUE) UCL	21.77
95% Modified-t UCL	18.1	99% Chebyshev (MVUE) UCL	31.81
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.368	Data do not follow a Discernable Distribution (0.05)	
Theta Star	19.61		
nu star	6.619		
Approximate Chi Square Value (.05)	1.964	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	16.07
Adjusted Chi Square Value	1.476	95% Jackknife UCL	17.23
		95% Standard Bootstrap UCL	15.52
Anderson-Darling Test Statistic	1.26	95% Bootstrap-t UCL	69.62
Anderson-Darling 5% Critical Value	0.782	95% Hall's Bootstrap UCL	59.34
Kolmogorov-Smirnov Test Statistic	0.315	95% Percentile Bootstrap UCL	17.5
Kolmogorov-Smirnov 5% Critical Value	0.296	95% BCA Bootstrap UCL	19.21
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.69
		97.5% Chebyshev(Mean, Sd) UCL	40.85
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	60.81
95% Approximate Gamma UCL	24.3		
95% Adjusted Gamma UCL	32.35		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	60.81
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
TRICHLOROETHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C20

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	8
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	3430	Maximum of Log Data	8.14
Mean	419.5	Mean of log Data	2.383
Median	5	SD of log Data	2.913
SD	1133		
Coefficient of Variation	2.701		
Skewness	2.958		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.438	Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	1122	95% H-UCL	3977779
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	973.2
95% Adjusted-CLT UCL	1439	97.5% Chebyshev (MVUE) UCL	1305
95% Modified-t UCL	1184	99% Chebyshev (MVUE) UCL	1956
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.208	Data appear Lognormal at 5% Significance Level	
Theta Star	2015		
nu star	3.747		
Approximate Chi Square Value (.05)	0.624	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	1041
Adjusted Chi Square Value	0.41	95% Jackknife UCL	1122
		95% Standard Bootstrap UCL	1014
Anderson-Darling Test Statistic	1.142	95% Bootstrap-t UCL	69836
Anderson-Darling 5% Critical Value	0.845	95% Hall's Bootstrap UCL	49298
Kolmogorov-Smirnov Test Statistic	0.343	95% Percentile Bootstrap UCL	1148
Kolmogorov-Smirnov 5% Critical Value	0.307	95% BCA Bootstrap UCL	1560
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	2066
		97.5% Chebyshev(Mean, Sd) UCL	2778
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	4178
95% Approximate Gamma UCL	2518		
95% Adjusted Gamma UCL	3834		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	4178
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
TRICHLOROFLUOROMETHANE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C21

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	50	Maximum of Log Data	3.912
Mean	7.1	Mean of log Data	0.445
Median	0.5	SD of log Data	1.629
SD	16.2		
Coefficient of Variation	2.282		
Skewness	2.923		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.475	Shapiro Wilk Test Statistic	0.758
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	17.14	95% H-UCL	96.78
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	15.55
95% Adjusted-CLT UCL	21.6	97.5% Chebyshev (MVUE) UCL	20.32
95% Modified-t UCL	18.02	99% Chebyshev (MVUE) UCL	29.69
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.36	Data do not follow a Discernable Distribution (0.05)	
Theta Star	19.71		
nu star	6.485		
Approximate Chi Square Value (.05)	1.893	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	15.98
Adjusted Chi Square Value	1.416	95% Jackknife UCL	17.14
		95% Standard Bootstrap UCL	15.5
Anderson-Darling Test Statistic	1.355	95% Bootstrap-t UCL	72.23
Anderson-Darling 5% Critical Value	0.784	95% Hall's Bootstrap UCL	70.12
Kolmogorov-Smirnov Test Statistic	0.307	95% Percentile Bootstrap UCL	17.5
Kolmogorov-Smirnov 5% Critical Value	0.297	95% BCA Bootstrap UCL	22.5
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	30.64
		97.5% Chebyshev(Mean, Sd) UCL	40.82
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	60.83
95% Approximate Gamma UCL	24.33		
95% Adjusted Gamma UCL	32.51		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	60.83
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
VINYL CHLORIDE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C22

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	1110	Maximum of Log Data	7.012
Mean	180.6	Mean of log Data	1.708
Median	0.5	SD of log Data	3.279
SD	369		
Coefficient of Variation	2.044		
Skewness	2.475		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.586	Shapiro Wilk Test Statistic	0.735
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	409.3	95% H-UCL	59181943
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	970.9
95% Adjusted-CLT UCL	491.3	97.5% Chebyshev (MVUE) UCL	1305
95% Modified-t UCL	426.2	99% Chebyshev (MVUE) UCL	1962
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.214	Data do not follow a Discernable Distribution (0.05)	
Theta Star	844.8		
nu star	3.847		
Approximate Chi Square Value (.05)	0.662	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	382.9
Adjusted Chi Square Value	0.438	95% Jackknife UCL	409.3
		95% Standard Bootstrap UCL	366.6
Anderson-Darling Test Statistic	1.187	95% Bootstrap-t UCL	1356
Anderson-Darling 5% Critical Value	0.842	95% Hall's Bootstrap UCL	1538
Kolmogorov-Smirnov Test Statistic	0.346	95% Percentile Bootstrap UCL	409.8
Kolmogorov-Smirnov 5% Critical Value	0.307	95% BCA Bootstrap UCL	493.8
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	716.7
		97.5% Chebyshev(Mean, Sd) UCL	948.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1404
95% Approximate Gamma UCL	1049		
95% Adjusted Gamma UCL	1587		
Potential UCL to Use		Use 95% Hall's Bootstrap UCL	1538

Recommended UCL exceeds the maximum observation
In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BENZO(A)ANTHRACENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C23

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.756	Mean of log Data	0.0753
Median	0.5	SD of log Data	1.007
SD	1.916		
Coefficient of Variation	1.091		
Skewness	1.332		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.687	Shapiro Wilk Test Statistic	0.751
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.943	95% H-UCL	5.836
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.18
95% Adjusted-CLT UCL	3.109	97.5% Chebyshev (MVUE) UCL	5.27
95% Modified-t UCL	2.99	99% Chebyshev (MVUE) UCL	7.411
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.85	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.065		
nu star	15.3		
Approximate Chi Square Value (.05)	7.471	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	2.806
Adjusted Chi Square Value	6.353	95% Jackknife UCL	2.943
		95% Standard Bootstrap UCL	2.715
Anderson-Darling Test Statistic	1.132	95% Bootstrap-t UCL	4.891
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	4.195
Kolmogorov-Smirnov Test Statistic	0.34	95% Percentile Bootstrap UCL	2.833
Kolmogorov-Smirnov 5% Critical Value	0.286	95% BCA Bootstrap UCL	3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.539
		97.5% Chebyshev(Mean, Sd) UCL	5.744
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.11
95% Approximate Gamma UCL	3.595		
95% Adjusted Gamma UCL	4.228		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.11
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BENZO(A)PYRENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C24

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.656	Mean of log Data	-0.0331
Median	0.5	SD of log Data	1.029
SD	1.951		
Coefficient of Variation	1.178		
Skewness	1.42		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.632	Shapiro Wilk Test Statistic	0.662
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.865	95% H-UCL	5.589
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.869
95% Adjusted-CLT UCL	3.054	97.5% Chebyshev (MVUE) UCL	4.886
95% Modified-t UCL	2.916	99% Chebyshev (MVUE) UCL	6.884
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.785	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.109		
nu star	14.13		
Approximate Chi Square Value (.05)	6.661	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	2.725
Adjusted Chi Square Value	5.616	95% Jackknife UCL	2.865
		95% Standard Bootstrap UCL	2.603
Anderson-Darling Test Statistic	1.594	95% Bootstrap-t UCL	4.324
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	7.354
Kolmogorov-Smirnov Test Statistic	0.42	95% Percentile Bootstrap UCL	2.656
Kolmogorov-Smirnov 5% Critical Value	0.287	95% BCA Bootstrap UCL	2.656
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.49
		97.5% Chebyshev(Mean, Sd) UCL	5.716
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.125
95% Approximate Gamma UCL	3.512		
95% Adjusted Gamma UCL	4.166		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.125
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BENZO(B)FLUORANTHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C25

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	2.067	Mean of log Data	0.2
Median	0.5	SD of log Data	1.101
SD	2.078		
Coefficient of Variation	1.005		
Skewness	0.759		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.719	Shapiro Wilk Test Statistic	0.724
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.355	95% H-UCL	8.873
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.425
95% Adjusted-CLT UCL	3.393	97.5% Chebyshev (MVUE) UCL	6.89
95% Modified-t UCL	3.384	99% Chebyshev (MVUE) UCL	9.768
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.799	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.587		
nu star	14.38		
Approximate Chi Square Value (.05)	6.83	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	3.206
Adjusted Chi Square Value	5.77	95% Jackknife UCL	3.355
		95% Standard Bootstrap UCL	3.134
Anderson-Darling Test Statistic	1.214	95% Bootstrap-t UCL	3.544
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	2.876
Kolmogorov-Smirnov Test Statistic	0.359	95% Percentile Bootstrap UCL	3.211
Kolmogorov-Smirnov 5% Critical Value	0.286	95% BCA Bootstrap UCL	3.278
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5.086
		97.5% Chebyshev(Mean, Sd) UCL	6.392
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.958
95% Approximate Gamma UCL	4.35		
95% Adjusted Gamma UCL	5.15		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.958
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BENZO(G,H,I)PERYLENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C26

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.644	Mean of log Data	-0.0391
Median	0.5	SD of log Data	1.024
SD	1.949		
Coefficient of Variation	1.185		
Skewness	1.444		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.627	Shapiro Wilk Test Statistic	0.661
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.853	95% H-UCL	5.483
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.822
95% Adjusted-CLT UCL	3.048	97.5% Chebyshev (MVUE) UCL	4.825
95% Modified-t UCL	2.905	99% Chebyshev (MVUE) UCL	6.796
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.786	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.092		
nu star	14.15		
Approximate Chi Square Value (.05)	6.671	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	2.713
Adjusted Chi Square Value	5.625	95% Jackknife UCL	2.853
		95% Standard Bootstrap UCL	2.646
Anderson-Darling Test Statistic	1.602	95% Bootstrap-t UCL	4.554
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	3.699
Kolmogorov-Smirnov Test Statistic	0.419	95% Percentile Bootstrap UCL	2.789
Kolmogorov-Smirnov 5% Critical Value	0.287	95% BCA Bootstrap UCL	2.644
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.477
		97.5% Chebyshev(Mean, Sd) UCL	5.703
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.11
95% Approximate Gamma UCL	3.487		
95% Adjusted Gamma UCL	4.135		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.11
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
CHRYSENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C27

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	11.1	Maximum of Log Data	2.407
Mean	2.433	Mean of log Data	0.167
Median	0.5	SD of log Data	1.177
SD	3.568		
Coefficient of Variation	1.466		
Skewness	2.229		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.64	Shapiro Wilk Test Statistic	0.778
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	4.645	95% H-UCL	11.12
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	5.875
95% Adjusted-CLT UCL	5.334	97.5% Chebyshev (MVUE) UCL	7.501
95% Modified-t UCL	4.792	99% Chebyshev (MVUE) UCL	10.7
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.62	Data do not follow a Discernable Distribution (0.05)	
Theta Star	3.922		
nu star	11.17		
Approximate Chi Square Value (.05)	4.684	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	4.39
Adjusted Chi Square Value	3.838	95% Jackknife UCL	4.645
		95% Standard Bootstrap UCL	4.262
Anderson-Darling Test Statistic	1.078	95% Bootstrap-t UCL	12.65
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL	12.97
Kolmogorov-Smirnov Test Statistic	0.325	95% Percentile Bootstrap UCL	4.533
Kolmogorov-Smirnov 5% Critical Value	0.289	95% BCA Bootstrap UCL	5.456
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	7.618
		97.5% Chebyshev(Mean, Sd) UCL	9.861
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	14.27
95% Approximate Gamma UCL	5.802		
95% Adjusted Gamma UCL	7.08		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	14.27
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
FLUORANTHENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C28

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5.5	Maximum of Log Data	1.705
Mean	2.256	Mean of log Data	0.255
Median	0.5	SD of log Data	1.151
SD	2.264		
Coefficient of Variation	1.004		
Skewness	0.671		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.728	Shapiro Wilk Test Statistic	0.718
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.659	95% H-UCL	11.09
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	6.168
95% Adjusted-CLT UCL	3.677	97.5% Chebyshev (MVUE) UCL	7.862
95% Modified-t UCL	3.687	99% Chebyshev (MVUE) UCL	11.19
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.76	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.967		
nu star	13.69		
Approximate Chi Square Value (.05)	6.357	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	3.497
Adjusted Chi Square Value	5.34	95% Jackknife UCL	3.659
		95% Standard Bootstrap UCL	3.404
Anderson-Darling Test Statistic	1.239	95% Bootstrap-t UCL	3.803
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL	3.125
Kolmogorov-Smirnov Test Statistic	0.363	95% Percentile Bootstrap UCL	3.456
Kolmogorov-Smirnov 5% Critical Value	0.287	95% BCA Bootstrap UCL	3.511
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	5.545
		97.5% Chebyshev(Mean, Sd) UCL	6.968
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	9.764
95% Approximate Gamma UCL	4.856		
95% Adjusted Gamma UCL	5.78		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	9.764
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
INDENO(1,2,3-CD)PYRENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C29

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	3
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.589	Mean of log Data	-0.0753
Median	0.5	SD of log Data	1.005
SD	1.952		
Coefficient of Variation	1.228		
Skewness	1.548		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.598	Shapiro Wilk Test Statistic	0.65
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2.799	95% H-UCL	4.988
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3.585
95% Adjusted-CLT UCL	3.018	97.5% Chebyshev (MVUE) UCL	4.519
95% Modified-t UCL	2.855	99% Chebyshev (MVUE) UCL	6.353
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.784	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.027		
nu star	14.11		
Approximate Chi Square Value (.05)	6.645	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	2.659
Adjusted Chi Square Value	5.602	95% Jackknife UCL	2.799
		95% Standard Bootstrap UCL	2.536
Anderson-Darling Test Statistic	1.695	95% Bootstrap-t UCL	6.629
Anderson-Darling 5% Critical Value	0.742	95% Hall's Bootstrap UCL	6.249
Kolmogorov-Smirnov Test Statistic	0.41	95% Percentile Bootstrap UCL	2.589
Kolmogorov-Smirnov 5% Critical Value	0.287	95% BCA Bootstrap UCL	2.678
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.424
		97.5% Chebyshev(Mean, Sd) UCL	5.651
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.062
95% Approximate Gamma UCL	3.373		
95% Adjusted Gamma UCL	4.002		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.062
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
PHENANTHRENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C30

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	4
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	5	Maximum of Log Data	1.609
Mean	1.856	Mean of log Data	0.115
Median	0.5	SD of log Data	1.043
SD	1.959		
Coefficient of Variation	1.056		
Skewness	1.089		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.71	Shapiro Wilk Test Statistic	0.741
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3.07	95% H-UCL	6.775
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	4.58
95% Adjusted-CLT UCL	3.183	97.5% Chebyshev (MVUE) UCL	5.792
95% Modified-t UCL	3.109	99% Chebyshev (MVUE) UCL	8.171
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.828	Data do not follow a Discernable Distribution (0.05)	
Theta Star	2.241		
nu star	14.91		
Approximate Chi Square Value (.05)	7.196	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	2.93
Adjusted Chi Square Value	6.102	95% Jackknife UCL	3.07
		95% Standard Bootstrap UCL	2.835
Anderson-Darling Test Statistic	1.161	95% Bootstrap-t UCL	4.027
Anderson-Darling 5% Critical Value	0.741	95% Hall's Bootstrap UCL	2.803
Kolmogorov-Smirnov Test Statistic	0.346	95% Percentile Bootstrap UCL	2.856
Kolmogorov-Smirnov 5% Critical Value	0.286	95% BCA Bootstrap UCL	3
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4.702
		97.5% Chebyshev(Mean, Sd) UCL	5.934
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	8.353
95% Approximate Gamma UCL	3.844		
95% Adjusted Gamma UCL	4.533		
Potential UCL to Use		Use 99% Chebyshev (Mean, Sd) UCL	8.353
Recommended UCL exceeds the maximum observation			

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
PYRENE

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C31

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	5
Raw Statistics		Log-transformed Statistics	
Minimum	0.5	Minimum of Log Data	-0.693
Maximum	15.9	Maximum of Log Data	2.766
Mean	3.544	Mean of log Data	0.501
Median	1.4	SD of log Data	1.3
SD	4.993		
Coefficient of Variation	1.409		
Skewness	2.283		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.676	Shapiro Wilk Test Statistic	0.852
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	6.64	95% H-UCL	24.45
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.865
95% Adjusted-CLT UCL	7.636	97.5% Chebyshev (MVUE) UCL	12.69
95% Modified-t UCL	6.851	99% Chebyshev (MVUE) UCL	18.25
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.593	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5.975		
nu star	10.68		
Approximate Chi Square Value (.05)	4.37	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	6.282
Adjusted Chi Square Value	3.559	95% Jackknife UCL	6.64
		95% Standard Bootstrap UCL	6.105
Anderson-Darling Test Statistic	0.675	95% Bootstrap-t UCL	10.88
Anderson-Darling 5% Critical Value	0.751	95% Hall's Bootstrap UCL	15.26
Kolmogorov-Smirnov Test Statistic	0.26	95% Percentile Bootstrap UCL	6.256
Kolmogorov-Smirnov 5% Critical Value	0.289	95% BCA Bootstrap UCL	7.467
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	10.8
		97.5% Chebyshev(Mean, Sd) UCL	13.94
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	20.11
95% Approximate Gamma UCL	8.661		
95% Adjusted Gamma UCL	10.63		
Potential UCL to Use		Use 95% Approximate Gamma UCL	8.661

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Groundwater Data
BARIUM

User Selected Options	
From File	WorkSheet.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C32

General Statistics			
Number of Valid Samples	9	Number of Unique Samples	9
Raw Statistics		Log-transformed Statistics	
Minimum	25.9	Minimum of Log Data	3.254
Maximum	193	Maximum of Log Data	5.263
Mean	105.8	Mean of log Data	4.473
Median	89	SD of log Data	0.69
SD	62.1		
Coefficient of Variation	0.587		
Skewness	0.214		
Relevant UCL Statistics			
Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.9	Shapiro Wilk Test Statistic	0.918
Shapiro Wilk Critical Value	0.829	Shapiro Wilk Critical Value	0.829
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	144.3	95% H-UCL	211.5
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	218.4
95% Adjusted-CLT UCL	141.4	97.5% Chebyshev (MVUE) UCL	266.3
95% Modified-t UCL	144.5	99% Chebyshev (MVUE) UCL	360.3
Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.951	Data appear Normal at 5% Significance Level	
Theta Star	54.23		
nu star	35.11		
Approximate Chi Square Value (.05)	22.55	Nonparametric Statistics	
Adjusted Level of Significance	0.0231	95% CLT UCL	139.8
Adjusted Chi Square Value	20.46	95% Jackknife UCL	144.3
		95% Standard Bootstrap UCL	138.2
Anderson-Darling Test Statistic	0.398	95% Bootstrap-t UCL	148.2
Anderson-Darling 5% Critical Value	0.727	95% Hall's Bootstrap UCL	134.1
Kolmogorov-Smirnov Test Statistic	0.186	95% Percentile Bootstrap UCL	136.5
Kolmogorov-Smirnov 5% Critical Value	0.282	95% BCA Bootstrap UCL	136.5
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	196
		97.5% Chebyshev(Mean, Sd) UCL	235
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	311.7
95% Approximate Gamma UCL	164.7		
95% Adjusted Gamma UCL	181.6		
Potential UCL to Use		Use 95% Student's-t UCL	144.3

All Chemical Data from the Analysis of Soil Gas Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	A10-SG 9/17/2008	A1-SG 9/16/2008	A2-SG 9/16/2008	A3-SG 9/16/2008	A4-SG 9/16/2008	A5-SG 9/17/2008	A6-SG 9/17/2008	A7-SG 9/17/2008	A8-SG 9/17/2008	A9-SG 9/17/2008	B10-SG 9/16/2008	B11-SG 9/16/2008	B12-SG 9/17/2008	B2-SG 9/16/2008
Volatile Organics (ppbV)														
1,1-Dichloroethene	5 U	0.5 U	0.92	0.5 U	0.5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.5 U
cis-1,2-Dichloroethene	5 U	0.5 U	0.5 U	0.5 U	1.7	920	33	4900	13	5 U	5 U	5 U	8.6	0.5 U
Tetrachloroethene	12	23	14	16	3.5	53	17	6.5	5 U	5 U	590	61	69	6.3
trans-1,2-Dichloroethene	5 U	0.5 U	0.5 U	0.5 U	0.5 U	34	16	330	5 U	5 U	5 U	5 U	5 U	0.5 U
Trichloroethene	190	450	12	15	150	56000	14000	63000	210	150	1600	440	8300	88
Vinyl Chloride	50 U	5 U	5 U	5 U	5 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	5 U

All Chemical Data from the Analysis of Soil Gas Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	B3-SG 9/16/2008	B4-SG 9/16/2008	B5-SG 9/16/2008	B6-SG 9/17/2008	B7-SG 9/16/2008	B8-SG 9/16/2008	B9-SG 9/17/2008	C10-SG 9/16/2008	C11-SG 9/16/2008	C12-SG 9/16/2008	C1-SG 9/16/2008	C2-SG 9/17/2008	C3-SG 9/16/2008	C4-SG 9/16/2008
Volatile Organics (ppbV)														
1,1-Dichloroethene	0.5 U	5 U	5 U	5 U	5 U	17	5 U	5 U	5 U	5 U	0.5 U	5 U	0.5 U	5 U
cis-1,2-Dichloroethene	0.5 U	160	73	2900	170	19000	23000	5 U	5 U	5 U	0.5 U	5 U	4.2	19
Tetrachloroethene	46	46	50	48	71	140	26	5 U	59	14	0.5 U	15	18	5 U
trans-1,2-Dichloroethene	0.5 U	5.3	5 U	220	19	300	440	5 U	5 U	5 U	0.5 U	5 U	0.5 U	5 U
Trichloroethene	700	2000	190	40000	30000	160000 D	66000	1100	2200	350	1.3	200	560	73
Vinyl Chloride	5 U	50 U	50 U	50 U	50 U	50 U	140	50 U	50 U	50 U	5 U	50 U	5 U	50 U

All Chemical Data from the Analysis of Soil Gas Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	C5-SG 9/16/2008	C6-SG 9/16/2008	C7-SG 9/16/2008	C8-SG 9/16/2008	C9-SG 9/17/2008	D10-SG 9/16/2008	D12-SG 9/16/2008	D1-SG 9/16/2008	D2-SG 9/16/2008	D3-SG 9/16/2008	D5-SG 9/16/2008	D6-SG 9/17/2008	D7-SG 9/16/2008	D8-SG 9/16/2008
Volatile Organics (ppbV)														
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	780	11	150	1300	5 U	1500	33	50	8.5	0.5 U	510	2500	32	120
Tetrachloroethene	70	23	27	78	6.6	660	50	15	34	4.7	94	25	16	15
trans-1,2-Dichloroethene	20	1.1	12	82	5 U	66	5 U	57	3.4	0.5 U	22	69	12	36
Trichloroethene	20000 E	11000 E	25000 E	61000	410	20000	4800	15000 D	12000 D	270	11000 E	65000	13000	6500
Vinyl Chloride	5 U	5 U	5 U	50 U	50 U	50 U	50 U	5 U	5 U	5 U	5 U	50 U	50 U	50 U

All Chemical Data from the Analysis of Soil Gas Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	E10-SG 9/16/2008	E11-SG 9/16/2008	E12-SG 9/16/2008	E1-SG 9/16/2008	E3-SG 9/16/2008	E4-SG 9/16/2008	E5-SG 9/17/2008	E7-SG 9/16/2008	E8-SG 9/16/2008	E9-SG 9/17/2008
Volatile Organics (ppbV)										
1,1-Dichloroethene	5 U	5 U	5 U	0.5 U	0.5 U	0.5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	190	27	34	0.72	1.9	0.5 U	9.9	620	2400	1100
Tetrachloroethene	110	55	310	9.3	580	48	5 U	9.9	77	1400
trans-1,2-Dichloroethene	10	5 U	5 U	0.61	0.67	0.5 U	5 U	38	45	29
Trichloroethene	19000	9100	6100	7600	2000	74	230	11000	5900	220000 D
Vinyl Chloride	50 U	50 U	50 U	5 U	5 U	5 U	50 U	50 U	50 U	50 U

ppbV - parts per billion by volume

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area A through E
1,1-Dichloroethene

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\Database\ProUCL-SG-A-E.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethene

General Statistics

Number of Valid Samples	52	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	50
		Percent Non-Detects	96.15%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.92	Minimum Detected	-0.0834
Maximum Detected	17	Maximum Detected	2.833
Mean of Detected	8.96	Mean of Detected	1.375
SD of Detected	11.37	SD of Detected	2.062
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	51
Number treated as Detected	1
Single DL Non-Detect Percentage	98.08%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	1	Lilliefors Test Statistic	1
5% Lilliefors Critical Value	N/A	5% Lilliefors Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.013	Mean	0.181
SD	2.37	SD	1.144
95% DL/2 (t) UCL	2.563	95% H-Stat (DL/2) UCL	3.294
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	0.356	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	1.229
5% K-S Critical Value	N/A	SD	2.208
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.433
		95% KM (t) UCL	1.955
Assuming Gamma Distribution		95% KM (z) UCL	1.942
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	11.69
Minimum	N/A	95% KM (bootstrap t) UCL	1.8E+308
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	3.117
SD	N/A	97.5% KM (Chebyshev) UCL	3.934
k star	N/A	99% KM (Chebyshev) UCL	5.538
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	99% KM (Chebyshev) UCL	5.538
95% Gamma Approximate UCL	N/A		
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area A through E
cis-1,2-Dichloroethene

cis-1,2-Dichloroethene

General Statistics

Number of Valid Samples	52	Number of Detected Data	35
Number of Unique Samples	34	Number of Non-Detect Data	17
		Percent Non-Detects	32.69%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.72	Minimum Detected	-0.329
Maximum Detected	23000	Maximum Detected	10.04
Mean of Detected	1788	Mean of Detected	4.775
SD of Detected	4941	SD of Detected	2.668
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	21
Number treated as Detected	31
Single DL Non-Detect Percentage	40.38%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.401	Lilliefors Test Statistic	0.972
5% Lilliefors Critical Value	0.934	5% Lilliefors Critical Value	0.934
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1204	Mean	3.159
SD	4122	SD	3.266
95% DL/2 (t) UCL	2162	95% H-Stat (DL/2) UCL	35598
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	2.749
		SD in Log Scale	3.786
		Mean in Original Scale	1204
		SD in Original Scale	4122
		95% Percentile Bootstrap UCL	2246
		95% BCA Bootstrap UCL	2577
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.257	**Data appear Lognormal at 5% Significance Level**	
Theta Star	6963		
nu star	17.98		
A-D Test Statistic	1.672	**Nonparametric Statistics**	
5% A-D Critical Value	0.874	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.874	Mean	1204
5% K-S Critical Value	0.163	SD	4082
Data not Gamma Distributed at 5% Significance Level		SE of Mean	574.3
		95% KM (t) UCL	2166
Assuming Gamma Distribution		95% KM (z) UCL	2148
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2161
Minimum	0	95% KM (bootstrap t) UCL	5351
Maximum	23000	95% KM (BCA) UCL	2268
Mean	1207	95% KM (Percentile Bootstrap) UCL	2269
Median	23	95% KM (Chebyshev) UCL	3707
SD	4121	97.5% KM (Chebyshev) UCL	4791
k star	0.09	99% KM (Chebyshev) UCL	6918
Theta star	13411		
Nu star	9.359	**Potential UCLs to Use**	
AppChi2	3.545	99% KM (Chebyshev) UCL	6918
95% Gamma Approximate UCL	3186		
95% Adjusted Gamma UCL	3280		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area A through E
Tetrachloroethene

Tetrachloroethene

General Statistics

Number of Valid Samples	52	Number of Detected Data	46
Number of Unique Samples	38	Number of Non-Detect Data	6
		Percent Non-Detects	11.54%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	3.5	Minimum Detected	1.253
Maximum Detected	1400	Maximum Detected	7.244
Mean of Detected	111.3	Mean of Detected	3.628
SD of Detected	245.3	SD of Detected	1.334
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	5	Maximum Non-Detect	1.609
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	8
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	44
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	15.38%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Lilliefors Test Statistic	0.456	Lilliefors Test Statistic	0.945
5% Lilliefors Critical Value	0.945	5% Lilliefors Critical Value	0.945
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	98.74	Mean	3.271
SD	233.1	SD	1.629
95% DL/2 (t) UCL	152.9	95% H-Stat (DL/2) UCL	157.1
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	70.99	Mean in Log Scale	3.298
SD	256.9	SD in Log Scale	1.566
95% MLE (t) UCL	130.7	Mean in Original Scale	98.78
95% MLE (Tiku) UCL	127.7	SD in Original Scale	233
		95% Percentile Bootstrap UCL	157.6
		95% BCA Bootstrap UCL	175.6
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.551	**Data appear Lognormal at 5% Significance Level**	
Theta Star	202.2		
nu star	50.65		
A-D Test Statistic	3.461	**Nonparametric Statistics**	
5% A-D Critical Value	0.807	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.807	Mean	98.94
5% K-S Critical Value	0.137	SD	230.7
Data not Gamma Distributed at 5% Significance Level		SE of Mean	32.35
		95% KM (t) UCL	153.1
Assuming Gamma Distribution		95% KM (z) UCL	152.1
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	153
Minimum	0	95% KM (bootstrap t) UCL	202.1
Maximum	1400	95% KM (BCA) UCL	162.5
Mean	98.5	95% KM (Percentile Bootstrap) UCL	157
Median	25.5	95% KM (Chebyshev) UCL	240
SD	233.2	97.5% KM (Chebyshev) UCL	301
k star	0.197	99% KM (Chebyshev) UCL	420.8
Theta star	499.3		
Nu star	20.52	**Potential UCLs to Use**	
AppChi2	11.23	95% KM (Chebyshev) UCL	240
95% Gamma Approximate UCL	179.9		
95% Adjusted Gamma UCL	183.1		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area A through E
trans-1,2-Dichloroethene

trans-1,2-Dichloroethene

General Statistics

Number of Valid Samples	52	Number of Detected Data	25
Number of Unique Samples	24	Number of Non-Detect Data	27
		Percent Non-Detects	51.92%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.61	Minimum Detected	-0.494
Maximum Detected	440	Maximum Detected	6.087
Mean of Detected	74.72	Mean of Detected	3.158
SD of Detected	117.1	SD of Detected	1.777
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	31
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	21
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	59.62%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Lilliefors Test Statistic	0.638	Lilliefors Test Statistic	0.951
5% Lilliefors Critical Value	0.918	5% Lilliefors Critical Value	0.918
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	36.79	Mean	1.551
SD	88.39	SD	2.14
95% DL/2 (t) UCL	57.32	95% H-Stat (DL/2) UCL	105.6
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	0.83
		SD in Log Scale	2.821
		Mean in Original Scale	36.29
		SD in Original Scale	88.59
		95% Percentile Bootstrap UCL	58.27
		95% BCA Bootstrap UCL	64.21

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.504	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	148.2		
nu star	25.21		
A-D Test Statistic	0.621	**Nonparametric Statistics**	
5% A-D Critical Value	0.803	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.803	Mean	36.32
5% K-S Critical Value	0.184	SD	87.72
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	12.42
		95% KM (t) UCL	57.12
Assuming Gamma Distribution		95% KM (z) UCL	56.74
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	56.87
Minimum	0.61	95% KM (bootstrap t) UCL	69.38
Maximum	440	95% KM (BCA) UCL	59.37
Mean	75.09	95% KM (Percentile Bootstrap) UCL	57.73
Median	67.69	95% KM (Chebyshev) UCL	90.44
SD	80.62	97.5% KM (Chebyshev) UCL	113.9
k star	0.982	99% KM (Chebyshev) UCL	159.9
Theta star	76.48		
Nu star	102.1	**Potential UCLs to Use**	
AppChi2	79.79	95% KM (t) UCL	57.12
95% Gamma Approximate UCL	96.08		
95% Adjusted Gamma UCL	96.77		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area A through E
Trichloroethene

Trichloroethene

General Statistics

Number of Valid Samples	52	Number of Unique Samples	46

Raw Statistics		Log-transformed Statistics	
Minimum	1.3	Minimum of Log Data	0.262
Maximum	220000	Maximum of Log Data	12.3
Mean	19115	Mean of log Data	7.746
Median	5350	SD of log Data	2.671
SD	39644		
Coefficient of Variation	2.074		
Skewness	3.648		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Lilliefors Test Statistic	0.315	Lilliefors Test Statistic	0.137
Lilliefors Critical Value	0.123	Lilliefors Critical Value	0.123
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	28325	95% H-UCL	433682
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	222769
95% Adjusted-CLT UCL	31129	97.5% Chebyshev (MVUE) UCL	292042
95% Modified-t UCL	28788	99% Chebyshev (MVUE) UCL	428116

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.317	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	60335		
nu star	32.95		
Approximate Chi Square Value (.05)	20.83	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0454	95% CLT UCL	28158
Adjusted Chi Square Value	20.55	95% Jackknife UCL	28325
		95% Standard Bootstrap UCL	27987
Anderson-Darling Test Statistic	0.822	95% Bootstrap-t UCL	35213
Anderson-Darling 5% Critical Value	0.857	95% Hall's Bootstrap UCL	69244
Kolmogorov-Smirnov Test Statistic	0.118	95% Percentile Bootstrap UCL	29272
Kolmogorov-Smirnov 5% Critical Value	0.133	95% BCA Bootstrap UCL	32025
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	43079
		97.5% Chebyshev(Mean, Sd) UCL	53448
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	73816
95% Approximate Gamma UCL	30242		
95% Adjusted Gamma UCL	30647		

Potential UCL to Use		Use 95% Adjusted Gamma UCL	30647

All Chemical Data from the Analysis of Soil Gas (Summa) Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	A2-24-SG 9/18/2008	A5-24-SG 9/18/2008	A8-24-SG 9/18/2008	B11-24-SG 9/18/2008	B2-24-SG 9/18/2008	B5-24-SG 9/18/2008	B8-24-SG 9/18/2008	C11-24-SG 9/18/2008	C2-24-SG 9/18/2008	C5-24-SG 9/18/2008	C8-24-SG 9/18/2008	D10-24-SG 9/18/2008	D1-24-SG 9/18/2008
Volatile Organics (ppbV)													
1,1-Dichloroethene	0.05 U	10 U	0.5 U	0.1 U	0.05 U	0.05 U	11	0.25 U	0.05 U	2 U	10 U	2 U	2 U
cis-1,2-Dichloroethene	0.05 U	530	28	0.1 U	0.05	93	10000	0.25 U	0.05 U	850	1400	1200	63
Tetrachloroethene	12	160	0.5 U	48	0.1	46	160	57	14	69	370	850	17 U
trans-1,2-Dichloroethene	0.05 U	19	0.5 U	0.1 U	0.05 U	0.22	180	0.25 U	0.05 U	19	76	79	69
Trichloroethene	9.7	27000	160	420	0.78	210	110000	1400	89	11000	42000	14000	9700
Vinyl Chloride	0.05 U	10 U	0.5 U	0.1 U	0.05 U	0.05 U	10 U	0.25 U	0.05 U	2 U	10 U	2 U	2 U

All Chemical Data from the Analysis of Soil Gas (Summa) Samples
Inside CBI Building - Area A through E
ACF Carter Carburetor Site, St. Louis, MO

Parameter	D4-24-SG 9/18/2008	D7-24-SG 9/18/2008	E10-24-SG 9/18/2008	E11-24-SG 9/18/2008	E12-24-SG 9/18/2008	E3-24-SG 9/18/2008	E7-24-SG 9/18/2008	E9-24-SG 9/18/2008
Volatile Organics (ppbV)								
1,1-Dichloroethene	0.19	1 U	2 U	1 U	1 U	0.25 U	0.05 U	2 U
cis-1,2-Dichloroethene	20	34	230	28	41	1.7	14	220
Tetrachloroethene	0.45	16	110	49	330	390	0.17	240
trans-1,2-Dichloroethene	0.4	11	11	2.1	3.1	0.5	0.72	5.9
Trichloroethene	19	7000	10000	4500	3600	1200	210	18000
Vinyl Chloride	71	1 U	2 U	1 U	1 U	0.25 U	0.05 U	2 U

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area A through E
1,1-Dichloroethene

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\Soil Gas Evaluation\ProUCL-SG-A-E-Summa.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethene

General Statistics

Number of Valid Samples	21	Number of Detected Data	2
Number of Unique Samples	2	Number of Non-Detect Data	19
		Percent Non-Detects	90.48%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.19	Minimum Detected	-1.661
Maximum Detected	11	Maximum Detected	2.398
Mean of Detected	5.595	Mean of Detected	0.369
SD of Detected	7.644	SD of Detected	2.87
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	10	Maximum Non-Detect	2.303

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	20
Number treated as Detected	1
Single DL Non-Detect Percentage	95.24%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.351	Mean	-1.196
SD	2.632	SD	1.906
95% DL/2 (t) UCL	2.341	95% H-Stat (DL/2) UCL	9.115
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	N/A	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	N/A		
nu star	N/A		
A-D Test Statistic	0.355	**Nonparametric Statistics**	
5% A-D Critical Value	N/A	Kaplan-Meier (KM) Method	
K-S Test Statistic	N/A	Mean	0.705
5% K-S Critical Value	N/A	SD	2.302
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.71
		95% KM (t) UCL	1.93
Assuming Gamma Distribution		95% KM (z) UCL	1.873
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	7.86
Minimum	N/A	95% KM (bootstrap t) UCL	1.8E+308
Maximum	N/A	95% KM (BCA) UCL	N/A
Mean	N/A	95% KM (Percentile Bootstrap) UCL	N/A
Median	N/A	95% KM (Chebyshev) UCL	3.801
SD	N/A	97.5% KM (Chebyshev) UCL	5.141
k star	N/A	99% KM (Chebyshev) UCL	7.774
Theta star	N/A		
Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	99% KM (Chebyshev) UCL	7.774
95% Gamma Approximate UCL	N/A		
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area A through E
cis-1,2-Dichloroethene

cis-1,2-Dichloroethene

General Statistics

Number of Valid Samples	21	Number of Detected Data	17
Number of Unique Samples	16	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	10000	Maximum Detected	9.21
Mean of Detected	867.8	Mean of Detected	4.303
SD of Detected	2394	SD of Detected	2.825
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	0.25	Maximum Non-Detect	-1.386

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	5
Number treated as Detected	16
Single DL Non-Detect Percentage	23.81%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.393	Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	702.5	Mean	2.89
SD	2170	SD	3.921
95% DL/2 (t) UCL	1519	95% H-Stat (DL/2) UCL	15346375
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	246.2	Mean in Log Scale	3.144
SD	2511	SD in Log Scale	3.531
95% MLE (t) UCL	1191	Mean in Original Scale	702.6
95% MLE (Tiku) UCL	1188	SD in Original Scale	2170
		95% Percentile Bootstrap UCL	1620
		95% BCA Bootstrap UCL	2236
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.272	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	3191		
nu star	9.248		
A-D Test Statistic	0.763	**Nonparametric Statistics**	
5% A-D Critical Value	0.849	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.849	Mean	702.5
5% K-S Critical Value	0.228	SD	2117
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	476.3
		95% KM (t) UCL	1524
Assuming Gamma Distribution		95% KM (z) UCL	1486
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1519
Minimum	0	95% KM (bootstrap t) UCL	4916
Maximum	10000	95% KM (BCA) UCL	1615
Mean	702.5	95% KM (Percentile Bootstrap) UCL	1621
Median	34	95% KM (Chebyshev) UCL	2779
SD	2170	97.5% KM (Chebyshev) UCL	3677
k star	0.129	99% KM (Chebyshev) UCL	5442
Theta star	5434		
Nu star	5.43	**Potential UCLs to Use**	
AppChi2	1.356	95% KM (Chebyshev) UCL	2779
95% Gamma Approximate UCL	2814		
95% Adjusted Gamma UCL	3159		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area A through E
Tetrachloroethene

Tetrachloroethene

General Statistics

Number of Valid Samples	21	Number of Detected Data	19
Number of Unique Samples	18	Number of Non-Detect Data	2
		Percent Non-Detects	9.52%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	850	Maximum Detected	6.745
Mean of Detected	153.8	Mean of Detected	3.56
SD of Detected	211.8	SD of Detected	2.598
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	17	Maximum Non-Detect	2.833

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	8
Number treated as Detected	13
Single DL Non-Detect Percentage	38.10%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.725	Shapiro Wilk Test Statistic	0.855
5% Shapiro Wilk Critical Value	0.901	5% Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	139.5	Mean	3.257
SD	205.9	SD	2.702
95% DL/2 (t) UCL	217	95% H-Stat (DL/2) UCL	23626
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	63.88	Mean in Log Scale	3.252
SD	282.5	SD in Log Scale	2.655
95% MLE (t) UCL	170.2	Mean in Original Scale	139.3
95% MLE (Tiku) UCL	181.5	SD in Original Scale	206.1
		95% Percentile Bootstrap UCL	213.4
		95% BCA Bootstrap UCL	235.3
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.405	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	379.6		
nu star	15.4		
A-D Test Statistic	0.284	**Nonparametric Statistics**	
5% A-D Critical Value	0.815	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.815	Mean	139.4
5% K-S Critical Value	0.212	SD	201
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	45.07
		95% KM (t) UCL	217.2
Assuming Gamma Distribution		95% KM (z) UCL	213.6
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	217
Minimum	0	95% KM (bootstrap t) UCL	261.8
Maximum	850	95% KM (BCA) UCL	213
Mean	139.1	95% KM (Percentile Bootstrap) UCL	219.8
Median	49	95% KM (Chebyshev) UCL	335.9
SD	206.2	97.5% KM (Chebyshev) UCL	420.9
k star	0.203	99% KM (Chebyshev) UCL	587.9
Theta star	685.9		
Nu star	8.52	**Potential UCLs to Use**	
AppChi2	3.039	95% KM (Chebyshev) UCL	335.9
95% Gamma Approximate UCL	390		
95% Adjusted Gamma UCL	424.4		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area A through E
trans-1,2-Dichloroethene

trans-1,2-Dichloroethene

General Statistics

Number of Valid Samples	21	Number of Detected Data	15
Number of Unique Samples	13	Number of Non-Detect Data	6
		Percent Non-Detects	28.57%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.22	Minimum Detected	-1.514
Maximum Detected	180	Maximum Detected	5.193
Mean of Detected	31.8	Mean of Detected	1.934
SD of Detected	50.02	SD of Detected	2.141
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	8
Number treated as Detected	13
Single DL Non-Detect Percentage	38.10%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.678	Shapiro Wilk Test Statistic	0.947
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	22.74	Mean	0.547
SD	44.35	SD	2.916
95% DL/2 (t) UCL	39.43	95% H-Stat (DL/2) UCL	4498
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	5.114	Mean in Log Scale	0.532
SD	60.48	SD in Log Scale	2.919
95% MLE (t) UCL	27.88	Mean in Original Scale	22.73
95% MLE (Tiku) UCL	30.27	SD in Original Scale	44.35
		95% Percentile Bootstrap UCL	39.34
		95% BCA Bootstrap UCL	44.83

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.386	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	82.38		
nu star	11.58		
A-D Test Statistic	0.407	**Nonparametric Statistics**	
5% A-D Critical Value	0.809	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.809	Mean	22.78
5% K-S Critical Value	0.236	SD	43.26
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	9.771
		95% KM (t) UCL	39.63
Assuming Gamma Distribution		95% KM (z) UCL	38.85
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	39.42
Minimum	0	95% KM (bootstrap t) UCL	58.92
Maximum	180	95% KM (BCA) UCL	41.33
Mean	22.71	95% KM (Percentile Bootstrap) UCL	39.6
Median	2.1	95% KM (Chebyshev) UCL	65.37
SD	44.36	97.5% KM (Chebyshev) UCL	83.8
k star	0.122	99% KM (Chebyshev) UCL	120
Theta star	186.2		
Nu star	5.124	**Potential UCLs to Use**	
AppChi2	1.21	95% KM (Chebyshev) UCL	65.37
95% Gamma Approximate UCL	96.19		
95% Adjusted Gamma UCL	108.5		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area A through E
Trichloroethene

Trichloroethene

General Statistics

Number of Valid Samples	21	Number of Unique Samples	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.78	Minimum of Log Data	-0.248
Maximum	110000	Maximum of Log Data	11.61
Mean	12406	Mean of log Data	7.169
Median	3600	SD of log Data	3.067
SD	24781		
Coefficient of Variation	1.998		
Skewness	3.413		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.538	Shapiro Wilk Test Statistic	0.94
Shapiro Wilk Critical Value	0.908	Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	21732	95% H-UCL	8932064
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	273085
95% Adjusted-CLT UCL	25604	97.5% Chebyshev (MVUE) UCL	364909
95% Modified-t UCL	22404	99% Chebyshev (MVUE) UCL	545280
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.293	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	42343		
nu star	12.31		
Approximate Chi Square Value (.05)	5.429	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0383	95% CLT UCL	21300
Adjusted Chi Square Value	5.081	95% Jackknife UCL	21732
		95% Standard Bootstrap UCL	21056
Anderson-Darling Test Statistic	0.213	95% Bootstrap-t UCL	39192
Anderson-Darling 5% Critical Value	0.845	95% Hall's Bootstrap UCL	55710
Kolmogorov-Smirnov Test Statistic	0.11	95% Percentile Bootstrap UCL	21963
Kolmogorov-Smirnov 5% Critical Value	0.205	95% BCA Bootstrap UCL	27554
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	35977
		97.5% Chebyshev(Mean, Sd) UCL	46177
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	66211
95% Approximate Gamma UCL	28120		
95% Adjusted Gamma UCL	30046		
Potential UCL to Use		Use 95% Adjusted Gamma UCL	30046

All Chemical Data from the Analysis of Soil Gas Samples
Inside CBI Building - Area F through H
ACF Carter Carburetor Site, St. Louis, MO

Parameter	F1-SG 9/16/2008	F2-SG 9/16/2008	F3-SG 9/17/2008	F4-SG 9/16/2008	G1-SG 9/16/2008	G2-SG 9/16/2008	G3-SG 9/16/2008	G4-SG 9/16/2008	H1-SG 9/16/2008	H2-SG 9/16/2008	H3-SG 9/16/2008	H4-SG 9/16/2008
Volatile Organics (ppbV)												
1,1-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Tetrachloroethene	5.2	14	50	8.8	0.63	2.2	24	8.7	0.5 U	1.2	0.5 U	3.8
trans-1,2-Dichloroethene	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Trichloroethene	15	29	56	2.6	27	1400	35	0.91	0.5 U	1.7	0.6	4.4
Vinyl Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U

ppbV - parts per billion by volume

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area F through H
Tetrachloroethene

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\Database\ProUCL-SG-F-H.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Number of Valid Samples	12	Number of Detected Data	10
Number of Unique Samples	10	Number of Non-Detect Data	2
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.63	Minimum Detected	-0.462
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	11.85	Mean of Detected	1.756
SD of Detected	15.16	SD of Detected	1.346
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.74	Shapiro Wilk Test Statistic	0.989
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	9.919	Mean	1.232
SD	14.44	SD	1.726
95% DL/2 (t) UCL	17.4	95% H-Stat (DL/2) UCL	53.2
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	8.276	Mean in Log Scale	1.21
SD	15.73	SD in Log Scale	1.77
95% MLE (t) UCL	16.43	Mean in Original Scale	9.916
95% MLE (Tiku) UCL	16.23	SD in Original Scale	14.44
		95% Percentile Bootstrap UCL	17.06
		95% BCA Bootstrap UCL	20.36

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.644	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	18.4		
nu star	12.88		
A-D Test Statistic	0.205	**Nonparametric Statistics**	
5% A-D Critical Value	0.754	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.754	Mean	9.983
5% K-S Critical Value	0.275	SD	13.78
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	4.193
		95% KM (t) UCL	17.51
Assuming Gamma Distribution		95% KM (z) UCL	16.88
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	17.39
Minimum	0	95% KM (bootstrap t) UCL	29.25
Maximum	50	95% KM (BCA) UCL	18.04
Mean	9.878	95% KM (Percentile Bootstrap) UCL	17.36
Median	4.5	95% KM (Chebyshev) UCL	28.26
SD	14.47	97.5% KM (Chebyshev) UCL	36.17
k star	0.187	99% KM (Chebyshev) UCL	51.7
Theta star	52.79		
Nu star	4.491	**Potential UCLs to Use**	
AppChi2	0.925	95% KM (Chebyshev) UCL	28.26
95% Gamma Approximate UCL	47.97		
95% Adjusted Gamma UCL	62.7		

Note: DL/2 is not a recommended method.

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas - Inside CBI Building - Area F through H
Trichloroethene

Trichloroethene

General Statistics

Number of Valid Samples	12	Number of Detected Data	11
Number of Unique Samples	11	Number of Non-Detect Data	1
		Percent Non-Detects	8.33%
Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.6	Minimum Detected	-0.511
Maximum Detected	1400	Maximum Detected	7.244
Mean of Detected	142.9	Mean of Detected	2.414
SD of Detected	417.3	SD of Detected	2.245
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.381	Shapiro Wilk Test Statistic	0.935
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	131	Mean	2.098
SD	400	SD	2.405
95% DL/2 (t) UCL	338.4	95% H-Stat (DL/2) UCL	5545
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	107.2	Mean in Log Scale	1.962
SD	404.2	SD in Log Scale	2.653
95% MLE (t) UCL	316.7	Mean in Original Scale	131
95% MLE (Tiku) UCL	298.5	SD in Original Scale	400
		95% Percentile Bootstrap UCL	359.3
		95% BCA Bootstrap UCL	476.8
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	0.26	**Data appear Lognormal at 5% Significance Level**	
Theta Star	549.1		
nu star	5.726		
A-D Test Statistic	1.248	**Nonparametric Statistics**	
5% A-D Critical Value	0.83	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.83	Mean	131.1
5% K-S Critical Value	0.277	SD	383
Data not Gamma Distributed at 5% Significance Level		SE of Mean	116
		95% KM (t) UCL	339.3
Assuming Gamma Distribution		95% KM (z) UCL	321.8
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	338.4
Minimum	0	95% KM (bootstrap t) UCL	3697
Maximum	1400	95% KM (BCA) UCL	360.9
Mean	131	95% KM (Percentile Bootstrap) UCL	360.1
Median	9.7	95% KM (Chebyshev) UCL	636.5
SD	400	97.5% KM (Chebyshev) UCL	855.2
k star	0.184	99% KM (Chebyshev) UCL	1285
Theta star	710.9		
Nu star	4.423	**Potential UCLs to Use**	
AppChi2	0.896	99% KM (Chebyshev) UCL	1285
95% Gamma Approximate UCL	647		
95% Adjusted Gamma UCL	848.1		

Note: DL/2 is not a recommended method.

All Chemical Data from the Analysis of Soil Gas (Summa) Samples
Inside CBI Building - Area F through H
ACF Carter Carburetor Site, St. Louis, MO

Parameter	F1-24-SG 9/18/2008	F2-24-SG 9/18/2008	F3-24-SG 9/18/2008	G2-24-SG 9/18/2008	H1-24-SG 9/18/2008	H4-24-SG 9/18/2008
Volatile Organics (ppbV)						
1,1-Dichloroethene	0.05 U	0.05 U	0.05 U	0.1 U	0.05 U	0.05 U
cis-1,2-Dichloroethene	0.05 U	0.05 U	0.05 U	0.12	0.05 U	0.05 U
Tetrachloroethene	4.7	11	47	1.7	0.21	2.4
trans-1,2-Dichloroethene	0.05 U	0.05	0.05 U	0.1 U	0.05 U	0.05 U
Trichloroethene	13	23	44	730	0.33	2.6
Vinyl Chloride	0.05 U	0.05 U	0.05 U	0.1 U	0.05 U	0.05 U

ppbV - parts per billion by volume

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area F through H
Tetrachloroethene

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	P:\W8-RISK\St Louis\CarterCarb\SRE\SRE Directory, Revised\Soil Gas Evaluation\ProUCL-SG-F-H-Summa.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Number of Valid Samples	6	Number of Unique Samples	6
Raw Statistics		**Log-transformed Statistics**	
Minimum	0.21	Minimum of Log Data	-1.561
Maximum	47	Maximum of Log Data	3.85
Mean	11.17	Mean of log Data	1.274
Median	3.55	SD of log Data	1.829
SD	17.96		
Coefficient of Variation	1.608		
Skewness	2.222		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.671	Shapiro Wilk Test Statistic	0.987
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	25.94	95% H-UCL	8130
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	46.31
95% Adjusted-CLT UCL	30.33	97.5% Chebyshev (MVUE) UCL	61.25
95% Modified-t UCL	27.05	99% Chebyshev (MVUE) UCL	90.6
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.386	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	28.95		
nu star	4.63		
Approximate Chi Square Value (.05)	0.985	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	23.23
Adjusted Chi Square Value	0.512	95% Jackknife UCL	25.94
		95% Standard Bootstrap UCL	22.1
Anderson-Darling Test Statistic	0.281	95% Bootstrap-t UCL	109.9
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	77.83
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL	24.35
Kolmogorov-Smirnov 5% Critical Value	0.348	95% BCA Bootstrap UCL	26.52
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	43.12
		97.5% Chebyshev(Mean, Sd) UCL	56.95
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	84.11
95% Approximate Gamma UCL	52.49		
95% Adjusted Gamma UCL	101		
Potential UCL to Use		Use 95% Approximate Gamma UCL	52.49

Recommended UCL exceeds the maximum observation

General UCL Statistics for Full Data Sets
Carter Carburetor EE/CA
Soil Gas (Summa) - Inside CBI Building - Area F through H
Trichloroethene

Trichloroethene

General Statistics

Number of Valid Samples	6	Number of Unique Samples	6

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.33	Minimum of Log Data	-1.109
Maximum	730	Maximum of Log Data	6.593
Mean	135.5	Mean of log Data	2.654
Median	18	SD of log Data	2.611
SD	291.7		
Coefficient of Variation	2.153		
Skewness	2.433		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.546	Shapiro Wilk Test Statistic	0.986
Shapiro Wilk Critical Value	0.788	Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	375.4	95% H-UCL	83846001
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	583.1
95% Adjusted-CLT UCL	457.8	97.5% Chebyshev (MVUE) UCL	781
95% Modified-t UCL	395.2	99% Chebyshev (MVUE) UCL	1170

Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.264	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	514		
nu star	3.163		
Approximate Chi Square Value (.05)	0.422	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0122	95% CLT UCL	331.4
Adjusted Chi Square Value	0.191	95% Jackknife UCL	375.4
		95% Standard Bootstrap UCL	310.9
Anderson-Darling Test Statistic	0.453	95% Bootstrap-t UCL	4227
Anderson-Darling 5% Critical Value	0.766	95% Hall's Bootstrap UCL	2403
Kolmogorov-Smirnov Test Statistic	0.295	95% Percentile Bootstrap UCL	366.3
Kolmogorov-Smirnov 5% Critical Value	0.357	95% BCA Bootstrap UCL	380.1
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	654.5
		97.5% Chebyshev(Mean, Sd) UCL	879.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1320
95% Approximate Gamma UCL	1015		
95% Adjusted Gamma UCL	2246		

Potential UCL to Use		Use 95% Adjusted Gamma UCL	2246

Recommended UCL exceeds the maximum observation

All Chemical Data from the Analysis of Soil Gas Samples
Outside CBI Building - Area LA through LC
ACF Carter Carburetor Site, St. Louis, MO

Parameter	LA1-SG 9/17/2008	LA2-SG 9/17/2008	LA3-SG 9/17/2008	LA4-SG 9/17/2008	LA5-SG 9/17/2008	LB1-SG 9/17/2008	LB2-SG 9/17/2008	LB3-SG 9/17/2008	LB4-SG 9/17/2008	LC2-SG 9/17/2008	LC3-SG 9/17/2008	LC4-SG 9/17/2008
Volatile Organics (ppbV)												
1,1-Dichloroethene	7.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,2-Dichloroethene	2600	5 U	5 U	5 U	5 U	6	5 U	5 U	5 U	5 U	5 U	5 U
Tetrachloroethene	15	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
trans-1,2-Dichloroethene	120	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Trichloroethene	66000	720	90	330	200	440	150	200	140	64	55	43
Vinyl Chloride	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U

ppbV - parts per billion by volume

Appendix B
Chemical Intake and Risk Calculations

TABLE B-1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SURFACE SOIL	EXTERIOR TO THE CBI BUILDING	INGESTION	PCB-1248	0.91	mg/kg	1.5E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-08	3.1E-06	mg/kg/day	5.0E-05	mg/kg/day	6.E-02
			EXPOSURE ROUTE TOTAL								3.E-08					6.E-02
			DERMAL	PCB-1248	0.91	mg/kg	6.3E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-08	1.3E-06	mg/kg/day	5.0E-05	mg/kg/day	3.E-02
												--				
												--				
			EXPOSURE ROUTE TOTAL								1.E-08					3.E-02
		EXPOSURE POINT TOTAL									4.E-08					9.E-02
	EXPOSURE MEDIUM TOTAL										4.E-08					9.E-02
	AIR	DUST EXTERIOR TO THE CBI BUILDING	DUST INHALATION	PCB-1248	0.91	mg/kg	5.0E-08	ug/m3	5.7E-04	(ug/m3)-1	3.E-11	1.0E-05	ug/m3	1.8E-01	ug/m3	6.E-05
			EXPOSURE ROUTE TOTAL								3.E-11					6.E-05
		EXPOSURE POINT TOTAL									3.E-11					6.E-05

TABLE B-1
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	AMBIENT VAPORS EXTERIOR TO THE CBI BUILDING	AMBIENT VAPOR INHALATIO	PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										3.E-11					6.E-05
SOIL TOTAL											**4.E-08**					**9.E-02**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**3.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
							INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
					VALUE	UNITS	VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SUBSURFACE SOIL	EXTERIOR TO THE CBI BUILDIN	INGESTION	Tetrachloroethylene	1.7	mg/kg	2.8E-08	mg/kg/day	5.4E-01	(mg/kg/day)-1	2.E-08	5.7E-06	mg/kg/day	1.0E-01	mg/kg/day	6.E-05
				PCB-1242	1.9	mg/kg	3.2E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-08	6.4E-06	mg/kg/day	5.0E-05	mg/kg/day	1.E-01
				PCB-1248	1.9	mg/kg	3.2E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-08	6.4E-06	mg/kg/day	5.0E-05	mg/kg/day	1.E-01
				PCB-1260	48.9	mg/kg	8.1E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-06	1.6E-04	mg/kg/day	5.0E-05	mg/kg/day	3.E+00
				Arsenic	21.1	mg/kg	3.5E-07	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.E-07	7.1E-05	mg/kg/day	3.0E-04	mg/kg/day	2.E-01
			EXPOSURE ROUTE TOTAL								2.E-06					4.E+00
			DERMAL	Tetrachloroethylene	1.7	mg/kg	--		5.4E-01	(mg/kg/day)-1		--		1.0E-01	mg/kg/day	
				PCB-1242	1.9	mg/kg	1.3E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-08	2.7E-06	mg/kg/day	5.0E-05	mg/kg/day	5.E-02
				PCB-1248	1.9	mg/kg	1.3E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-08	2.7E-06	mg/kg/day	5.0E-05	mg/kg/day	5.E-02
				PCB-1260	48.9	mg/kg	3.4E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	7.E-07	6.9E-05	mg/kg/day	5.0E-05	mg/kg/day	1.E+00
				Arsenic	21.1	mg/kg	3.2E-08	mg/kg/day	1.5E+00	(mg/kg/day)-1	5.E-08	6.4E-06	mg/kg/day	3.0E-04	mg/kg/day	2.E-02
												--				
												--				
			EXPOSURE ROUTE TOTAL								8.E-07					2.E+00
		EXPOSURE POINT TOTAL									3.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										3.E-06					5.E+00

TABLE B-2
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	DUST EXTERIOR TO THE CBI BUILDING	DUST INHALATION	Tetrachloroethylene	1.7	mg/kg	9.3E-08	ug/m3	5.9E-06	(ug/m3)-1	6.E-13	1.9E-05	ug/m3	2.7E+02	ug/m3	7.E-08
				PCB-1242	1.9	mg/kg	1.0E-07	ug/m3	5.7E-04	(ug/m3)-1	6.E-11	2.1E-05	ug/m3	1.8E-01	ug/m3	1.E-04
				PCB-1248	1.9	mg/kg	1.0E-07	ug/m3	5.7E-04	(ug/m3)-1	6.E-11	2.1E-05	ug/m3	1.8E-01	ug/m3	1.E-04
				PCB-1260	48.9	mg/kg	2.7E-06	ug/m3	5.7E-04	(ug/m3)-1	2.E-09	5.5E-04	ug/m3	1.8E-01	ug/m3	3.E-03
				Arsenic	21.1	mg/kg	1.2E-06	ug/m3	4.3E-03	(ug/m3)-1	5.E-09	2.4E-04	ug/m3	1.5E-02	ug/m3	2.E-02
			EXPOSURE ROUTE TOTAL								7.E-09					2.E-02
		EXPOSURE POINT TOTAL									7.E-09					2.E-02
	AIR	AMBIENT VAPORS EXTERIOR TO THE CBI BUILDING	AMBIENT VAPOR INHALATION	Tetrachloroethylene	0.41	ug/m3	4.8E-04	ug/m3	5.9E-06	(ug/m3)-1	3.E-09	9.8E-02	ug/m3	2.7E+02	ug/m3	4.E-04
				PCB-1242	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				Arsenic	NV	ug/m3	--		4.3E-03	(ug/m3)-1				1.5E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								3.E-09					4.E-04
		EXPOSURE POINT TOTAL									3.E-09					4.E-04
	EXPOSURE MEDIUM TOTAL										9.E-09					2.E-02
SOIL TOTAL											**3.E-06**					**5.E+00**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**4.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-3
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SURFACE SOIL	UNDER THE CBI BUILDING	INGESTION	PCB-1248	1.1	mg/kg	1.8E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-08	3.7E-06	mg/kg/day	5.0E-05	mg/kg/day	7.E-02
				PCB-1260	0.22	mg/kg	3.7E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	7.E-09	7.4E-07	mg/kg/day	5.0E-05	mg/kg/day	1.E-02
			EXPOSURE ROUTE TOTAL								4.E-08					9.E-02
			DERMAL	PCB-1248	1.1	mg/kg	7.7E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-08	1.6E-06	mg/kg/day	5.0E-05	mg/kg/day	3.E-02
				PCB-1260	0.22	mg/kg	1.5E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-09	3.1E-07	mg/kg/day	5.0E-05	mg/kg/day	6.E-03
												--				
												--				
			EXPOSURE ROUTE TOTAL								2.E-08					4.E-02
		EXPOSURE POINT TOTAL									6.E-08					1.E-01
	EXPOSURE MEDIUM TOTAL										6.E-08					1.E-01
	AIR	DUST AT UNDER THE CBI BUILDING	DUST INHALATION	PCB-1248	1.1	mg/kg	6.0E-08	ug/m3	5.7E-04	(ug/m3)-1	3.E-11	1.2E-05	ug/m3	1.8E-01	ug/m3	7.E-05
				PCB-1260	0.22	mg/kg	1.2E-08	ug/m3	5.7E-04	(ug/m3)-1	7.E-12	2.5E-06	ug/m3	1.8E-01	ug/m3	1.E-05
			EXPOSURE ROUTE TOTAL								4.E-11					8.E-05
		EXPOSURE POINT TOTAL									4.E-11					8.E-05

TABLE B-3
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	AMBIENT VAPORS AT UNDER THE CBI BUILDING	AMBIENT VAPOR INHALATION	PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										4.E-11					8.E-05
SOIL TOTAL											**6.E-08**					**1.E-01**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**3.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-4
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
							INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
					VALUE	UNITS	VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SUBSURFACE SOIL	UNDER THE CBI BUILDING	INGESTION	PCB-1248	1.3	mg/kg	2.2E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-08	4.4E-06	mg/kg/day	5.0E-05	mg/kg/day	9.E-02
				PCB-1260	0.2	mg/kg	3.3E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	7.E-09	6.7E-07	mg/kg/day	5.0E-05	mg/kg/day	1.E-02
			EXPOSURE ROUTE TOTAL								5.E-08					1.E-01
			DERMAL	PCB-1248	1.3	mg/kg	9.1E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-08	1.8E-06	mg/kg/day	5.0E-05	mg/kg/day	4.E-02
				PCB-1260	0.2	mg/kg	1.4E-09	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-09	2.8E-07	mg/kg/day	5.0E-05	mg/kg/day	6.E-03
												--				
												--				
			EXPOSURE ROUTE TOTAL								2.E-08					4.E-02
		EXPOSURE POINT TOTAL									7.E-08					1.E-01
	EXPOSURE MEDIUM TOTAL										7.E-08					1.E-01
	AIR	DUST UNDER THE CBI BUILDING	DUST INHALATION	PCB-1248	1.3	mg/kg	7.1E-08	ug/m3	5.7E-04	(ug/m3)-1	4.E-11	1.4E-05	ug/m3	1.8E-01	ug/m3	8.E-05
				PCB-1260	0.2	mg/kg	1.1E-08	ug/m3	5.7E-04	(ug/m3)-1	6.E-12	2.2E-06	ug/m3	1.8E-01	ug/m3	1.E-05
			EXPOSURE ROUTE TOTAL								5.E-11					9.E-05
		EXPOSURE POINT TOTAL									5.E-11					9.E-05

TABLE B-4
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC VALUE	EPC UNITS	CANCER RISK CALCULATIONS: INTAKE/EXPOSURE CONCENTRATION VALUE	INTAKE/EXPOSURE CONCENTRATION UNITS	CSF/UNIT RISK VALUE	CSF/UNIT RISK UNITS	CANCER RISK	NON-CANCER HAZARD CALCULATIONS: INTAKE/EXPOSURE CONCENTRATION VALUE	INTAKE/EXPOSURE CONCENTRATION UNITS	RfD/RfC (1) VALUE	RfD/RfC (1) UNITS	HAZARD QUOTIENT
	AIR	AMBIENT VAPORS UNDER THE CBI BUILDING	AMBIENT VAPOR INHALATION	PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										5.E-11					9.E-05
SOIL TOTAL											**7.E-08**					**1.E-01**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**3.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-5
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SURFACE SOIL	FORMER DIE CAST BUILDING AREA	INGESTION	PCB-1242	61801	mg/kg	1.0E-03	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-03	2.1E-01	mg/kg/day	5.0E-05	mg/kg/day	4.E+03
				PCB-1248	4610	mg/kg	7.7E-05	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-04	1.6E-02	mg/kg/day	5.0E-05	mg/kg/day	3.E+02
				PCB-1260	430	mg/kg	7.1E-06	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-05	1.4E-03	mg/kg/day	5.0E-05	mg/kg/day	3.E+01
			EXPOSURE ROUTE TOTAL								2.E-03					5.E+03
			DERMAL	PCB-1242	61801	mg/kg	4.3E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	9.E-04	8.7E-02	mg/kg/day	5.0E-05	mg/kg/day	2.E+03
				PCB-1248	4610	mg/kg	3.2E-05	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-05	6.5E-03	mg/kg/day	5.0E-05	mg/kg/day	1.E+02
				PCB-1260	430	mg/kg	3.0E-06	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-06	6.1E-04	mg/kg/day	5.0E-05	mg/kg/day	1.E+01
												--				
												--				
			EXPOSURE ROUTE TOTAL								9.E-04					2.E+03
		EXPOSURE POINT TOTAL									3.E-03					6.E+03
	EXPOSURE MEDIUM TOTAL										3.E-03					6.E+03

TABLE B-5

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	DUST AT FORMER DIE CAST BUILDING AREA	DUST INHALATION	PCB-1242	61801	mg/kg	3.4E-03	ug/m3	5.7E-04	(ug/m3)-1	2.E-06	6.9E-01	ug/m3	1.8E-01	ug/m3	4.E+00
				PCB-1248	4610	mg/kg	2.5E-04	ug/m3	5.7E-04	(ug/m3)-1	1.E-07	5.1E-02	ug/m3	1.8E-01	ug/m3	3.E-01
				PCB-1260	430	mg/kg	2.4E-05	ug/m3	5.7E-04	(ug/m3)-1	1.E-08	4.8E-03	ug/m3	1.8E-01	ug/m3	3.E-02
			EXPOSURE ROUTE TOTAL								2.E-06					4.E+00
		EXPOSURE POINT TOTAL									2.E-06					4.E+00
	AIR	AMBIENT VAPORS AT FORMER DIE CAST BUILDING AREA	AMBIENT VAPOR INHALATION	PCB-1242	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										2.E-06					4.E+00
SOIL TOTAL											**3.E-03**					**6.E+03**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**3.E-03**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**7.E+03**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SUBSURFACE SOIL	FORMER DIE CAST BUILDING AREA	INGESTION	PCB-1242	30838	mg/kg	5.1E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-03	1.0E-01	mg/kg/day	5.0E-05	mg/kg/day	2.E+03
				PCB-1248	17611	mg/kg	2.9E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-04	5.9E-02	mg/kg/day	5.0E-05	mg/kg/day	1.E+03
				PCB-1254	10	mg/kg	1.7E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-07	3.4E-05	mg/kg/day	5.0E-05	mg/kg/day	7.E-01
				PCB-1260	430	mg/kg	7.1E-06	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-05	1.4E-03	mg/kg/day	5.0E-05	mg/kg/day	3.E+01
			EXPOSURE ROUTE TOTAL								2.E-03					3.E+03
			DERMAL	PCB-1242	30838	mg/kg	2.2E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-04	4.4E-02	mg/kg/day	5.0E-05	mg/kg/day	9.E+02
				PCB-1248	17611	mg/kg	1.2E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-04	2.5E-02	mg/kg/day	5.0E-05	mg/kg/day	5.E+02
				PCB-1254	10	mg/kg	7.0E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-07	1.4E-05	mg/kg/day	5.0E-05	mg/kg/day	3.E-01
				PCB-1260	430	mg/kg	3.0E-06	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-06	6.1E-04	mg/kg/day	5.0E-05	mg/kg/day	1.E+01
												--				
												--				
			EXPOSURE ROUTE TOTAL								7.E-04					1.E+03
		EXPOSURE POINT TOTAL									2.E-03					5.E+03
	EXPOSURE MEDIUM TOTAL										2.E-03					5.E+03

TABLE B-6
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	DUST AT FORMER DIE CAST BUILDING AREA	DUST INHALATION	PCB-1242	30838	mg/kg	1.7E-03	ug/m3	5.7E-04	(ug/m3)-1	1.E-06	3.4E-01	ug/m3	1.8E-01	ug/m3	2.E+00
				PCB-1248	17611	mg/kg	9.7E-04	ug/m3	5.7E-04	(ug/m3)-1	6.E-07	2.0E-01	ug/m3	1.8E-01	ug/m3	1.E+00
				PCB-1254	10	mg/kg	5.5E-07	ug/m3	5.7E-04	(ug/m3)-1	3.E-10	1.1E-04	ug/m3	1.8E-01	ug/m3	6.E-04
				PCB-1260	430	mg/kg	2.4E-05	ug/m3	5.7E-04	(ug/m3)-1	1.E-08	4.8E-03	ug/m3	1.8E-01	ug/m3	3.E-02
			EXPOSURE ROUTE TOTAL								2.E-06					3.E+00
		EXPOSURE POINT TOTAL									2.E-06					3.E+00
	AIR	AMBIENT VAPORS AT FORMER DIE CAST BUILDING AREA	AMBIENT VAPOR INHALATIO	PCB-1242	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1254	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				1.8E-01	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										2.E-06					3.E+00
SOIL TOTAL											**2.E-03**					**5.E+03**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**2.E-03**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**5.E+03**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
							INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
					VALUE	UNITS	VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SURFACE SOIL	TRICHLOROETHYLENE IMPACTED AREA	INGESTION	Trichloroethylene	370	mg/kg	6.1E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	8.E-08	1.2E-03	mg/kg/day	3.0E-04	mg/kg/day	4.E+00
			EXPOSURE ROUTE TOTAL								8.E-08					4.E+00
			DERMAL	Trichloroethylene	370	mg/kg	--		1.3E-02	(mg/kg/day)-1		-- -- --		3.0E-04	mg/kg/day	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									8.E-08					4.E+00
	EXPOSURE MEDIUM TOTAL										8.E-08					4.E+00
	AIR	DUST AT TRICHLOROETHYLENE	DUST INHALATION	Trichloroethylene	370	mg/kg	2.0E-05	ug/m3	2.0E-06	(ug/m3)-1	4.E-11	4.1E-03	ug/m3	1.0E+01	ug/m3	4.E-04
			EXPOSURE ROUTE TOTAL								4.E-11					4.E-04
		EXPOSURE POINT TOTAL									4.E-11					4.E-04

TABLE B-7
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	AMBIENT VAPORS AT TRICHLOROETHYLENE	AMBIENT VAPOR INHALATIO	Trichloroethylene	110	ug/m3	1.3E-01	ug/m3	2.0E-06	(ug/m3)-1	3.E-07	2.6E+01	ug/m3	1.0E+01	ug/m3	3.E+00
			EXPOSURE ROUTE TOTAL								3.E-07					3.E+00
		EXPOSURE POINT TOTAL									3.E-07					3.E+00
	EXPOSURE MEDIUM TOTAL										3.E-07					3.E+00
SOIL TOTAL											**3.E-07**					**7.E+00**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**3.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-8
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
GROUND WATER	GROUND WATER	GROUNDWATER IN TRENCH	DERMAL	Benzene	0.044	mg/l	1.0E-07	mg/kg/day	5.5E-02	(mg/kg/day)-1	6.E-09	2.1E-05	mg/kg/day	4.0E-03	mg/kg/day	5.E-03
				1,3-Dichlorobenzene	1.12	mg/l	NC		NC			2.8E-03	mg/kg/day	ND		
				cis-1,2-Dichloroethene	14.1	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Isopropylbenzene (Cumene)	0.0198	mg/l	NC		NC			--		1.0E-01	mg/kg/day	
				p-Isopropyltoluene	0.0061	mg/l	NC		NC			--		ND		
				Trichloroethene	3.43	mg/l	7.9E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-07	1.6E-03	mg/kg/day	3.0E-04	mg/kg/day	5.E+00
				1,2,4-Trimethylbenzene	0.0706	mg/l	NC		NC			--		ND		
				Vinyl chloride	1.11	mg/l	9.7E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	7.E-07	2.0E-04	mg/kg/day	3.0E-03	mg/kg/day	7.E-02
				Benzo(a)anthracene	0.0021	mg/l	3.5E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.1E-05	mg/kg/day	3.0E-01	mg/kg/day	2.E-04
				Benzo(a)pyrene	0.0019	mg/l	5.4E-07	mg/kg/day	7.3E+00	(mg/kg/day)-1	4.E-06	1.1E-04	mg/kg/day	3.0E-01	mg/kg/day	4.E-04
				Benzo(b)fluoranthene	0.0043	mg/l	1.2E-06	mg/kg/day	7.3E-01	(mg/kg/day)-1	9.E-07	2.5E-04	mg/kg/day	3.0E-01	mg/kg/day	8.E-04
				Benzo(g,h,i)perylene	0.0018	mg/l	NC		NC			--		3.0E-01	mg/kg/day	
				Chrysene	0.0111	mg/l	1.9E-06	mg/kg/day	7.3E-03	(mg/kg/day)-1	1.E-08	3.8E-04	mg/kg/day	3.0E-01	mg/kg/day	1.E-03
				Indeno(1,2,3-cd)pyrene	0.0013	mg/l	3.9E-07	mg/kg/day	7.3E-01	(mg/kg/day)-1	3.E-07	7.9E-05	mg/kg/day	3.0E-01	mg/kg/day	3.E-04
				Phenanthrene	0.003	mg/l	NC		NC			2.2E-05	mg/kg/day	3.0E-01	mg/kg/day	7.E-05
			EXPOSURE ROUTE TOTAL								6.E-06					5.E+00
		EXPOSURE POINT TOTAL									6.E-06					5.E+00
	EXPOSURE MEDIUM TOTAL										6.E-06					5.E+00
	AIR	AIR IN TRENCH	AMBIENT VAPOR INHALATIO	Benzene	411	ug/m3	1.1E-01	ug/m3	7.8E-06	(ug/m3)-1	8.E-07	2.2E+01	ug/m3	3.0E+01	ug/m3	7.E-01
				1,3-Dichlorobenzene	7580	ug/m3	NC		NC			4.0E+02	ug/m3	ND		
				cis-1,2-Dichloroethene	118000	ug/m3	NC		NC			6.2E+03	ug/m3	ND		
				Isopropylbenzene (Cumene)	151	ug/m3	NC		NC			8.0E+00	ug/m3	4.0E+02	ug/m3	2.E-02
				p-Isopropyltoluene	43.8	ug/m3	NC		NC			2.3E+00	ug/m3	ND		
				Trichloroethene	24900	ug/m3	6.5E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.3E+03	ug/m3	1.0E+01	ug/m3	1.E+02
				1,2,4-Trimethylbenzene	533	ug/m3	NC		NC			2.8E+01	ug/m3	7.0E+00	ug/m3	4.E+00
				Vinyl chloride	11700	ug/m3	3.1E+00	ug/m3	4.4E-06	(ug/m3)-1	1.E-05	6.2E+02	ug/m3	1.0E+02	ug/m3	6.E+00
				Benzo(a)anthracene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(a)pyrene	NV	ug/m3	--		1.1E-03	(ug/m3)-1				ND		
				Benzo(b)fluoranthene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Benzo(g,h,i)perylene	NV	ug/m3	NC		NC					ND		
				Chrysene	NV	ug/m3	--		1.1E-06	(ug/m3)-1				ND		
				Indeno(1,2,3-cd)pyrene	NV	ug/m3	--		1.1E-04	(ug/m3)-1				ND		
				Phenanthrene	NV	ug/m3	NC		NC					ND		
			EXPOSURE ROUTE TOTAL								3.E-05					1.E+02
		EXPOSURE POINT TOTAL									3.E-05					1.E+02
	EXPOSURE MEDIUM TOTAL										3.E-05					1.E+02
GROUNDWATER TOTAL											**3.E-05**					**1.E+02**
SOIL	SUBSURFACE SOIL	TRICHLOROETHYLENE IMPACTED AREA	INGESTION	Trichloroethylene	158	mg/kg	2.6E-06	mg/kg/day	1.3E-02	(mg/kg/day)-1	3.E-08	5.3E-04	mg/kg/day	3.0E-04	mg/kg/day	2.E+00
				cis-1,2-Dichloroethylene	41.7	mg/kg	NC		NC			1.4E-04	mg/kg/day	3.0E-01	mg/kg/day	5.E-04
				trans-1,2-Dichloroethylene	2.03	mg/kg	NC		NC			6.8E-06	mg/kg/day	2.0E-01	mg/kg/day	3.E-05
				Vinyl Chloride	16.6	mg/kg	2.8E-07	mg/kg/day	7.2E-01	(mg/kg/day)-1	2.E-07	5.6E-05	mg/kg/day	3.0E-03	mg/kg/day	2.E-02
			EXPOSURE ROUTE TOTAL								2.E-07					2.E+00
			DERMAL	Trichloroethylene	158	mg/kg	--		1.3E-02	(mg/kg/day)-1		--		3.0E-04	mg/kg/day	
				cis-1,2-Dichloroethylene	41.7	mg/kg	NC		NC			--		3.0E-01	mg/kg/day	
				trans-1,2-Dichloroethylene	2.03	mg/kg	NC		NC			--		2.0E-01	mg/kg/day	
				Vinyl Chloride	16.6	mg/kg	--		7.2E-01	(mg/kg/day)-1		--		3.0E-03	mg/kg/day	
												--				
												--				
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									2.E-07					2.E+00
	EXPOSURE MEDIUM TOTAL										2.E-07					2.E+00

TABLE B-8
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - CONSTRUCTION WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: CONSTRUCTION WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
	AIR	DUST AT TRICHLOROETHYLENE	DUST INHALATION	Trichloroethylene	158	mg/kg	8.7E-06	ug/m3	2.0E-06	(ug/m3)-1	2.E-11	1.8E-03	ug/m3	1.0E+01	ug/m3	2.E-04
				cis-1,2-Dichloroethylene	41.7	mg/kg	NC		NC			4.6E-04	ug/m3	ND		
				trans-1,2-Dichloroethylene	2.03	mg/kg	NC		NC			2.3E-05	ug/m3	8.0E+02	ug/m3	3.E-08
				Vinyl Chloride	16.6	mg/kg	9.1E-07	ug/m3	4.4E-06	(ug/m3)-1	4.E-12	1.9E-04	ug/m3	1.0E+02	ug/m3	2.E-06
			EXPOSURE ROUTE TOTAL								2.E-11					2.E-04
		EXPOSURE POINT TOTAL									2.E-11					2.E-04
	AIR	AMBIENT VAPORS AT TRICHLOROETHYLENE	AMBIENT VAPOR INHALATIO	Trichloroethylene	46.9	ug/m3	5.5E-02	ug/m3	2.0E-06	(ug/m3)-1	1.E-07	1.1E+01	ug/m3	1.0E+01	ug/m3	1.E+00
				cis-1,2-Dichloroethylene	11.1	ug/m3	NC		NC			2.6E+00	ug/m3	ND		
				trans-1,2-Dichloroethylene	0.74	ug/m3	NC		NC			1.8E-01	ug/m3	8.0E+02	ug/m3	2.E-04
				Vinyl Chloride	12.3	ug/m3	1.4E-02	ug/m3	4.4E-06	(ug/m3)-1	6.E-08	2.9E+00	ug/m3	1.0E+02	ug/m3	3.E-02
			EXPOSURE ROUTE TOTAL								2.E-07					1.E+00
		EXPOSURE POINT TOTAL									2.E-07					1.E+00
	EXPOSURE MEDIUM TOTAL										2.E-07					1.E+00
SOIL TOTAL											**4.E-07**					**3.E+00**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**3.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E+02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-9
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE- FUTURE- OUTDOOR GROUNDSKEEPER- ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: OUTDOOR GROUNDSKEEPER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	EXTERIOR TO THE CBI BUILDING	INGESTION	PCB-1248	0.91	mg/kg	2.4E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	5.E-07	6.8E-07	mg/kg/day	2.0E-05	mg/kg/day	3.E-02
			EXPOSURE ROUTE TOTAL								5.E-07					3.E-02
			DERMAL	PCB-1248	0.91	mg/kg	2.2E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-07	6.3E-07 -- --	mg/kg/day	2.0E-05	mg/kg/day	3.E-02
			EXPOSURE ROUTE TOTAL								4.E-07					3.E-02
		EXPOSURE POINT TOTAL									9.E-07					7.E-02
	EXPOSURE MEDIUM TOTAL										9.E-07					7.E-02
	AIR	DUST EXTERIOR TO THE CBI BUILDING	DUST INHALATION	PCB-1248	0.91	mg/kg	7.5E-09	ug/m3	5.7E-04	(ug/m3)-1	4.E-12	2.1E-08	ug/m3	7.0E-02	ug/m3	3.E-07
			EXPOSURE ROUTE TOTAL								4.E-12					3.E-07
		EXPOSURE POINT TOTAL									4.E-12					3.E-07
	AIR	AMBIENT VAPORS EXTERIOR TO THE CBI BUILDING	AMBIENT VAPOR INHALATIO	PCB-1248	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										4.E-12					3.E-07
SOIL TOTAL											**9.E-07**					**7.E-02**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**9.E-07**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**7.E-02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-10
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - OUTDOOR GROUNDSKEEPER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: OUTDOOR GROUNDSKEEPER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	UNDER THE CBI BUILDING	INGESTION	PCB-1248	1.1	mg/kg	2.9E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	6.E-07	8.2E-07	mg/kg/day	2.0E-05	mg/kg/day	4.E-02
				PCB-1260	0.22	mg/kg	5.8E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-07	1.6E-07	mg/kg/day	2.0E-05	mg/kg/day	8.E-03
			EXPOSURE ROUTE TOTAL								7.E-07					5.E-02
			DERMAL	PCB-1248	1.1	mg/kg	2.7E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	5.E-07	7.6E-07	mg/kg/day	2.0E-05	mg/kg/day	4.E-02
				PCB-1260	0.22	mg/kg	5.4E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-07	1.5E-07	mg/kg/day	2.0E-05	mg/kg/day	8.E-03
												--				
												--				
			EXPOSURE ROUTE TOTAL								6.E-07					5.E-02
		EXPOSURE POINT TOTAL									1.E-06					9.E-02
	EXPOSURE MEDIUM TOTAL										1.E-06					9.E-02
	AIR	DUST UNDER THE CBI BUILDING	DUST INHALATION	PCB-1248	1.1	mg/kg	9.0E-09	ug/m3	5.7E-04	(ug/m3)-1	5.E-12	2.5E-08	ug/m3	7.0E-02	ug/m3	4.E-07
				PCB-1260	0.22	mg/kg	1.8E-09	ug/m3	5.7E-04	(ug/m3)-1	1.E-12	5.0E-09	ug/m3	7.0E-02	ug/m3	7.E-08
			EXPOSURE ROUTE TOTAL								6.E-12					4.E-07
		EXPOSURE POINT TOTAL									6.E-12					4.E-07
	AIR	AMBIENT VAPORS UNDER THE CBI BUILDING	AMBIENT VAPOR INHALATIO	PCB-1248	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										6.E-12					4.E-07
SOIL TOTAL											**1.E-06**					**9.E-02**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**1.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**9.E-02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-11
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - OUTDOOR GROUNDSKEEPER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: OUTDOOR GROUNDSKEEPER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	FORMER DIE CAST BUILDING AREA	INGESTION	PCB-1242	61801	mg/kg	1.6E-02	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-02	4.6E-02	mg/kg/day	2.0E-05	mg/kg/day	2.E+03
				PCB-1248	4610	mg/kg	1.2E-03	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-03	3.4E-03	mg/kg/day	2.0E-05	mg/kg/day	2.E+02
				PCB-1260	430	mg/kg	1.1E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-04	3.2E-04	mg/kg/day	2.0E-05	mg/kg/day	2.E+01
			EXPOSURE ROUTE TOTAL								4.E-02					2.E+03
			DERMAL	PCB-1242	61801	mg/kg	1.5E-02	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-02	4.2E-02	mg/kg/day	2.0E-05	mg/kg/day	2.E+03
				PCB-1248	4610	mg/kg	1.1E-03	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-03	3.2E-03	mg/kg/day	2.0E-05	mg/kg/day	2.E+02
				PCB-1260	430	mg/kg	1.1E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-04	3.0E-04	mg/kg/day	2.0E-05	mg/kg/day	1.E+01
												--				
												--				
			EXPOSURE ROUTE TOTAL								3.E-02					2.E+03
		EXPOSURE POINT TOTAL									7.E-02					5.E+03
	EXPOSURE MEDIUM TOTAL										7.E-02					5.E+03
	AIR	DUST AT FORMER DIE CAST BUILDING AREA	DUST INHALATION	PCB-1242	61801	mg/kg	5.1E-04	ug/m3	5.7E-04	(ug/m3)-1	3.E-07	1.4E-03	ug/m3	7.0E-02	ug/m3	2.E-02
				PCB-1248	4610	mg/kg	3.8E-05	ug/m3	5.7E-04	(ug/m3)-1	2.E-08	1.1E-04	ug/m3	7.0E-02	ug/m3	2.E-03
				PCB-1260	430	mg/kg	3.5E-06	ug/m3	5.7E-04	(ug/m3)-1	2.E-09	9.9E-06	ug/m3	7.0E-02	ug/m3	1.E-04
			EXPOSURE ROUTE TOTAL								3.E-07					2.E-02
		EXPOSURE POINT TOTAL									3.E-07					2.E-02
	AIR	AMBIENT VAPORS AT FORMER DIE CAST BUILDING AREA	AMBIENT VAPOR INHALATION	PCB-1242	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1248	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										3.E-07					2.E-02
SOIL TOTAL											**7.E-02**					**5.E+03**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**7.E-02**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**5.E+03**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-12
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - OUTDOOR GROUNDSKEEPER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: OUTDOOR GROUNDSKEEPER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	TRICHLOROETHYLENE IMPACTED AREA	INGESTION	Trichloroethylene	370	mg/kg	9.8E-05	mg/kg/day	1.3E-02	(mg/kg/day)-1	1.E-06	2.8E-04	mg/kg/day	3.0E-04	mg/kg/day	9.E-01
			EXPOSURE ROUTE TOTAL								1.E-06					9.E-01
			DERMAL	Trichloroethylene	370	mg/kg	--		1.3E-02	(mg/kg/day)-1		-- -- --		3.0E-04	mg/kg/day	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									1.E-06					9.E-01
	EXPOSURE MEDIUM TOTAL										1.E-06					9.E-01
	AIR	DUST AT TRICHLOROETHYLENE	DUST INHALATION	Trichloroethylene	370	mg/kg	3.0E-06	ug/m3	2.0E-06	(ug/m3)-1	6.E-12	8.5E-06	ug/m3	1.0E+01	ug/m3	8.E-07
			EXPOSURE ROUTE TOTAL								6.E-12					8.E-07
		EXPOSURE POINT TOTAL									6.E-12					8.E-07
	AIR	AMBIENT VAPORS AT TRICHLOROETHYLENE IMPACTED AREA	AMBIENT VAPOR INHALATIO	Trichloroethylene	110	ug/m3	8.5E-01	ug/m3	2.0E-06	(ug/m3)-1	2.E-06	2.4E+00	ug/m3	1.0E+01	ug/m3	2.E-01
			EXPOSURE ROUTE TOTAL								2.E-06					2.E-01
		EXPOSURE POINT TOTAL									2.E-06					2.E-01
	EXPOSURE MEDIUM TOTAL										2.E-06					2.E-01
SOIL TOTAL											**3.E-06**					**1.E+00**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**3.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E+00**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-13
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - RECREATIONAL ADOLESCENT - ADOLESCENT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: RECREATIONAL ADOLESCENT
RECEPTOR AGE: ADOLESCENT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	EXTERIOR TO THE CBI BUILDING	INGESTION	PCB-1248	0.91	mg/kg	1.5E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-07	8.6E-07	mg/kg/day	2.0E-05	mg/kg/day	4.E-02
			EXPOSURE ROUTE TOTAL								3.E-07					4.E-02
			DERMAL	PCB-1248	0.91	mg/kg	2.7E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	5.E-07	1.6E-06 -- --	mg/kg/day	2.0E-05	mg/kg/day	8.E-02
			EXPOSURE ROUTE TOTAL								5.E-07					8.E-02
		EXPOSURE POINT TOTAL									8.E-07					1.E-01
	EXPOSURE MEDIUM TOTAL										8.E-07					1.E-01
	AIR	DUST EXTERIOR TO THE CBI BUILDING	DUST INHALATION	PCB-1248	0.91	mg/kg	5.9E-09	ug/m3	5.7E-04	(ug/m3)-1	3.E-12	3.4E-08	ug/m3	7.0E-02	ug/m3	5.E-07
			EXPOSURE ROUTE TOTAL								3.E-12					5.E-07
		EXPOSURE POINT TOTAL									3.E-12					5.E-07
	AIR	AMBIENT VAPORS EXTERIOR TO THE CBI BUILDING	AMBIENT VAPOR INHALATION	PCB-1248	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										3.E-12					5.E-07
SOIL TOTAL											**8.E-07**					**1.E-01**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**8.E-07**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E-01**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-14
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - RECREATIONAL ADOLESCENT - ADOLESCENT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: RECREATIONAL ADOLESCENT
RECEPTOR AGE: ADOLESCENT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	UNDER THE CBI BUILDING	INGESTION	PCB-1248	1.1	mg/kg	1.8E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-07	1.0E-06	mg/kg/day	2.0E-05	mg/kg/day	5.E-02
				PCB-1260	0.22	mg/kg	3.6E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	7.E-08	2.1E-07	mg/kg/day	2.0E-05	mg/kg/day	1.E-02
			EXPOSURE ROUTE TOTAL								4.E-07					6.E-02
			DERMAL	PCB-1248	1.1	mg/kg	3.3E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	7.E-07	1.9E-06	mg/kg/day	2.0E-05	mg/kg/day	1.E-01
				PCB-1260	0.22	mg/kg	6.6E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-07	3.8E-07	mg/kg/day	2.0E-05	mg/kg/day	2.E-02
												--				
												--				
			EXPOSURE ROUTE TOTAL								8.E-07					1.E-01
		EXPOSURE POINT TOTAL									1.E-06					2.E-01
	EXPOSURE MEDIUM TOTAL										1.E-06					2.E-01
	AIR	DUST UNDER THE CBI BUILDING	DUST INHALATION	PCB-1248	1.1	mg/kg	7.1E-09	ug/m3	5.7E-04	(ug/m3)-1	4.E-12	4.1E-08	ug/m3	7.0E-02	ug/m3	6.E-07
				PCB-1260	0.22	mg/kg	1.4E-09	ug/m3	5.7E-04	(ug/m3)-1	8.E-13	8.3E-09	ug/m3	7.0E-02	ug/m3	1.E-07
			EXPOSURE ROUTE TOTAL								5.E-12					7.E-07
		EXPOSURE POINT TOTAL									5.E-12					7.E-07
	AIR	AMBIENT VAPORS UNDER THE CBI BUILDING	AMBIENT VAPOR INHALATIO[N]	PCB-1248	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	--	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										5.E-12					7.E-07
SOIL TOTAL											**1.E-06**					**2.E-01**
								TOTAL RECEPTOR RISK ACROSS ALL MEDIA			**1.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E-01**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-15
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - RECREATIONAL ADOLESCENT - ADOLESCENT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: RECREATIONAL ADOLESCENT
RECEPTOR AGE: ADOLESCENT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	FORMER DIE CAST BUILDING AREA	INGESTION	PCB-1242	61801	mg/kg	1.0E-02	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-02	5.9E-02	mg/kg/day	2.0E-05	mg/kg/day	3.E+03
				PCB-1248	4610	mg/kg	7.5E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-03	4.4E-03	mg/kg/day	2.0E-05	mg/kg/day	2.E+02
				PCB-1260	430	mg/kg	7.0E-05	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-04	4.1E-04	mg/kg/day	2.0E-05	mg/kg/day	2.E+01
			EXPOSURE ROUTE TOTAL								2.E-02					3.E+03
			DERMAL	PCB-1242	61801	mg/kg	1.8E-02	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-02	1.1E-01	mg/kg/day	2.0E-05	mg/kg/day	5.E+03
				PCB-1248	4610	mg/kg	1.4E-03	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-03	8.0E-03	mg/kg/day	2.0E-05	mg/kg/day	4.E+02
				PCB-1260	430	mg/kg	1.3E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	3.E-04	7.5E-04	mg/kg/day	2.0E-05	mg/kg/day	4.E+01
												--				
												--				
			EXPOSURE ROUTE TOTAL								4.E-02					6.E+03
		EXPOSURE POINT TOTAL									6.E-02					9.E+03
	EXPOSURE MEDIUM TOTAL										6.E-02					9.E+03
	AIR	DUST AT FORMER DIE CAST BUILDING AREA	DUST INHALATION	PCB-1242	61801	mg/kg	4.0E-04	ug/m3	5.7E-04	(ug/m3)-1	2.E-07	2.3E-03	ug/m3	7.0E-02	ug/m3	3.E-02
				PCB-1248	4610	mg/kg	3.0E-05	ug/m3	5.7E-04	(ug/m3)-1	2.E-08	1.7E-04	ug/m3	7.0E-02	ug/m3	2.E-03
				PCB-1260	430	mg/kg	2.8E-06	ug/m3	5.7E-04	(ug/m3)-1	2.E-09	1.6E-05	ug/m3	7.0E-02	ug/m3	2.E-04
			EXPOSURE ROUTE TOTAL								2.E-07					4.E-02
		EXPOSURE POINT TOTAL									2.E-07					4.E-02
	AIR	AMBIENT VAPORS AT FORMER DIE CAST BUILDING AREA	AMBIENT VAPOR INHALATION	PCB-1242	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										2.E-07					4.E-02
SOIL TOTAL											**6.E-02**					**9.E+03**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**6.E-02**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**9.E+03**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not available from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-16
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - RECREATIONAL ADOLESCENT - ADOLESCENT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: RECREATIONAL ADOLESCENT
RECEPTOR AGE: ADOLESCENT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	TRICHLOROETHYLENE IMPACTED AREA	INGESTION	Trichloroethylene	370	mg/kg	6.0E-05	mg/kg/day	1.3E-02	(mg/kg/day)-1	8.E-07	3.5E-04	mg/kg/day	3.0E-04	mg/kg/day	1.E+00
			EXPOSURE ROUTE TOTAL								8.E-07					1.E+00
			DERMAL	Trichloroethylene	370	mg/kg	--		1.3E-02	(mg/kg/day)-1		-- -- --		3.0E-04	mg/kg/day	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									8.E-07					1.E+00
	EXPOSURE MEDIUM TOTAL										8.E-07					1.E+00
	AIR	DUST AT TRICHLOROETHYLENE	DUST INHALATION	Trichloroethylene	370	mg/kg	2.4E-06	ug/m3	2.0E-06	(ug/m3)-1	5.E-12	1.4E-05	ug/m3	1.0E+01	ug/m3	1.E-06
			EXPOSURE ROUTE TOTAL								5.E-12					1.E-06
		EXPOSURE POINT TOTAL									5.E-12					1.E-06
	AIR	AMBIENT VAPORS AT TRICHLOROETHYLENE	AMBIENT VAPOR INHALATIO	Trichloroethylene	110	ug/m3	6.7E-01	ug/m3	2.0E-06	(ug/m3)-1	1.E-06	3.9E+00	ug/m3	1.0E+01	ug/m3	4.E-01
			EXPOSURE ROUTE TOTAL								1.E-06					4.E-01
		EXPOSURE POINT TOTAL									1.E-06					4.E-01
	EXPOSURE MEDIUM TOTAL										1.E-06					4.E-01
SOIL TOTAL											**2.E-06**					**2.E+00**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**2.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E+00**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-17
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - ADULT STAFF WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: ADULT STAFF WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	EXTERIOR TO THE CBI BUILDING	INGESTION	PCB-1248	0.91	mg/kg	9.9E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-07	2.8E-07	mg/kg/day	2.0E-05	mg/kg/day	1.E-02
			EXPOSURE ROUTE TOTAL								2.E-07					1.E-02
			DERMAL	PCB-1248	0.91	mg/kg	1.8E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-07	5.1E-07 -- --	mg/kg/day	2.0E-05	mg/kg/day	3.E-02
			EXPOSURE ROUTE TOTAL								4.E-07					3.E-02
		EXPOSURE POINT TOTAL									6.E-07					4.E-02
	EXPOSURE MEDIUM TOTAL										6.E-07					4.E-02
	AIR	DUST EXTERIOR TO THE CBI BUILDING	DUST INHALATION	PCB-1248	0.91	mg/kg	2.4E-08	ug/m3	5.7E-04	(ug/m3)-1	1.E-11	6.9E-08	ug/m3	7.0E-02	ug/m3	1.E-06
			EXPOSURE ROUTE TOTAL								1.E-11					1.E-06
		EXPOSURE POINT TOTAL									1.E-11					1.E-06
	AIR	AMBIENT VAPORS EXTERIOR TO THE CBI BUILDING	AMBIENT VAPOR INHALATION	PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										1.E-11					1.E-06
SOIL TOTAL											**6.E-07**					**4.E-02**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**6.E-07**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**4.E-02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not available from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-18
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - ADULT STAFF WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: ADULT STAFF WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	UNDER THE CBI BUILDING	INGESTION	PCB-1248	1.1	mg/kg	1.2E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-07	3.4E-07	mg/kg/day	2.0E-05	mg/kg/day	2.E-02
				PCB-1260	0.22	mg/kg	2.4E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	5.E-08	6.7E-08	mg/kg/day	2.0E-05	mg/kg/day	3.E-03
			EXPOSURE ROUTE TOTAL								3.E-07					2.E-02
			DERMAL	PCB-1248	1.1	mg/kg	2.2E-07	mg/kg/day	2.0E+00	(mg/kg/day)-1	4.E-07	6.2E-07	mg/kg/day	2.0E-05	mg/kg/day	3.E-02
				PCB-1260	0.22	mg/kg	4.4E-08	mg/kg/day	2.0E+00	(mg/kg/day)-1	9.E-08	1.2E-07	mg/kg/day	2.0E-05	mg/kg/day	6.E-03
												--				
												--				
			EXPOSURE ROUTE TOTAL								5.E-07					4.E-02
		EXPOSURE POINT TOTAL									8.E-07					6.E-02
	EXPOSURE MEDIUM TOTAL										8.E-07					6.E-02
	AIR	DUST UNDER THE CBI BUILDING	DUST INHALATION	PCB-1248	1.1	mg/kg	3.0E-08	ug/m3	5.7E-04	(ug/m3)-1	2.E-11	8.3E-08	ug/m3	7.0E-02	ug/m3	1.E-06
				PCB-1260	0.22	mg/kg	5.9E-09	ug/m3	5.7E-04	(ug/m3)-1	3.E-12	1.7E-08	ug/m3	7.0E-02	ug/m3	2.E-07
			EXPOSURE ROUTE TOTAL								2.E-11					1.E-06
		EXPOSURE POINT TOTAL									2.E-11					1.E-06
	AIR	AMBIENT VAPORS UNDER THE CBI BUILDING	AMBIENT VAPOR INHALATION	PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										2.E-11					1.E-06
SOIL TOTAL											**8.E-07**					**6.E-02**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**8.E-07**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**6.E-02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not available from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-19
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - ADULT STAFF WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: ADULT STAFF WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
							INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
					VALUE	UNITS	VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	FORMER DIE CAST BUILDING AREA	INGESTION	PCB-1242	61801	mg/kg	6.7E-03	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-02	1.9E-02	mg/kg/day	2.0E-05	mg/kg/day	9.E+02
				PCB-1248	4610	mg/kg	5.0E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	1.E-03	1.4E-03	mg/kg/day	2.0E-05	mg/kg/day	7.E+01
				PCB-1260	430	mg/kg	4.7E-05	mg/kg/day	2.0E+00	(mg/kg/day)-1	9.E-05	1.3E-04	mg/kg/day	2.0E-05	mg/kg/day	7.E+00
			EXPOSURE ROUTE TOTAL								1.E-02					1.E+03
			DERMAL	PCB-1242	61801	mg/kg	1.2E-02	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-02	3.5E-02	mg/kg/day	2.0E-05	mg/kg/day	2.E+03
				PCB-1248	4610	mg/kg	9.3E-04	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-03	2.6E-03	mg/kg/day	2.0E-05	mg/kg/day	1.E+02
				PCB-1260	430	mg/kg	8.7E-05	mg/kg/day	2.0E+00	(mg/kg/day)-1	2.E-04	2.4E-04	mg/kg/day	2.0E-05	mg/kg/day	1.E+01
												--				
												--				
			EXPOSURE ROUTE TOTAL								3.E-02					2.E+03
		EXPOSURE POINT TOTAL									4.E-02					3.E+03
	EXPOSURE MEDIUM TOTAL										4.E-02					3.E+03
	AIR	DUST AT FORMER DIE CAST BUILDING AREA	DUST INHALATION	PCB-1242	61801	mg/kg	1.7E-03	ug/m3	5.7E-04	(ug/m3)-1	9.E-07	4.7E-03	ug/m3	7.0E-02	ug/m3	7.E-02
				PCB-1248	4610	mg/kg	1.2E-04	ug/m3	5.7E-04	(ug/m3)-1	7.E-08	3.5E-04	ug/m3	7.0E-02	ug/m3	5.E-03
				PCB-1260	430	mg/kg	1.2E-05	ug/m3	5.7E-04	(ug/m3)-1	7.E-09	3.2E-05	ug/m3	7.0E-02	ug/m3	5.E-04
			EXPOSURE ROUTE TOTAL								1.E-06					7.E-02
		EXPOSURE POINT TOTAL									1.E-06					7.E-02
	AIR	AMBIENT VAPORS AT FORMER DIE CAST BUILDING AREA	AMBIENT VAPOR INHALATIOI	PCB-1242	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1248	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
				PCB-1260	NV	ug/m3	--		5.7E-04	(ug/m3)-1				7.0E-02	ug/m3	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									0.E+00					0.E+00
	EXPOSURE MEDIUM TOTAL										1.E-06					7.E-02
SOIL TOTAL											**4.E-02**					**3.E+03**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**4.E-02**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**3.E+03**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not available from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-20
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - ADULT STAFF WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: ADULT STAFF WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL	SURFACE SOIL	TRICHLOROETHYLENE IMPACTED AREA	INGESTION	Trichloroethylene	370	mg/kg	4.0E-05	mg/kg/day	1.3E-02	(mg/kg/day)-1	5.E-07	1.1E-04	mg/kg/day	3.0E-04	mg/kg/day	4.E-01
			EXPOSURE ROUTE TOTAL								5.E-07					4.E-01
			DERMAL	Trichloroethylene	370	mg/kg	--		1.3E-02	(mg/kg/day)-1		-- -- --		3.0E-04	mg/kg/day	
			EXPOSURE ROUTE TOTAL								--					--
		EXPOSURE POINT TOTAL									5.E-07					4.E-01
	EXPOSURE MEDIUM TOTAL										5.E-07					4.E-01
	AIR	DUST AT TRICHLOROETHYLENE	DUST INHALATION	Trichloroethylene	370	mg/kg	1.0E-05	ug/m3	2.0E-06	(ug/m3)-1	2.E-11	2.8E-05	ug/m3	1.0E+01	ug/m3	3.E-06
			EXPOSURE ROUTE TOTAL								2.E-11					3.E-06
		EXPOSURE POINT TOTAL									2.E-11					3.E-06
	AIR	AMBIENT VAPORS AT TRICHLOROETHYLENE	AMBIENT VAPOR INHALATIO	Trichloroethylene	110	ug/m3	2.8E+00	ug/m3	2.0E-06	(ug/m3)-1	6.E-06	7.8E+00	ug/m3	1.0E+01	ug/m3	8.E-01
			EXPOSURE ROUTE TOTAL								6.E-06					8.E-01
		EXPOSURE POINT TOTAL									6.E-06					8.E-01
	EXPOSURE MEDIUM TOTAL										6.E-06					8.E-01
SOIL TOTAL											**6.E-06**					**1.E+00**
								TOTAL RECEPTOR RISK ACROSS ALL MEDIA			**6.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**1.E+00**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/11/08
Checked by: JHP 12/12/08

TABLE B-21
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - INDOOR COMMERCIAL WORKER - ADULT

ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: INDOOR COMMERCIAL WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC VALUE	EPC UNITS	CANCER RISK CALCULATIONS: INTAKE/EXPOSURE CONCENTRATION VALUE	INTAKE/EXPOSURE CONCENTRATION UNITS	CSF/UNIT RISK VALUE	CSF/UNIT RISK UNITS	CANCER RISK	NON-CANCER HAZARD CALCULATIONS: INTAKE/EXPOSURE CONCENTRATION VALUE	INTAKE/EXPOSURE CONCENTRATION UNITS	RfD/RfC (1) VALUE	RfD/RfC (1) UNITS	HAZARD QUOTIENT
GROUND WATER	AIR	AIR INSIDE THE CBI BUILDING	INDOOR VAPOR INHALATION	Benzene	0.0139	ug/m3	1.1E-03	ug/m3	7.8E-06	(ug/m3)-1	9.E-09	3.2E-03	ug/m3	3.0E+01	ug/m3	1.E-04
				1,3-Dichlorobenzene	0.144	ug/m3	NC		NC			3.3E-02	ug/m3	ND		
				cis-1,2-Dichloroethene	3.27	ug/m3	NC		NC			7.5E-01	ug/m3	ND		
				Isopropylbenzene (Cumene)	0.010	ug/m3	NC		NC			2.3E-03	ug/m3	4.0E+02	ug/m3	6.E-06
				Trichloroethene	1.86	ug/m3	1.5E-01	ug/m3	2.0E-06	(ug/m3)-1	3.E-07	4.2E-01	ug/m3	1.0E+01	ug/m3	4.E-02
				1,2,4-Trimethylbenzene	0.0163	ug/m3	NC		NC			3.7E-03	ug/m3	7.0E+00	ug/m3	5.E-04
				Vinyl chloride	2.32	ug/m3	1.9E-01	ug/m3	4.4E-06	(ug/m3)-1	8.E-07	5.3E-01	ug/m3	1.0E+02	ug/m3	5.E-03
			EXPOSURE ROUTE TOTAL								1.E-06					5.E-02
		EXPOSURE POINT TOTAL									1.E-06					5.E-02
	EXPOSURE MEDIUM TOTAL										1.E-06					5.E-02
GROUNDWATER TOTAL											**1.E-06**					**5.E-02**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**1.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**5.E-02**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 12/15/08
Checked by: JHP 12/15/08

TABLE B-22
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - INDOOR COMMERCIAL WORKER - ADULT
TEDLAR SAMPLES, ALPHA = 9.8E-03
ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: INDOOR COMMERCIAL WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
							INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
					VALUE	UNITS	VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL GAS	AIR	AIR INSIDE THE CBI BUILDING AREAS A THROUGH E	INDOOR VAPOR INHALATION	1,1-Dichloroethene	0.22	µg/m³	NC		NC			5.0E-02	ug/m3	2.0E+02	ug/m3	3.E-04
				cis-1,2-Dichloroethene	273	µg/m³	NC		NC			6.2E+01	ug/m3	ND		
				Tetrachloroethene	16.2	µg/m³	1.3E+00	ug/m3	5.9E-06	(ug/m3)-1	8.E-06	3.7E+00	ug/m3	2.7E+02	ug/m3	1.E-02
				trans-1,2-Dichloroethene	2.3	µg/m³	NC		NC			5.3E-01	ug/m3	6.0E+01	ug/m3	9.E-03
				Trichloroethene	1637	µg/m³	1.3E+02	ug/m3	2.0E-06	(ug/m3)-1	3.E-04	3.7E+02	ug/m3	1.0E+01	ug/m3	4.E+01
				Vinyl Chloride	3.5	µg/m³	2.9E-01	ug/m3	4.4E-06	(ug/m3)-1	1.E-06	8.0E-01	ug/m3	1.0E+02	ug/m3	8.E-03
			EXPOSURE ROUTE TOTAL								3.E-04					4.E+01
		EXPOSURE POINT TOTAL									3.E-04					4.E+01
	EXPOSURE MEDIUM TOTAL										3.E-04					4.E+01
SOIL TOTAL											**3.E-04**					**4.E+01**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**3.E-04**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**4.E+01**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 03/03/09
Checked by: JHP 03/03/09

TABLE B-23
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - INDOOR COMMERCIAL WORKER - ADULT
SUMMA SAMPLES, ALPHA = 9.8E-03
ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: INDOOR COMMERCIAL WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL GAS	AIR	AIR INSIDE THE CBI BUILDING AREAS A THROUGH E	INDOOR VAPOR INHALATION	1,1-Dichloroethene	0.31	µg/m³	NC		NC			7.1E-02	ug/m3	2.0E+02	ug/m3	4.E-04
				cis-1,2-Dichloroethene	110	µg/m³	NC		NC			2.5E+01	ug/m3	ND		
				Tetrachloroethene	22.7	µg/m³	1.9E+00	ug/m3	5.9E-06	(ug/m3)-1	1.E-05	5.2E+00	ug/m3	2.7E+02	ug/m3	2.E-02
				trans-1,2-Dichloroethene	2.6	µg/m³	NC		NC			5.9E-01	ug/m3	6.0E+01	ug/m3	1.E-02
				Trichloroethene	1605	µg/m³	1.3E+02	ug/m3	2.0E-06	(ug/m3)-1	3.E-04	3.7E+02	ug/m3	1.0E+01	ug/m3	3.7.E+01
				Vinyl Chloride	5.1	µg/m³	4.2E-01	ug/m3	4.4E-06	(ug/m3)-1	2.E-06	1.2E+00	ug/m3	1.0E+02	ug/m3	1.E-02
			EXPOSURE ROUTE TOTAL								3.E-04					4.E+01
		EXPOSURE POINT TOTAL									3.E-04					4.E+01
	EXPOSURE MEDIUM TOTAL										3.E-04					4.E+01
SOIL TOTAL											**3.E-04**					**4.E+01**
								TOTAL RECEPTOR RISK ACROSS ALL MEDIA			**3.E-04**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**4.E+01**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 03/03/09
Checked by: JHP 03/03/09

TABLE B-24
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - INDOOR COMMERCIAL WORKER - ADULT
TEDLAR SAMPLES, ALPHA = 9.8E-03
ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: INDOOR COMMERCIAL WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL GAS	AIR	AIR INSIDE THE CBI BUILDING AREAS F THROUGH H	INDOOR VAPOR INHALATION	1,1-Dichloroethene			NC		NC					2.0E+02	ug/m3	
				cis-1,2-Dichloroethene			NC		NC					ND		
				Tetrachloroethene	1.9	$\mu g/m^3$	1.5E-01	ug/m3	5.9E-06	(ug/m3)-1	9.E-07	4.3E-01	ug/m3	2.7E+02	ug/m3	2.E-03
				trans-1,2-Dichloroethene			NC		NC					6.0E+01	ug/m3	
				Trichloroethene	68.6	$\mu g/m^3$	5.6E+00	ug/m3	2.0E-06	(ug/m3)-1	1.E-05	1.6E+01	ug/m3	1.0E+01	ug/m3	1.6.E+00
				Vinyl Chloride			--		4.4E-06	(ug/m3)-1				1.0E+02	ug/m3	
			EXPOSURE ROUTE TOTAL								1.E-05					2.E+00
		EXPOSURE POINT TOTAL									1.E-05					2.E+00
	EXPOSURE MEDIUM TOTAL										1.E-05					2.E+00
SOIL TOTAL											**1.E-05**					**2.E+00**
							TOTAL RECEPTOR RISK ACROSS ALL MEDIA				**1.E-05**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**2.E+00**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 03/02/09
Checked by: JHP 03/02/09

TABLE B-25
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS -- REASONABLE MAXIMUM EXPOSURE - FUTURE - INDOOR COMMERCIAL WORKER - ADULT
SUMMA SAMPLES, ALPHA = 9.8E-03
ACF CARTER CARBURETOR SITE
ST LOUIS, MISSOURI

SCENARIO TIMEFRAME: FUTURE
RECEPTOR POPULATION: INDOOR COMMERCIAL WORKER
RECEPTOR AGE: ADULT

MEDIUM	EXPOSURE MEDIUM	EXPOSURE POINT	EXPOSURE ROUTE	CHEMICAL	EPC		CANCER RISK CALCULATIONS					NON-CANCER HAZARD CALCULATIONS				
					VALUE	UNITS	INTAKE/EXPOSURE CONCENTRATION		CSF/UNIT RISK		CANCER RISK	INTAKE/EXPOSURE CONCENTRATION		RfD/RfC (1)		HAZARD QUOTIENT
							VALUE	UNITS	VALUE	UNITS		VALUE	UNITS	VALUE	UNITS	
SOIL GAS	AIR	AIR INSIDE THE CBI BUILDING AREAS F THROUGH H	INDOOR VAPOR INHALATION	1,1-Dichloroethene			NC		NC					2.0E+02	ug/m3	
				cis-1,2-Dichloroethene	0.0047	$\mu g/m^3$	NC		NC			1.1E-03	ug/m3	ND		
				Tetrachloroethene	3.2	$\mu g/m^3$	2.6E-01	ug/m3	5.9E-06	(ug/m3)-1	2.E-06	7.3E-01	ug/m3	2.7E+02	ug/m3	3.E-03
				trans-1,2-Dichloroethene	0.002	$\mu g/m^3$	NC		NC			4.6E-04	ug/m3	6.0E+01	ug/m3	8.E-06
				Trichloroethene	39	$\mu g/m^3$	3.2E+00	ug/m3	2.0E-06	(ug/m3)-1	6.E-06	8.9E+00	ug/m3	1.0E+01	ug/m3	8.9.E-01
				Vinyl Chloride			--		4.4E-06	(ug/m3)-1				1.0E+02	ug/m3	
			EXPOSURE ROUTE TOTAL								8.E-06					9.E-01
		EXPOSURE POINT TOTAL									8.E-06					9.E-01
	EXPOSURE MEDIUM TOTAL										8.E-06					9.E-01
SOIL TOTAL											**8.E-06**					**9.E-01**
										TOTAL RECEPTOR RISK ACROSS ALL MEDIA	**8.E-06**	**TOTAL RECEPTOR HAZARD ACROSS ALL MEDIA**				**9.E-01**

NOTES:
(1) - Blank cells indicate that an RfD or RfC is not avalailable from the sources used to obtain dose-response data for this risk assessment.
NC - Not carcinogenic by this exposure route.
NA - Not applicable; exposure route not applicable for this chemical/exposure medium.
NV - Not volatile; exposure route not complete for this chemical.
-- - Not calculated; dose-response data and/or dermal absorption values are not available.

Prepared by: KJC 03/03/09
Checked by: JHP 03/03/09

Table B-26
Daily Intake Calculations: Industrial/Commercial Worker
Ingestion of Chemicals in Interior Surface Dust
Carter Carburetor Site, St. Louis, Missouri

Equation	DI-ingestion	= [	CS	x	FTSS	x	FQ	x	SA_{finger}	x	SE	x	FI	x	ET	x	EF	x	ED	] / [	BW	x	AT	]
Units	mg/kg-day		mg/cm^2		unitless		(1/hr)		cm^2		unitless		unitless		hr/day		days/year		years		kg		days	
CARCINOGENIC EFFECTS																								
First Floor																								
PCB-1248	1.27E-05	= [	0.005049	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
PCB-1260	2.63E-06	= [	0.001044	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
Second Floor																								
PCB-1248	9.56E-08	= [	0.000038	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
Fourth Floor																								
PCB-1248	1.18E-07	= [	0.000047	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
Pump Room																								
PCB-1248	5.69E-07	= [	0.000226	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
PCB-1260	8.30E-07	= [	0.00033	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	25,550	]
NONCARCINOGENIC EFFECTS																								
First Floor																								
PCB-1248	3.56E-05	= [	0.005049	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]
PCB-1260	7.35E-06	= [	0.001044	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]
Second Floor																								
PCB-1248	2.68E-07	= [	0.000038	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]
Second Floor																								
PCB-1248	3.31E-07	= [	0.000047	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]
Pump Room																								
PCB-1248	1.59E-06	= [	0.000226	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]
PCB-1260	2.32E-06	= [	0.00033	x	0.25	x	1	x	30	x	0.25	x	1	x	8	x	12	x	25	] / [	70	x	9,125	]

DI-ingestion = daily chemical intake via interior dust
CS = chemical concentration on surface
FTSS = fraction transferred, surface to skin (%)
FQ = frequency of hand-mouth activity (per hour)
SA_{finger} = surface area, fingers (cm^2)
SE = saliva extraction factor (%)
FI = fraction ingested (%)
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B-27
Daily Intake Calculations: Future Industrial/Commercial Worker
Inhalation of Chemicals in Interior Surface Dust
Carter Carburetor Site, St. Louis, Missouri

Equation	$DI_{Inh-Dust}$	= [[	CA_{Bld}	x	EF	x	ET	x	ED	] / [	AT	]] /	CF
Units	mg/m^3		mg/m^3		days/year		hours/day		years		days		hours/day
CARCINOGENIC EFFECTS													
First Floor													
PCB-1248	3.60E-04	= [[	4.42E-03	x	250	x	8	x	25	] / [	25,550	]] /	24
PCB-1260	7.45E-05	= [[	9.14E-04	x	250	x	8	x	25	] / [	25,550	]] /	24
Second Floor													
PCB-1248	2.71E-06	= [[	3.33E-05	x	250	x	8	x	25	] / [	25,550	]] /	24
Fourth Floor													
PCB-1248	3.35E-06	= [[	4.11E-05	x	250	x	8	x	25	] / [	25,550	]] /	24
Pump Room													
PCB-1248	1.61E-05	= [[	1.98E-04	x	250	x	8	x	25	] / [	25,550	]] /	24
PCB-1260	2.35E-05	= [[	2.89E-04	x	250	x	8	x	25	] / [	25,550	]] /	24
NONCARCINOGENIC EFFECTS													
First Floor													
PCB-1248	1.01E-03	= [[	4.42E-03	x	250	x	8	x	25	] / [	9,125	]] /	24
PCB-1260	2.09E-04	= [[	9.14E-04	x	250	x	8	x	25	] / [	9,125	]] /	24
Second Floor													
PCB-1248	7.59E-06	= [[	3.33E-05	x	250	x	8	x	25	] / [	9,125	]] /	24
Fourth Floor													
PCB-1248	9.39E-06	= [[	4.11E-05	x	250	x	8	x	25	] / [	9,125	]] /	24
Pump Room													
PCB-1248	4.52E-05	= [[	1.98E-04	x	250	x	8	x	25	] / [	9,125	]] /	24
PCB-1260	6.59E-05	= [[	2.89E-04	x	250	x	8	x	25	] / [	9,125	]] /	24

$DI_{Inh-dust}$ = chemical concentration in air based on receptor exposure parameters

CA_{Bld} = chemical concentration in air, based on building parameters; see Table B-17

EF = exposure frequency

ET = exposure time

ED = exposure duration

AT = averaging time

CF = conversion factor (24 hours/day)

Table B-28
Chemical Concentrations in Air Calculations - Interior Dust
Carter Carburetor Site, St. Louis, Missouri

Equation	CA_{Bld}	= [(	CS	x	RSF	x	A	) / (	V	x	VR	)] x	CF
Units	mg/m^3		mg/cm^2		1/hr		cm^2		cm^3		1/hr		cm^3/m^3
Interior Dust - Industrial/Commercial Worker													
First Floor													
PCB-1248	4.42E-03	= [(	5.05E-03	x	0.00038	x	1.52E+08	) / (	6.60E+10	x	1	)] x	1.00E+06
PCB-1260	9.14E-04	= [(	1.04E-03	x	0.00038	x	1.52E+08	) / (	6.60E+10	x	1	)] x	1.00E+06
Second Floor													
PCB-1248	3.33E-05	= [(	3.80E-05	x	0.00038	x	1.52E+07	) / (	6.60E+09	x	1	)] x	1.00E+06
Fourth Floor													
PCB-1248	4.11E-05	= [(	4.70E-05	x	0.00038	x	1.52E+07	) / (	6.60E+09	x	1	)] x	1.00E+06
Pump Room													
PCB-1248	1.98E-04	= [(	2.26E-04	x	0.00038	x	1.52E+07	) / (	6.60E+09	x	1	)] x	1.00E+06
PCB-1260	2.89E-04	= [(	3.30E-04	x	0.00038	x	1.52E+07	) / (	6.60E+09	x	1	)] x	1.00E+06

CA_{Bld} = chemical concentration in air, based on buiding parameters

CS = chemical concentration in interior surface dust

RSF = resuspension factor (events/hr)

A = area of contaminated surfaces, calculated as below:

Building is "L" shaped with wall lengths of 575 ft, 225 ft, 400 ft, 150 ft, 175 ft, and 375 ft. Walls are 15 ft high, but only the first 4 ft have detectable PCBs.

Pump room is much smaller assumed to be 10% the size of the building.

V = volume of area

VR = ventilation rate of building

CF = conversion factor (cm^3/m^3)

Table B-29
Daily Intake Calculations: Future Industrial/Commercial Worker
Dermal Contact with Chemicals in Interior Dust
Carter Carburetor Site, St. Louis, Missouri

Equation	AD_{dermal}	= [	CS	x	FTSS	x	SA	x	ABS	x	SCT	x	EF	x	ED	] / [	BW	x	AT	]
Units	mg/kg-day		mg/cm^2		%		cm^2/day		unitless		unitless		days/year		years		kg		days	
CARCINOGENIC EFFECTS																				
First Floor																				
PCB-1248	1.19E-05	= [	5.05E-03	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
PCB-1260	2.45E-06	= [	1.04E-03	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
Second Floor																				
PCB-1248	8.92E-08	= [	3.80E-05	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
Fourth Floor																				
PCB-1248	1.10E-07	= [	4.70E-05	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
Pump Room																				
PCB-1248	5.31E-07	= [	2.26E-04	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
PCB-1260	7.75E-07	= [	3.30E-04	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	25,550	]
NONCARCINOGENIC EFFECTS																				
First Floor																				
PCB-1248	3.32E-05	= [	5.05E-03	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]
PCB-1260	6.86E-06	= [	1.04E-03	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]
Second Floor																				
PCB-1248	2.50E-07	= [	3.80E-05	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]
Fourth Floor																				
PCB-1248	3.09E-07	= [	4.70E-05	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]
Pump Room																				
PCB-1248	1.49E-06	= [	2.26E-04	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]
PCB-1260	2.17E-06	= [	3.30E-04	x	2.50E-01	x	400	x	0.14	x	1	x	12	x	25	] / [	70	x	9,125	]

AD_{dermal} = daily absorbed chemical dose
CS = chemical concentration in soil
CF = conversion factor
FTSS = fraction transferred, surface to skin (%)
SA = skin surface area available for contact, palms
ABS = absorption factor
SCT = skin contact time
EF = exposure frequency
ED = exposure duration
BW = body weight
AT = averaging time

Table B-30
Risk Characterization
Future Industrial/Commercial Worker Exposed to Interior Dust
Carter Carburetor Site, St. Louis, Missouri

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**$(mg/kg\text{-}day)^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Ingestion of Chemicals in Interior Dust										
First Floor										
PCB-1248	1.27E-05	x	2.0E+00	=	3E-05	3.56E-05	/	2.0E-05	=	**2**
PCB-1260	2.63E-06	x	2.0E+00	=	5E-06	7.35E-06	/	2.0E-05	=	0.4
			Pathway total	=	3E-05			Pathway total	=	**2**
Second Floor										
PCB-1248	9.56E-08	x	2.0E+00	=	2E-07	2.68E-07	/	2.0E-05	=	0.01
			Pathway total	=	2E-07			Pathway total	=	0.01
Fourth Floor										
PCB-1248	1.18E-07	x	2.0E+00	=	2E-07	3.31E-07	/	2.0E-05	=	0.02
			Pathway total	=	2E-07			Pathway total	=	0.02
Pump Room										
PCB-1248	5.69E-07	x	2.0E+00	=	1E-06	1.59E-06	/	2.0E-05	=	0.08
PCB-1260	8.30E-07	x	2.0E+00	=	2E-06	2.32E-06	/	2.0E-05	=	0.1
			Pathway total	=	3E-06			Pathway total	=	0.2

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**UR**	**=**	**CR**	**DI**	**/**	**RfC**	**=**	**HQ**
Units	**mg/m^3**		**(µg/m3)-1**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Inhalation of Chemicals in Interior Dust [(a)]										
First Floor										
PCB-1248	3.60E-04	x	5.7E-04	=	**2E-04**	1.01E-03	/	7.0E-05	=	**14**
PCB-1260	7.45E-05	x	5.7E-04	=	4E-05	2.09E-04	/	7.0E-05	=	**3**
			Pathway total =		**2E-04**			Pathway total =		**17**
Second Floor										
PCB-1248	2.71E-06	x	5.7E-04	=	2E-09	7.59E-06	/	7.0E-05	=	0.1
			Pathway total =		2E-09			Pathway total =		0.1
Fourth Floor										
PCB-1248	3.35E-06	x	5.7E-04	=	2E-09	9.39E-06	/	7.0E-05	=	0.1
			Pathway total =		2E-09			Pathway total =		0.1
Pump Room										
PCB-1248	1.61E-05	x	5.7E-04	=	9E-09	4.52E-05	/	7.0E-05	=	0.6
PCB-1260	2.35E-05	x	5.7E-04	=	1E-08	6.59E-05	/	7.0E-05	=	0.9
			Pathway total =		2E-08			Pathway total =		**2**

	Carcinogenic Effects					Noncarcinogenic Effects				
Equation	**DI**	**x**	**SF**	**=**	**CR**	**DI**	**/**	**RfD**	**=**	**HQ**
Units	**mg/kg-day**		**$(mg/kg\text{-}day)^{-1}$**		**unitless**	**mg/kg-day**		**mg/kg-day**		**unitless**
Dermal Contact with Chemicals in Interior Dust										
First Floor										
PCB-1248	1.19E-05	x	2.0E+00	=	2E-05	3.32E-05	/	2.0E-05	=	**2**
PCB-1260	2.45E-06	x	2.0E+00	=	5E-06	6.86E-06	/	2.0E-05	=	0.3
			Pathway total =		3E-05			Pathway total =		**2**
Second Floor										
PCB-1248	8.92E-08	x	2.0E+00	=	2E-07	2.50E-07	/	2.0E-05	=	0.01
			Pathway total =		2E-07			Pathway total =		0.01
Fourth Floor										
PCB-1248	1.10E-07	x	2.0E+00	=	2E-07	3.09E-07	/	2.0E-05	=	0.02
			Pathway total =		2E-07			Pathway total =		0.02
Pump Room										
PCB-1248	5.31E-07	x	2.0E+00	=	1E-06	1.49E-06	/	2.0E-05	=	0.07
PCB-1260	7.75E-07	x	2.0E+00	=	2E-06	2.17E-06	/	2.0E-05	=	0.1
			Pathway total =		3E-06			Pathway total =		0.2

Table B-30
Risk Characterization
Future Industrial/Commercial Worker Exposed to Interior Dust
Carter Carburetor Site, St. Louis, Missouri

Chemical Totals	Carcinogenic Effects			Noncarcinogenic Effects		
First Floor						
PCB-1248	Sum of all pathways	=	**3E-04**	Sum of all pathways	=	**18**
PCB-1260	Sum of all pathways	=	5E-05	Sum of all pathways	=	**4**
	Total Carcinogenic Risk All Pathways and Chemicals	=	**3E-04**	Total Noncarcinogenic Risk All Pathways and Chemicals	=	**22**
Second Floor						
PCB-1248	Sum of all pathways	=	4E-07	Sum of all pathways	=	0.1
	Total Carcinogenic Risk All Pathways and Chemicals	=	4E-07	Total Noncarcinogenic Risk All Pathways and Chemicals	=	0.1
Fourth Floor						
PCB-1248	Sum of all pathways	=	5E-07	Sum of all pathways	=	0.2
	Total Carcinogenic Risk All Pathways and Chemicals	=	5E-07	Total Noncarcinogenic Risk All Pathways and Chemicals	=	0.2
Pump Room						
PCB-1248	Sum of all pathways	=	2E-06	Sum of all pathways	=	0.8
PCB-1260	Sum of all pathways	=	3E-06	Sum of all pathways	=	**1**
	Total Carcinogenic Risk All Pathways and Chemicals	=	5E-06	Total Noncarcinogenic Risk All Pathways and Chemicals	=	**2**

DI = Chemical Daily Intake; Tables B-22 & B-23
SF = Cancer Slope Factors; Tables 5-1, 5-2
UR = Unit Risk; Table 5-2
CR = Cancer Risk
RfD = Noncancer Reference Dose; Table 5-3
RfC = Noncancer Reference Concentration; Table 5-4
HQ = Hazard Quotient
ND = no data
NA = not applicable

[(a)] For the interior dust inhalation pathway only, risk is calculated using unit risks and RFCs.
the toxicity parameter used for PCBs is the unit risk = 5.7E-04 $(\mu g/m^3)^{-1}$ and the RfC = 7.0E-05 mg/m^3.

Bold indicates risk exceeding 1E-04 for carcinogenic effects and 1.0 for noncarcinogenic effects.

Appendix C

Modeling and Supporting Documentation

Jury Model –
Soil Vapor to Ambient Air

CALCULATION OF THE VOLATILIZATION FACTOR - SOIL TO AMBIENT AIR

EQUATIONS:

$$VF\ (m^3/kg) = Q/C \times (3.14 \times D_A \times T)^{1/2} \times 10^{-4} (m^2/cm^2) / (2 \times P_b \times D_A)$$

where

$$DA = [(\mathrm{O}_a^{10/3} D_i H' + \mathrm{O}_w^{10/3} D_w)/n^2] / P_b K_d + \mathrm{O}_w + \mathrm{O}_a H'$$

PARAMETER/DEFINITION	UNITS	DEFAULT
VF / volatilization factor	m^3/kg	Calculated
D_A / apparent diffusivity	cm^2/s	Calculated
Q/C / inverse of the mean concentration at the center of a 0.5-acre-square source	g/m^2-s per kg/m^3	97.78 USEPA, 1996 (value for Zone 7; 1/2 acres)
T / exposure interval	s	7.9E+08 (25 years)
Π_b / dry soil bulk density	g/cm^3	1.5 USEPA, 1996
O_a / air-filled soil porosity	L_{air}/L_{soil}	0.28 USEPA, 1996
n / total soil porosity	L_{pore}/L_{soil}	0.43 USEPA, 1996
O_w / water-filled soil porosity	L_{water}/L_{soil}	0.15 USEPA, 1996
Ψ_s / soil particle density	g/cm^3	2.65 USEPA, 1996
D_i / diffusivity in air	cm^2/s	chemical-specific
H' / Henry's Law constant	dimensionless	chemical-specific
D_w / diffusivity in water	cm^2/s	chemical-specific
K_d / soil-water partition coefficient ($K_{oc} \times f_{oc}$) organics	cm^3/g	chemical-specific
K_{oc} / soil organic carbon partition coefficient	cm^3/g	chemical-specific
f_{oc} / fraction organic carbon in soil	g/g	0.006 Default

Source: USEPA, 1996. Soil Screening Guidance. EPA/540/R-95/128.

CALCULATION OF THE VOLATILIZATION FACTOR - SOIL TO AMBIENT AIR
ACF CARTER CARBURETOR SITE
ST. LOUIS, MISSOURI

CHEMICAL	D_i (cm^2/s)	H'	D_w (cm^2/s)	K_d (cm^3/g)	K_{oc} (cm^3/g)	D_A (cm^2/s)	VF (m^3/kg)
Tetrachloroethylene	7.20E-02	7.50E-01	8.20E-06	1.60E+00	2.70E+02	1.54E-03	**4132**
Trichloroethylene	7.90E-02	4.22E-01	9.10E-06	5.66E-01	9.43E+01	2.32E-03	**3367**
cis-1,2-Dichloroethylene	7.36E-02	1.67E-01	1.13E-05	2.13E-01	3.55E+01	1.85E-03	**3768**
trans-1,2-Dichloroethylene	7.07E-02	3.85E-01	1.19E-05	2.28E-01	3.80E+01	3.52E-03	**2733**
Vinyl Chloride	1.06E-01	1.11E+00	1.23E-06	1.12E-01	1.86E+01	1.45E-02	**1345**

Source of D_i, H', D_w, K_d, K_{oc}, and D_A values:

USEPA, 2008. Region 6 Human Health Medium-Specific Screening Levels 2008.

CALCULATION OF AMBIENT AIR CONCENTRATIONS FOR SOIL
ACF CARTER CARBURETOR SITE
ST. LOUIS, MISSOURI

COMPOUND	MEDIUM EPC (mg/kg)	VF-SOIL (m3/kg)	Ambient Air Conc. Soil [a] (mg/m3)
OUTSIDE SOILS - Subsurface soil			
Tetrachloroethylene	1.70E+00	4.13E+03	4.11E-04
TCE IMPACTED AREA - Surface soil			
Trichloroethylene	3.70E+02	3.37E+03	1.10E-01
TCE IMPACTED AREA - Subsurface soil			
Trichloroethylene	1.58E+02	3.37E+03	4.69E-02
cis-1,2-Dichloroethylene	4.17E+01	3.77E+03	1.11E-02
trans-1,2-Dichloroethylene	2.03E+00	2.73E+03	7.43E-04
Vinyl Chloride	1.66E+01	1.35E+03	1.23E-02

Notes:
NA= Not applicable/Not available
[a] Ambient air concentration (associated with soil) = Maximum Soil Concentration / VF-Soil

Virginia DEQ Trench Model –
Groundwater Vapor to Ambient Air

For Mass-Transfer Coefficients

Kg,H2O	0.833	cm/s
MWH2O	18	
Kl,O2	0.002	cm/s
MWO2	32	
T	**77**	F
T	298	K
R	8.20E-05	atm-m3/mol-K

For Emission Flux and Concentration in Trench

CF1	1.00E-03	L/cm3
CF2	1.00E+04	cm2/m2
CF3	3600	s/hr
F	**1**	
ACH	2	hr-1

Trench dimensions

Length	**8**	ft
	2.44	m
Width	**3**	ft
	0.91	m
Depth	**8**	ft
	2.44	m
Width/Depth	0.38	

Exposure-point concentrations (inhalation) for construction utility workers in a trench Groundwater less than 15 feet deep revised 10/5/07	CAS No.	Molecular Weight MWi g/mol	Henry's Law Constant Hi atm-m3/mol	Gas-Phase Mass Transfer Coefficient KiG cm/s	Liquid-Phase Mass Transfer Coefficient KiL cm/s	Overall Mass Transfer Coefficient Ki cm/s	Concentration of Contaminant in Groundwater Cgw ug/L	Volatilization Factor VF L/m3	Concentration of Contaminant in Trench Ctrench ug/m3	Concentration of Contaminant in Trench Ctrench mg/m3
TCL Volatile Organic Compounds (VOCs										
Acetone	67-64-1	58.08	3.88E-05	5.63E-01	1.48E-03	5.58E-04				
Benzene	71-43-2	78.11	5.55E-03	5.09E-01	1.28E-03	1.27E-03	4.40E+01	9.35E+00	4.11E+02	4.11E-01
Bromochloromethane	74-97-5	139.38	1.46E-03	4.20E-01	9.58E-04	9.23E-04				
Bromodichloromethane	75-27-4	163.83	1.60E-03	3.98E-01	8.84E-04	8.55E-04				
Bromoform	75-25-2	252.73	5.35E-04	3.44E-01	7.12E-04	6.50E-04				
Bromomethane	74-83-9	94.94	6.24E-03	4.77E-01	1.16E-03	1.15E-03				
2-Butanone (methyl ethyl ketone	78-93-3	72.11	5.59E-05	5.23E-01	1.33E-03	6.31E-04				
Carbon disulfide	75-15-0	76.14	3.03E-02	5.14E-01	1.30E-03	1.29E-03				
Carbon tetrachloride	56-23-5	153.82	3.04E-02	4.06E-01	9.12E-04	9.11E-04				
Chlorobenzene	108-90-7	112.56	3.70E-03	4.51E-01	1.07E-03	1.05E-03				
Chloroethane	75-00-3	64.51	8.82E-03	5.43E-01	1.41E-03	1.40E-03				
Chloroform	67-66-3	119.38	3.67E-03	4.42E-01	1.04E-03	1.02E-03				
Chloromethane	74-87-3	50.49	8.82E-03	5.90E-01	1.59E-03	1.58E-03				
Cyclohexane	110-82-7	84.16	1.95E-01	4.97E-01	1.23E-03	1.23E-03				
1,2-Dibromo-3-chloropropane	96-12-8	236.33	1.47E-04	3.52E-01	7.36E-04	5.46E-04				
Dibromochloromethane	124-48-1	208.28	7.83E-04	3.67E-01	7.84E-04	7.35E-04				
1,2-Dibromoethane	106-93-4	187.86	7.43E-04	3.80E-01	8.25E-04	7.70E-04				
1,2-Dichlorobenzene (ortho	95-50-1	147.00	1.90E-03	4.12E-01	9.33E-04	9.07E-04				
1,3-Dichlorobenzene (meta	541-73-1	147.00	3.10E-03	4.12E-01	9.33E-04	9.17E-04	1.12E+03	6.77E+00	7.58E+03	7.58E+00
1,4-Dichlorobenzene (para	106-46-7	147.00	2.43E-03	4.12E-01	9.33E-04	9.12E-04				
Dichlorodifluoromethane	75-71-8	120.91	3.43E-01	4.40E-01	1.03E-03	1.03E-03				
1,1-Dichloroethane	75-34-3	98.96	5.62E-03	4.71E-01	1.14E-03	1.13E-03				
1,2-Dichloroethane	107-06-2	98.96	9.79E-04	4.71E-01	1.14E-03	1.07E-03				
1,1-Dichloroethene	75-35-4	96.94	2.61E-02	4.74E-01	1.15E-03	1.15E-03				
1,2-Dichloroethene (total	540-59-0	96.94	4.51E-03	4.74E-01	1.15E-03	1.13E-03				
cis-1,2-Dichloroethene	156-59-2	96.94	4.08E-03	4.74E-01	1.15E-03	1.13E-03	1.41E+04	8.36E+00	1.18E+05	1.18E+02
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03				
1,2-Dichloropropane	78-87-5	112.99	2.80E-03	4.50E-01	1.06E-03	1.04E-03				
1,3-Dichloropropene (total	542-75-6	110.97	1.77E-02	4.53E-01	1.07E-03	1.07E-03				
cis-1,3-Dichloropropene	10061-01-5	110.97	1.20E-03	4.53E-01	1.07E-03	1.02E-03				
trans-1,3-Dichloropropene	10061-02-6	110.97	8.00E-04	4.53E-01	1.07E-03	1.00E-03				
1,4-dioxane	123-91-1	88.11	4.80E-06	4.89E-01	1.21E-03	8.90E-05				
Ethylbenzene	100-41-4	106.17	7.88E-03	4.60E-01	1.10E-03	1.09E-03				
Hexane	110-54-3	86.18	1.69E+00	4.93E-01	1.22E-03	1.22E-03				
2-Hexanone	591-78-6	100.16	9.32E-05	4.69E-01	1.13E-03	6.93E-04				
Isopropylbenzene	98-82-8	120.19	1.16E+00	4.41E-01	1.03E-03	1.03E-03	1.98E+01	7.62E+00	1.51E+02	1.51E-01
4-Methyl-2-pentanone (methyl isobutyl ketone	108-10-1	100.16	1.38E-04	4.69E-01	1.13E-03	7.92E-04				
Methyl acetate	79-20-9	74.08	1.15E-04	5.19E-01	1.31E-03	8.54E-04				
Methyl tert-butyl ethe	1634-04-4	88.15	5.87E-04	4.89E-01	1.21E-03	1.09E-03				
Methylcyclohexane	108-87-2	98.19	4.30E-01	4.72E-01	1.14E-03	1.14E-03				
Methylene chloride	75-09-2	84.93	2.19E-03	4.95E-01	1.23E-03	1.19E-03				
Styrene	100-42-5	104.15	2.75E-03	4.63E-01	1.11E-03	1.09E-03				
1,1,2,2-Tetrachloroethane	79-34-5	167.85	3.45E-04	3.94E-01	8.73E-04	7.55E-04				
Tetrachloroethene	127-18-4	165.83	1.84E-02	3.96E-01	8.79E-04	8.76E-04				
Toluene	108-88-3	92.14	6.64E-03	4.82E-01	1.18E-03	1.17E-03				
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	187.37	4.81E-01	3.80E-01	8.27E-04	8.26E-04				
1,2,3-Trichlorobenzene	87-61-6	181.45	1.25E-03	3.84E-01	8.40E-04	8.05E-04				
1,2,4-Trichlorobenzene	120-82-1	181.45	1.42E-03	3.84E-01	8.40E-04	8.09E-04				
1,1,1-Trichloroethane	71-55-6	133.40	1.72E-02	4.26E-01	9.80E-04	9.76E-04				
1,1,2-Trichloroethane	79-00-5	133.40	9.13E-04	4.26E-01	9.80E-04	9.23E-04				
Trichloroethene	79-01-6	131.39	1.03E-02	4.28E-01	9.87E-04	9.82E-04	3.43E+03	7.25E+00	2.49E+04	2.49E+01
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	1.11E+03	1.05E+01	1.17E+04	1.17E+01
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				
Other VOCs										
n-butylbenzene	104-51-8	134.22	1.59E-02	4.25E-01	9.77E-04	9.73E-04				
sec-butylbenzene	135-98-8	134.22	1.76E-02	4.25E-01	9.77E-04	9.73E-04				
tert-butylbenzene	98-06-6	134.22	1.32E-02	4.25E-01	9.77E-04	9.72E-04				
isopropyltoluene	99-87-6	134.22	1.10E-02	4.25E-01	9.77E-04	9.72E-04	6.10E+00	7.17E+00	4.38E+01	4.38E-02
n-propylbenzene	103-65-1	120.19	1.05E-02	4.41E-01	1.03E-03	1.03E-03				
1,1,1,2-tetrachloroethane	630-20-6	167.85	2.42E-03	3.94E-01	8.73E-04	8.54E-04				
1,2,4-trimethylbenzene	95-63-6	120.19	6.16E-03	4.41E-01	1.03E-03	1.02E-03	7.06E+01	7.55E+00	5.33E+02	5.33E-01
1,3,5-trimethylbenzene	108-67-8	120.19	8.77E-03	4.41E-01	1.03E-03	1.03E-03				
m-xylene	108-38-3	106.17	7.34E-03	4.60E-01	1.10E-03	1.09E-03				
o-xylene	95-47-6	106.17	5.19E-03	4.60E-01	1.10E-03	1.09E-03				
p-xylene	106-42-3	106.17	7.66E-03	4.60E-01	1.10E-03	1.09E-03				

Johnson Ettinger Model – Groundwater Vapor to Indoor Air (Vapor Intrusion)

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
95636	7.06E+01	1,2,4-Trimethylbenzene

MORE ↓

Totals must add up to value of L_{WT} (cell G28)

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	305	305			A	SI	SI		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

1,2,4-Trimethylbenzene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.06E-02	7.92E-06	6.14E-03	25	9,369	442.30	649.17	1.35E+03	5.70E+01	0.0E+00	6.0E-03

END

1,2,4-Trimethylbenzene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	11,692	2.16E-03	9.30E-02	1.75E-04	5.82E-03	0.00E+00	0.00E+00	1.64E-04	2.86E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	6.56E+03	0.10	6.86E+01	5.82E-03	4.88E+03	3.09E+10	2.48E-06	1.63E-02	NA	6.0E-03

END

RESULTS SHEET

1,2,4-Trimethylbenzene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	5.70E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.9E-03

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
541731	1.12E+03	1,3-Dichlorobenzene

MORE ↓

Totals must add up to value of L_{WT} (cell G28)

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
10	15	305	305			A	SI	SI		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

1,3-Dichlorobenzene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
6.92E-02	7.86E-06	3.09E-03	25	9,230	446.00	684.00	1.98E+03	1.34E+02	0.0E+00	1.1E-01

END

1,3-Dichlorobenzene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	11,174	1.14E-03	4.90E-02	1.75E-04	6.65E-03	0.00E+00	0.00E+00	1.98E-04	3.45E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	5.49E+04	0.10	6.86E+01	6.65E-03	4.88E+03	1.53E+09	2.62E-06	1.44E-01	NA	1.1E-01

END

RESULTS SHEET

1,3-Dichlorobenzene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.34E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	9.4E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
71432	4.40E+01	Benzene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	305	305			A	SI	SI		

Totals must add up to value of L_{WT} (cell G28) [applies to h_A, h_B, h_C]

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Benzene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	7.8E-06	3.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Benzene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, θ_a^C (cm³/cm³)	Stratum A effective total fluid saturation, S_{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k_i (cm²)	Stratum A soil relative air permeability, k_{rg} (cm²)	Stratum A soil effective vapor permeability, k_v (cm²)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm³/cm³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm³/cm³)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm³/s)	Area of enclosed space below grade, A_B (cm²)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm²/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm²/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm²/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm²/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm²/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	8,122	2.68E-03	1.15E-01	1.75E-04	8.45E-03	0.00E+00	0.00E+00	2.32E-04	4.04E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m³)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm³/s)	Crack effective diffusion coefficient, D^{crack} (cm²/s)	Area of crack, A_{crack} (cm²)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m³)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m³)
15	5.07E+03	0.10	6.86E+01	8.45E-03	4.88E+03	1.67E+07	2.73E-06	1.39E-02	7.8E-06	3.0E-02

END

RESULTS SHEET

Benzene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.6E-08	3.2E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
156592	1.41E+04	cis-1,2-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	305	305			A	SI	SI		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

cis-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	3.55E+01	3.50E+03	0.0E+00	3.5E-02

END

INTERMEDIATE CALCULATIONS SHEET

cis-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	7,734	2.04E-03	8.77E-02	1.75E-04	7.07E-03	0.00E+00	0.00E+00	2.04E-04	3.55E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.24E+06	0.10	6.86E+01	7.07E-03	4.88E+03	4.33E+08	2.64E-06	3.27E+00	NA	3.5E-02

END

RESULTS SHEET

cis-1,2-Dichloroethylene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	3.50E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.4E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
98828	1.98E+01	Cumene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
10	15	305	305			A	SI	SI		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Cumene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.50E-02	7.10E-06	1.46E-02	25	10,335	425.56	631.10	4.89E+02	6.13E+01	0.0E+00	4.0E-01

END

Cumene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	12,644	4.71E-03	2.03E-01	1.75E-04	6.24E-03	0.00E+00	0.00E+00	1.67E-04	2.91E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	4.02E+03	0.10	6.86E+01	6.24E-03	4.88E+03	6.03E+09	2.49E-06	1.00E-02	NA	4.0E-01

END

RESULTS SHEET

Cumene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	6.13E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.7E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
79016	3.43E+03	Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
10	15	305	305			A	SI	SI		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Trichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	1.1E-04	4.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Trichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	8,557	4.78E-03	2.06E-01	1.75E-04	7.59E-03	0.00E+00	0.00E+00	2.03E-04	3.54E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.06E+05	0.10	6.86E+01	7.59E-03	4.88E+03	1.11E+08	2.64E-06	1.86E+00	1.1E-04	4.0E-02

END

RESULTS SHEET

Trichloroethylene

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.0E-05	3.2E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

DATA ENTRY SHEET

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75014	1.11E+03	Vinyl chloride (chloroethene)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm²)
10	15	305	305			A	SI	SI		

Totals must add up to value of L_{WT} (cell G28)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm³)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm³)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
SI	1.35	0.489	0.167								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	12192	12192	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-06	1

Used to calculate risk-based groundwater concentration.

END

CHEMICAL PROPERTIES SHEET

Vinyl chloride (chloroethene)

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	8.8E-06	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Vinyl chloride (chloroethene)

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
7.88E+08	290	0.322	ERROR	ERROR	0.267	6.74E-09	0.830	5.60E-09	163.04	0.489	0.107	0.382	48,768

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
1.89E+07	1.49E+08	3.26E-05	15	5,000	1.72E-02	7.41E-01	1.75E-04	1.02E-02	0.00E+00	0.00E+00	2.65E-04	4.62E-04	290

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	8.23E+05	0.10	6.86E+01	1.02E-02	4.88E+03	9.95E+05	2.82E-06	2.32E+00	8.8E-06	1.0E-01

END

RESULTS SHEET

Vinyl chloride (chloroethene)

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	8.80E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.0E-06	1.6E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

Johnson Ettinger Model –
Soil Gas to Indoor Air
(Vapor Intrusion)

- Areas A through E – Tedlar Samples – 95% UCL
- Areas A through E – Summa Samples – 95% UCL
- Areas F through H – Tedlar Samples – 95% UCL
- Areas F through H – Summa Samples – 95% UCL

Areas A through E – Tedlar Samples – 95% UCL

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
75354	2.22E+01			1,1-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)		ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1		

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

1,1-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	96.94	0.0E+00	2.0E-01

INTERMEDIATE CALCULATIONS SHEET

1,1-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	2.22E+01	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	6,392	1.47E-02	6.33E-01	1.75E-04	1.45E-02	0.00E+00	0.00E+00	1.45E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	2.22E+01	0.10	1.14E+03	1.45E-02	4.57E+03	2.59E+111	9.55E-05	2.12E-03	NA	2.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156592	2.79E+04			cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Totals must add up to value of Ls (cell F24) (applies to the three thickness columns h_A, h_B, h_C)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

cis-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	96.94	0.0E+00	3.5E-02

INTERMEDIATE CALCULATIONS SHEET

cis-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	2.79E+04	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	7,734	2.04E-03	8.77E-02	1.75E-04	1.19E-02	0.00E+00	0.00E+00	1.19E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.79E+04	0.10	1.14E+03	1.19E-02	4.57E+03	1.73E+136	9.54E-05	2.66E+00	NA	3.5E-02

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	1.66E+03			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.66	0.375	0.054								

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Tetrachloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01

INTERMEDIATE CALCULATIONS SHEET

Tetrachloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	1.66E+03	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	9,553	7.81E-03	3.36E-01	1.75E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.66E+03	0.10	1.14E+03	1.16E-02	4.57E+03	1.85E+139	9.54E-05	1.58E-01	5.9E-06	6.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156605	2.30E+02			trans-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

trans-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	96.94	0.0E+00	7.0E-02

trans-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	2.30E+02	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	7,136	4.94E-03	2.13E-01	1.75E-04	1.14E-02	0.00E+00	0.00E+00	1.14E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.30E+02	0.10	1.14E+03	1.14E-02	4.57E+03	6.73E+141	9.54E-05	2.19E-02	NA	7.0E-02

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	1.67E+05			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Trichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3$)$^{-1}$	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

Trichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	1.67E+05	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.67E+05	0.10	1.14E+03	1.28E-02	4.57E+03	8.45E+126	9.54E-05	1.59E+01	1.1E-04	4.0E-02

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
75014	3.61E+02			Vinyl chloride (chloroethene)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

(Thickness columns: Totals must add up to value of Ls (cell F24))

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Vinyl chloride (chloroethene)

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	62.50	8.8E-06	1.0E-01

INTERMEDIATE CALCULATIONS SHEET

Vinyl chloride (chloroethene)

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	3.61E+02	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	5,000	1.72E-02	7.41E-01	1.75E-04	1.71E-02	0.00E+00	0.00E+00	1.71E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.61E+02	0.10	1.14E+03	1.71E-02	4.57E+03	3.95E+94	9.55E-05	3.45E-02	8.8E-06	1.0E-01

END

Areas A through E – Summa Samples – 95% UCL

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
75354	3.15E+01			1,1-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Thickness columns: Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

1,1-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	96.94	0.0E+00	2.0E-01

INTERMEDIATE CALCULATIONS SHEET

1,1-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	3.15E+01	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	6,392	1.47E-02	6.33E-01	1.75E-04	1.45E-02	0.00E+00	0.00E+00	1.45E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	3.15E+01	0.10	1.14E+03	1.45E-02	4.57E+03	2.59E+111	9.55E-05	3.01E-03	NA	2.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156592	1.12E+04			cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Note: Totals must add up to value of Ls (cell F24) (applies to thickness of soil strata A, B, C).

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

cis-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	96.94	0.0E+00	3.5E-02

INTERMEDIATE CALCULATIONS SHEET

cis-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	1.12E+04	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	7,734	2.04E-03	8.77E-02	1.75E-04	1.19E-02	0.00E+00	0.00E+00	1.19E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.12E+04	0.10	1.14E+03	1.19E-02	4.57E+03	1.73E+136	9.54E-05	1.07E+00	NA	3.5E-02

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	2.32E+03			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Note: Thickness columns — Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Tetrachloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01

INTERMEDIATE CALCULATIONS SHEET

Tetrachloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	2.32E+03	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	9,553	7.81E-03	3.36E-01	1.75E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	2.32E+03	0.10	1.14E+03	1.16E-02	4.57E+03	1.85E+139	9.54E-05	2.21E-01	5.9E-06	6.0E-01

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156605	2.64E+02			trans-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

trans-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	96.94	0.0E+00	7.0E-02

trans-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	2.64E+02	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	7,136	4.94E-03	2.13E-01	1.75E-04	1.14E-02	0.00E+00	0.00E+00	1.14E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	2.64E+02	0.10	1.14E+03	1.14E-02	4.57E+03	6.73E+141	9.54E-05	2.52E-02	NA	7.0E-02

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	1.64E+05			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

(Totals must add up to value of Ls (cell F24) — applies to thickness of soil strata A, B and C)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

Trichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

INTERMEDIATE CALCULATIONS SHEET

Trichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	1.64E+05	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, $D^{eff}{}_A$ (cm^2/s)	Stratum B effective diffusion coefficient, $D^{eff}{}_B$ (cm^2/s)	Stratum C effective diffusion coefficient, $D^{eff}{}_C$ (cm^2/s)	Total overall effective diffusion coefficient, $D^{eff}{}_T$ (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.64E+05	0.10	1.14E+03	1.28E-02	4.57E+03	8.45E+126	9.54E-05	1.56E+01	1.1E-04	4.0E-02

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
75014	1.83E+02			Vinyl chloride (chloroethene)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	17526	5334	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Vinyl chloride (chloroethene)

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	62.50	8.8E-06	1.0E-01

INTERMEDIATE CALCULATIONS SHEET

Vinyl chloride (chloroethene)

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	45,720	1.83E+02	1.19E+07

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
9.35E+07	4.89E-05	15	5,000	1.72E-02	7.41E-01	1.75E-04	1.71E-02	0.00E+00	0.00E+00	1.71E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	1.83E+02	0.10	1.14E+03	1.71E-02	4.57E+03	3.95E+94	9.55E-05	1.75E-02	8.8E-06	1.0E-01

END

Areas F through H – Tedlar Samples – 95% UCL

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	1.95E+02			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Tetrachloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01

INTERMEDIATE CALCULATIONS SHEET

Tetrachloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	1.95E+02	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	9,553	7.81E-03	3.36E-01	1.75E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	1.95E+02	0.10	4.93E+02	1.16E-02	1.98E+03	1.85E+139	1.58E-04	3.08E-02	5.9E-06	6.0E-01

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	7.00E+03			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

Note: Thickness columns (stratum A, B, C) — Totals must add up to value of Ls (cell F24)

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Trichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

Trichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	7.00E+03	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	7.00E+03	0.10	4.93E+02	1.28E-02	1.98E+03	8.45E+126	1.58E-04	1.11E+00	1.1E-04	4.0E-02

END

Areas F through H – Summa Samples – 95% UCL

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156592	4.80E-01			cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

cis-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	96.94	0.0E+00	3.5E-02

cis-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. (μg/m^3)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	4.80E-01	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	7,734	2.04E-03	8.77E-02	1.75E-04	1.19E-02	0.00E+00	0.00E+00	1.19E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)	Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
15	4.80E-01	0.10	4.93E+02	1.19E-02	1.98E+03	1.73E+136	1.58E-04	7.58E-05	NA	3.5E-02

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
127184	3.25E+02			Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Tetrachloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Molecular weight, MW (g/mol)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	165.83	5.9E-06	6.0E-01

INTERMEDIATE CALCULATIONS SHEET

Tetrachloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	3.25E+02	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	9,553	7.81E-03	3.36E-01	1.75E-04	1.16E-02	0.00E+00	0.00E+00	1.16E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.25E+02	0.10	4.93E+02	1.16E-02	1.98E+03	1.85E+139	1.58E-04	5.13E-02	5.9E-06	6.0E-01

END

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156605	2.00E-01			trans-1,2-Dichloroethylene

MORE

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^oC)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of Ls (cell F24)					
15	20	10	20			S		

MORE

ENTER Stratum A SCS soil type (Lookup Soil Parameters)	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type (Lookup Soil Parameters)	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type (Lookup Soil Parameters)	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

trans-1,2-Dichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	96.94	0.0E+00	7.0E-02

trans-1,2-Dichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	2.00E-01	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	7,136	4.94E-03	2.13E-01	1.75E-04	1.14E-02	0.00E+00	0.00E+00	1.14E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
15	2.00E-01	0.10	4.93E+02	1.14E-02	1.98E+03	6.73E+141	1.58E-04	3.16E-05	NA	7.0E-02

END

DATA ENTRY SHEET

SG-ADV
Version 3.1; 02/04

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	3.98E+03			Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (^{o}C)	ENTER Totals must add up to value of Ls (cell F24) Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
15	20	10	20			S		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
S	1.66	0.375	0.054								

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s^2)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
15	40	5334	4572	457	0.1	1	

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
70	25	25	250

END

CHEMICAL PROPERTIES SHEET

Trichloroethylene

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Molecular weight, MW (g/mol)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	131.39	1.1E-04	4.0E-02

Trichloroethylene

Exposure duration, τ (sec)	Source-building separation, L_T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm^3/cm^3)	Stratum B soil air-filled porosity, θ_a^B (cm^3/cm^3)	Stratum C soil air-filled porosity, θ_a^C (cm^3/cm^3)	Stratum A effective total fluid saturation, S_{te} (cm^3/cm^3)	Stratum A soil intrinsic permeability, k_i (cm^2)	Stratum A soil relative air permeability, k_{rg} (cm^2)	Stratum A soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
7.88E+08	5	0.321	ERROR	ERROR	0.003	9.92E-08	0.998	9.91E-08	19,812	3.98E+03	3.10E+06

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D^{eff}_A (cm^2/s)	Stratum B effective diffusion coefficient, D^{eff}_B (cm^2/s)	Stratum C effective diffusion coefficient, D^{eff}_C (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)	Diffusion path length, L_d (cm)
2.44E+07	8.12E-05	15	8,557	4.78E-03	2.06E-01	1.75E-04	1.28E-02	0.00E+00	0.00E+00	1.28E-02	5

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
15	3.98E+03	0.10	4.93E+02	1.28E-02	1.98E+03	8.45E+126	1.58E-04	6.28E-01	1.1E-04	4.0E-02

END

Supporting Documentation for Dermal Groundwater Calculations

- PC Event

FOR ORGANIC CHEMICALS IN WATER (latest version 04/01)

Worksheet to Calculate Dermal Absorption of Organic Chemicals from Aqueous Media (latest version 04/01)

Enter the Following Exposure Conditions: for site specific conditions, change values in Cells I8-I18
The default exposure conditions used in this spreadsheet assume exposure duration for
carcinogenic effects of chemicals in water through showering

Concentration (mg/L*L/1000 cm3):	Conc =	1E+00 mg/cm3 (default value for purpose of illustration)
Input site specific concentrations in Column marked "Conc"		
Area exposed (cm2):	SA =	5670 cm2
Event time (hr/event):	t_event =	2.00 hr/event (35 minutes/event)
Event frequency (events/day):	EV =	1.0 event/day
Exposure frequency (days/year):	EF =	20.0 days/yr
Exposure duration (years):	ED =	1.0 years
for carcinogenic effects, ED = 30 years (used in this spreadsheet)		
for noncarcinogenic effects, ED = 9 years		
Body weight (kg):	BW =	70.0 kg
Averaging time (days):	AT =	25550 days
for carcinogenic effects, AT=70 years (25,550 days)		
for noncarcinogenic effects, AT=ED (in days)		
Skin thickness (assumed to be 10 um):	lsc =	1.00E-03 cm

CHEMICAL	CAS No.	MWT	logKow	Kp 95% LCI	Kp (cm/hr) predicted	Kp (cm/hr) measured	Kp 95% UCI	Special Chemicals (*) or (**)	B	tau (hr)	t_star (hr)	FA	Conc (mg/cm3)	Kp used in DA_event	DA_event (mg/cm2-evt)
Indeno(1,2,3-CD)pyrene	193-39-5	276.3	6.58	3.5E-02	1.0E+00		3.1E+01	*	6.7	3.78	16.83	0.6	1.0E+00	1.0E+00	4.7E+00
Benzo-b-fluoranthene	205-99-2	252.3	6.12	2.4E-02	7.0E-01		2.0E+01	*	4.3	2.77	12.03	1.0	1.0E+00	7.0E-01	4.6E+00
Chrysene	218-01-9	228.3	5.66	1.7E-02	4.7E-01		1.3E+01	*	2.8	2.03	8.53	1.0	1.0E+00	4.7E-01	2.6E+00
Benzo-a-pyrene	50-32-8	250.0	6.10	2.4E-02	7.0E-01		2.0E+01	*	4.3	2.69	11.67	1.0	1.0E+00	7.0E-01	4.5E+00
Dichlorobenzene, 1,3-	541-73-1	147.0	3.60	2.3E-03	5.8E-02		1.5E+00		0.3	0.71	1.71	1.0	1.0E+00	5.8E-02	1.9E-01
Benzo-a-anthracene	56-55-3	228.3	5.66	1.7E-02	4.7E-01		1.3E+01	*	2.8	2.03	8.53	1.0	1.0E+00	4.7E-01	2.6E+00
Benzene	71-43-2	78.1	2.13	5.9E-04	1.5E-02		3.7E-01		0.1	0.29	0.70	1.0	1.0E+00	1.5E-02	3.7E-02
Vinyl chloride	75-01-4-adul	62.5	1.36	2.2E-04	5.6E-03		1.4E-01	**	0.0	0.24	0.57	1.0	1.0E+00	5.6E-03	1.4E-02
Trichloroethylene	79-01-6-ALT	131.4	2.42	4.7E-04	1.2E-02		2.9E-01	**	0.1	0.58	1.39	1.0	1.0E+00	1.2E-02	3.6E-02
Phenanthrene	85-01-8	178.2	4.46	5.5E-03	1.4E-01		3.8E+00	*	0.7	1.06	4.11	1.0	1.0E+00	1.4E-01	5.8E-01

Construction Worker
Particulate Emission Factor

CALCULATION OF FUGITIVE DUST EMISSIONS FROM WIND EROSION

EQUATIONS:

$$M_{wind} = 0.036 \times (1\text{-}V) \times (U_m/U_t)^3 \times F(x) \times A_{surf} \times ED \times 8760 \text{ hr/yr}$$

PARAMETER / DEFINITIONS	UNITS	VALUES
M_{wind} / Unit mass emitted from wind erosion	g	**60,785** calculated
V / Fraction of vegetative cover	unitless	0
U_m / Mean windspeed during construction	m/s	4.69 USEPA, 1996
U_t / Equivalent Threshold value of windspeed at 7 m	m/s	11.32 USEPA, 1996
F(x) / Function dependent on Um/Ut derived from Cowherd et al (1985)	unitless	0.194 USEPA, 1996
A_{surf} / Areal extent of site with surface soil contamination	m^2	40,470 10-acres
ED / Exposure Duration	yr	0.35 126 days

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

USEPA, 1996. Soil Screening Guidance: User's Guide. Second Edition. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Publication 9355.4-23.

Cowherd, C.G., G. Muleski, P. Engelhart, and D. Gillette, 1985. Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites. EPA/600/8-85/002. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Washington, D.C.

Prepared by / Date: KJC 02/03/09

Checked by / Date: JHP 02/04/09

CALCULATION OF FUGITIVE DUST EMISSIONS FROM DUMPING OF EXCAVATED SOIL

EQUATIONS:

$$M_{excav} = 0.35 \times 0.0016 \times ((U_m/2.2)^{1.3}/(M/2)^{1.4}) \times \rho_{soil} \times A_{excav} \times d_{excav} \times N_A \times 10^3 \text{ g/kg}$$

PARAMETER / DEFINITIONS	UNITS	VALUES
M_{excav} / Unit mass emitted from excavation soil dumping	g	**50,540** calculated
0.35 / PM_{10} particle size multiplier	unitless	0.35 USEPA, 1996
U_m / Mean windspeed during construction	m/s	4.69 USEPA, 1996
M / Gravimetric soil moisture content	percent	12 USEPA, 1985
ρ_{soil} / In situ soil density (includes water)	Mg/m^3	1.68 USEPA, 2002
A_{excav} / Areal extent of excavation	m^2	40,470 10-acres
d_{excav} / Average depth of excavation	m	3.05 10 ft
N_A / Number of times soil is dumped	unitless	2 USEPA, 2002

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

USEPA, 1996. Soil Screening Guidance: User's Guide. Second Edition. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Publication 9355.4-23.

USEPA, 1985. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, and Supplements. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF FUGITIVE DUST EMISSIONS FROM DOZING OPERATIONS

EQUATIONS:

$$M_{doz} = 0.75 \times 0.45(s)^{1.5}/(M)^{1.4} \times \Sigma VKT/S \times 10^3 \text{ g/kg}$$

PARAMETER / DEFINITIONS	UNITS	VALUES
M_{doz} / Unit mass emitted from dozing operations	g	**5,796** calculated
0.75 / PM_{10} particle size multiplier	unitless	0.75 USEPA, 1996
s / Soil silt content	percent	50 Soil type: Silt
M / Gravimetric soil moisture content	percent	7.9 USEPA, 1985
ΣVKT / Sum of dozing kilometers traveled	km	10 Assumption
S / Average dozing speed	kph	11.4 USEPA, 1985

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

USEPA, 1996. Soil Screening Guidance: User's Guide. Second Edition. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Publication 9355.4-23.

USEPA, 1985. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, and Supplements. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF FUGITIVE DUST EMISSIONS FROM GRADING OPERATIONS

EQUATIONS:

$$M_{grade} = 0.60 \times 0.0056(S)^{2.0} \times \Sigma VKT \times 10^3 \text{ g/kg}$$

PARAMETER / DEFINITIONS	UNITS	VALUES
M_{grade} / Unit mass emitted from grading operations	g	**4,367** calculated
0.60 / PM_{10} particle size multiplier	unitless	0.60 USEPA, 2002
S / Average grading speed	kph	11.4 USEPA, 1985
ΣVKT / Sum of grading kilometers traveled	km	10 Assumption

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

USEPA, 1996. Soil Screening Guidance: User's Guide. Second Edition. Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Publication 9355.4-23.

USEPA, 1985. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, and Supplements. Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF FUGITIVE DUST EMISSIONS FROM TILLING OPERATIONS

EQUATIONS:

$$M_{till} = 1.1(s)^{0.6} \times A_{till} \times 4{,}047\ m^2/acre \times 10^{-4}\ ha/m^2 \times 10^3\ g/kg \times N_A$$

PARAMETER / DEFINITIONS	UNITS	VALUES
M_{till} / Unit mass emitted from tilling operations	g	**93,097** calculated
s / Soil silt content	percent	50 Soil type: Silt
A_{till} / Areal extent of tilling	acres	10
N_A / Number of times soil is tilled	unitless	2 USEPA, 2002

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

USEPA, 1992. Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures, EPA-450/2-92-004.
Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF TOTAL TIME-AVERAGED EMISSION FLUX

EQUATIONS:

$$\langle J'_T \rangle = (M_{wind} + M_{excav} + M_{doz} + M_{grade} + M_{till})/(A_c \times T)$$

PARAMETER / DEFINITIONS	UNITS	VALUES
$\langle J'_T \rangle$ / Total time-averaged PM_{10} unit emission flux for construction activities other than traffic on unpaved roads	g/m^2-s	**0.000002** calculated
M_{wind} / Unit mass emitted from wind erosion	g	60,785 calculated
M_{excav} / Unit mass emitted from excavation soil dumping	g	50,540 calculated
M_{doz} / Unit mass emitted from dozing operations	g	5,796 calculated
M_{grade} / Unit mass emitted from grading operations	g	4,367 calculated
M_{till} / Unit mass emitted from tilling operations	g	93,097 calculated
A_c / Areal extent of soil soil contamination	m^2	40,470 10-acres
T / Duration of construction	s	2,592,000 8 hr/day for 90 days

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF SUBCHRONIC ON-SITE DISPERSION FACTOR

EQUATIONS:

$$Q/C_{sa} = A \times \exp[(\ln A_c - B)^2/C]$$

PARAMETER / DEFINITIONS	UNITS	VALUES
Q/C_{sa} / Inverse of the ratio of the 1-hr geometric mean air concentration and the emission flux at the center of the square of emission source	g/m^2-s per kg/m^3	**8.4** calculated
A / Constant		2.4538 USEPA, 2002
B / Constant		17.5660 USEPA, 2002
C / Constant		189.0426 USEPA, 2002
A_c / Areal extent of soil soil contamination	acres	10

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

Notes:
Units not presented in USEPA (2002).

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF DISPERSION CORRECTION FACTOR FOR AVERAGING TIMES LESS THAN ONE YEAR

EQUATIONS:

$$F_D = 0.1852 + 5.3537/t_c + -9.6318/t_c^2$$

PARAMETER / DEFINITIONS	UNITS	VALUES
F_D / Dispersion correction factor	unitless	**0.19** calculated
t_c / Duration of construction	hr	720 8 hr/day for 90 days

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

CALCULATION OF TOTAL TIME-AVERAGED EMISSION FLUX

EQUATIONS:

$$PEF'_{SC} = Q/C_{sa} \times 1/F_D \times 1 / <J'_T>$$

PARAMETER / DEFINITIONS	UNITS	VALUES
PEF'_{sc} / Subchronic particulate emission factor for construction activities other than traffic on unpaved roads	m^3/kg	**21,356,283** calculated
Q/C_{sa} / Inverse of the ratio of the 1-hr geometric mean air concentration and the emission flux at the center of the square of emission source	g/m^2-s per kg/m^3	8.4 calculated
F_D / Dispersion correction factor	unitless	0.19 calculated
$<J'_T>$ / Total time-averaged PM_{10} unit emission flux for construction activities other than traffic on unpaved roads	g/m^2-s	0.000002 calculated

Source: USEPA, 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24. December.

Prepared by / Date: KJC 02/03/09
Checked by / Date: JHP 02/04/09

Tables

Table 3-1
Statistical Summary of Soil Data for the Streamlined Risk Evaluation
Exterior to the CBI Building
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (mg/kg) NON-DETECTS	RANGE OF CONCENTRATIONS (mg/kg) DETECTS	MEAN CONCENTRATION(1,2) (mg/kg)	USEPA REGION 6 SCREENING VALUE(3) (mg/kg)	COPC? (4)	UCL(1,2) (mg/kg)	EXPOSURE POINT CONCENTRATION (5) (mg/kg)
Surface Soil (0 to 1 ft)									
Polychlorinated Biphenyls									
PCB-1242	0 / 8	0%	0.31 - 0.419	na - na	0.18	0.83 c	NO(7)	0.19	na
PCB-1248	1 / 8	13%	0.318 - 0.419	1.27 - 1.27	0.319	0.83 c	**YES**	0.91	0.91
PCB-1254	0 / 8	0%	0.31 - 0.419	na - na	0.18	0.83 c	NO(7)	0.19	na
PCB-1260	0 / 8	0%	0.31 - 0.419	na - na	0.18	0.83 c	NO(7)	0.19	na
Subsurface Soil (0 to 10 ft)									
Volatile Organic Compounds									
Tetrachloroethylene	3 / 22	14%	0.0051 - 0.0064	0.0159 - 3.46	0.22	1.7 c	**YES**	1.7	1.7
Polychlorinated Biphenyls									
PCB-1242	1 / 64	2%	0.306 - 32	2.1 - 2.1	0.64	0.83 c	**YES**	1.9	1.9
PCB-1248	3 / 64	5%	0.306 - 32	0.936 - 2.61	0.68	0.83 c	**YES**	1.9	1.9
PCB-1254	0 / 64	0%	0.306 - 32	na - na	0.62	0.83 c	NO(7)	1.9	na
PCB-1260	5 / 64	8%	0.306 - 0.63	1.2 - 409	8.4	0.83 c	**YES**	48.9	48.9
Metals									
Arsenic	21 / 22	95%	4.1 - 4.1	6.5 - 23	16.1	1.8 c	**YES**	21.1	21.1

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.
(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.
(3) USEPA Region 6 Media Specific Screening Levels. Most conservative (lowest) concentration among commercial and industrial values was selected for screening purposes; if based on non-cancer effects, one-tenth of the value was used.
(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.
(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.
(6) Not selected as COPC because the maximum detected concentration is less than the screening value.
(7) Not selected as COPC because there were no detections.
UCL = upper confidence limit about the mean.
COPC = chemical of potential concern
na = not applicable
mg/kg = milligram per kilogram

Table 3-2
Statistical Summary of Soil Data for the Streamlined Risk Evaluation
Collected from Under the CBI Building
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF CONCENTRATIONS (mg/kg) NON-DETECTS	DETECTS	MEAN CONCENTRATION[1,2] (mg/kg)	USEPA REGION 6 SCREENING VALUE[3] (mg/kg)	COPC? [4]	UCL[1,2] (mg/kg)	EXPOSURE POINT CONCENTRATION[5] (mg/kg)
Surface Soil (0 to 1 ft)								
PCB-1242	0 / 38 0%	0.033 - 0.77	na - na	0.031	0.83 c	NO[6]	0.074	na
PCB-1248	14 / 38 37%	0.033 - 0.19	0.043 - 3.74	0.17	0.83 c	**YES**	1.1	1.1
PCB-1254	0 / 38 0%	0.033 - 0.77	na - na	0.031	0.83 c	NO[6]	0.074	na
PCB-1260	2 / 38 5%	0.033 - 0.77	0.454 - 1.23	0.073	0.83 c	**YES**	0.22	0.22
Subsurface Soil (0 to 10 ft)								
PCB-1242	0 / 43 0%	0.033 - 0.77	na - na	0.031	0.83 c	NO[6]	0.073	na
PCB-1248	17 / 43 40%	0.033 - 0.194	0.043 - 3.74	0.22	0.83 c	**YES**	1.3	1.3
PCB-1254	0 / 43 0%	0.033 - 0.77	na - na	0.031	0.83 c	NO[6]	0.073	na
PCB-1260	2 / 43 5%	0.033 - 0.77	0.454 - 1.23	0.072	0.83 c	**YES**	0.20	0.20

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.
(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.
(3) USEPA Region 6 Media Specific Screening Levels. Most conservative (lowest) concentration among commercial and industrial values was selected for screening purposes; if based on non-cancer effects, one-tenth of the value was used.
(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.
(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.
(6) Not selected as COPC because there were no detections.
UCL = upper confidence limit about the mean.
COPC = chemical of potential concern
na = not applicable

Table 3-3
Statistical Summary of Soil Data for the Streamlined Risk Evaluation
Collected from the Former Die Cast Building Area
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF CONCENTRATIONS (mg/kg) NON-DETECTS	DETECTS	MEAN CONCENTRATION(1,2) (mg/kg)	USEPA REGION 6 SCREENING VALUE(3) (mg/kg)	COPC? (4)	UCL(1,2) (mg/kg)	EXPOSURE POINT CONCENTRATION(5) (mg/kg)
Surface Soil (0 to 1 ft)								
PCB-1242	35 / 59 59%	0.52 - 4,900	0.82 - 270,000	11,798	0.83 c	**YES**	61,801	61,801
PCB-1248	9 / 59 15%	0.55 - 60,000	1.1 - 48,000	2,628	0.83 c	**YES**	4,610	4,610
PCB-1254	0 / 59 0%	0.52 - 60,000	na - na	1,721	0.83 c	NO(6)	3,420	na
PCB-1260	5 / 59 8%	0.52 - 60,000	1.1 - 430	1,728	0.83 c	**YES**	3,433	430
Subsurface Soil (0 to 10 ft)								
PCB-1242	63 / 141 45%	0.25 - 63,000	0.67 - 270,000	6,386	0.83 c	**YES**	30,838	30,838
PCB-1248	26 / 141 18%	0.31 - 60,000	0.34 - 200,000	2,832	0.83 c	**YES**	17,611	17,611
PCB-1254	1 / 141 1%	0.25 - 63,000	10 - 10	1,144	0.83 c	**YES**	4,997	10
PCB-1260	7 / 141 5%	0.25 - 63,000	1.1 - 430	1,147	0.83 c	**YES**	4,999	430

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.

(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.

(3) USEPA Region 6 Media Specific Screening Levels. Most conservative (lowest) concentration among commercial and industrial values was selected for screening purposes; if based on non-cancer effects, one-tenth of the value was used.

(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.

(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.

(6) Not selected as COPC because there were no detections.

UCL = upper confidence limit about the mean.

COPC = chemical of potential concern

na = not applicable

Table 3-4
Statistical Summary of Soil Data for the Streamlined Risk Evaluation
Trichloroethylene Impacted Area
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (mg/kg) NON-DETECTS	RANGE OF CONCENTRATIONS (mg/kg) DETECTS	MEAN CONCENTRATION[1,2] (mg/kg)	USEPA REGION 6 SCREENING VALUE[3] (mg/kg)	COPC? [4]	UCL[1,2] (mg/kg)	EXPOSURE POINT CONCENTRATION[5] (mg/kg)
Surface Soil (0 to 1 ft)									
trichloroethylene	16 / 22	73%	0.00055 - 0.0082	0.0009 - 495	118	0.092 c	**YES**	370	370
cis-1,2-dichloroethylene	7 / 22	32%	0.00055 - 27	0.068 - 5.05	2.4	15 n	NO[6]	6.0	na
trans-1,2-dichloroethylene	0 / 22	0%	0.00055 - 27	na - na	2.0	18 n	NO[7]	5.3	na
vinyl chloride	0 / 22	0%	0.00055 - 34	na - na	2.4	0.86 c	NO[7]	6.4	na
Subsurface Soil (0 to 10 ft)									
trichloroethylene	184 / 206	89%	0.00055 - 0.33	0.0009 - 13700	612	0.092 c	**YES**	158	158
cis-1,2-dichloroethylene	94 / 206	46%	0.00055 - 293	0.0065 - 393	14.0	15 n	**YES**	41.7	41.7
trans-1,2-dichloroethylene	3 / 206	1%	0.00055 - 293	0.66 - 2.03	5.2	18 n	**YES[4]**	15.4	2.03
vinyl chloride	8 / 206	4%	0.00055 - 293	0.012 - 49.6	5.9	0.86 c	**YES**	16.6	16.6

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.
(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.
(3) USEPA Region 6 Media Specific Screening Levels. Most conservative (lowest) concentration among commercial and industrial values was selected for screening purposes; if based on non-cancer effects, one-tenth of the value was used.
(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.
(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.
(6) Not selected as COPC because the maximum detected concentration is less than the screening value.
(7) Not selected as COPC because there were no detections.
UCL = upper confidence limit about the mean.
COPC = chemical of potential concern
na = not applicable

Table 3-5
Statistical Summary of Dust Sample Data for the Streamlined Risk Evaluation
Interior Wipe Samples from the CBI Building
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF CONCENTRATIONS ($\mu g/100\ cm^2$) NON-DETECTS	DETECTS	MEAN CONCENTRATION[1,2] ($\mu g/100\ cm^2$)	TSCA SCREENING VALUE[3] ($\mu g/100\ cm^2$)	COPC? [4]	UCL[1,2] ($\mu g/100\ cm^2$)	EXPOSURE POINT CONCENTRATION[5] ($\mu g/100\ cm^2$)
First Floor								
PCB-1242	0 / 81 0%	1.0 - 500	na - na	10.2	10	NO[6]	32.0	na
PCB-1248	74 / 81 91%	1.0 - 1.0	1.5 - 4,840	116	10	**YES**	505	505
PCB-1254	0 / 81 0%	1.0 - 500	na - na	10.2	10	NO[6]	32.0	na
PCB-1260	31 / 81 38%	1.0 - 100	1 - 871	30.2	10	**YES**	104	104
Second Floor								
PCB-1242	0 / 25 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1248	10 / 25 40%	1.0 - 1.0	1.1 - 12.6	1.7	10	**YES**	3.8	3.8
PCB-1254	0 / 25 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1260	2 / 25 8%	1.0 - 1.0	1.6 - 3.4	0.66	10	NO[7]	0.89	na
Third Floor								
PCB-1242	0 / 44 0%	1.0 - 10	na - na	0.60	10	NO[6]	0.97	na
PCB-1248	27 / 44 61%	1.0 - 10	1.0 - 5.0	1.9	10	NO[7]	2.9	na
PCB-1254	1 / 44 2%	1.0 - 10	5.1 - 5.1	0.71	10	NO[7]	na	na
PCB-1260	14 / 44 32%	1.0 - 1.0	0.5 - 4.5	1.1	10	NO[7]	1.7	na
Fourth Floor								
PCB-1242	0 / 15 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1248	9 / 15 60%	1.0 - 1.0	1.2 - 16.6	2.6	10	**YES**	4.7	4.7
PCB-1254	0 / 15 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1260	2 / 15 13%	1.0 - 1.0	1.7 - 6.7	0.99	10	NO[7]	2.8	na
Roof								
PCB-1242	0 / 17 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1248	3 / 17 18%	1.0 - 1.0	3.8 - 7.5	1.5	10	NO[7]	4.0	na
PCB-1254	0 / 17 0%	1.0 - 1.0	na - na	0.50	10	NO[6]	na	na
PCB-1260	1 / 17 6%	1.0 - 1.0	3.9 - 3.9	0.70	10	NO[7]	0.70	na

Table 3-5
Statistical Summary of Dust Sample Data for the Streamlined Risk Evaluation
Interior Wipe Samples from the CBI Building
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (µg/100 cm^2) NON-DETECTS	RANGE OF CONCENTRATIONS (µg/100 cm^2) DETECTS	MEAN CONCENTRATION[1,2] (µg/100 cm^2)	TSCA SCREENING VALUE[3] (µg/100 cm^2)	COPC? [4]	UCL[1,2] (µg/100 cm^2)	EXPOSURE POINT CONCENTRATION[5] (µg/100 cm^2)
Pump Room									
PCB-1242	0 / 3	0%	1.0 - 2.0	na - na	0.67	10	NO[6]	na	na
PCB-1248	2 / 3	67%	1.0 - 1.0	12.6 - 22.6	11.9	10	**YES**	30.6	22.6
PCB-1254	0 / 3	0%	1.0 - 2.0	na - na	0.67	10	NO[6]	na	na
PCB-1260	2 / 3	67%	1.0 - 1.0	1.4 - 33	11.6	10	**YES**	42.8	33

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.

(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.

(3) Toxic Substances Control Act (TSCA) amendment of 1998 (the "Megarule") Section 761.79(4) established PCB decontamination standard (US CFR xx, 1998).

(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.

(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.

(6) Not selected as COPC because there were no detections.

(7) Not selected as COPC because the maximum detected concentration is less than the screening value.

UCL = upper confidence limit about the mean.

COPC = chemical of potential concern

na = not applicable

Table 3-6
Statistical Summary of Groundwater Data for the Streamlined Risk Evaluation
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (µg/L) NON-DETECTIONS	RANGE OF CONCENTRATIONS (µg/L) DETECTIONS	MEAN CONCENTRATION(1,2) (µg/L)	SCREENING VALUE(3) (µg/L)	COPC? (4)	UCL(1,2) (µg/L)	EXPOSURE POINT CONCENTRATION(5) (µg/L)
Volatile Organic Compounds (VOCs)									
BENZENE	2 / 12	17%	1 - 100	24.3 - 44	10.6	5.0	**YES**	63.3	44.0
N-BUTYLBENZENE	2 / 9	22%	1 - 100	8.3 - 8.7	8.8	260	NO(6)	26.7	na
SEC-BUTYLBENZENE	3 / 9	33%	1 - 100	3.5 - 20.7	9.5	250	NO(6)	40.0	na
CHLOROBENZENE	1 / 9	11%	1 - 100	269 - 269	36.3	390	NO(6)	na	na
1,2-DICHLOROBENZENE	1 / 9	11%	1 - 100	33.7 - 33.7	10.2	2,600	NO(6)	71.4	na
1,3-DICHLOROBENZENE	1 / 9	11%	1 - 100	1120 - 1120	131	830	**YES**	na	1,120
1,4-DICHLOROBENZENE	1 / 9	11%	1 - 100	207 - 207	29.4	8,200	NO(6)	na	na
1,2-DICHLOROETHANE	1 / 9	11%	1 - 100	4 - 4	7.4	5.0	NO(6)	60.8	na
1,1-DICHLOROETHENE	1 / 9	11%	1 - 100	21.4 - 21.4	8.8	190	NO(6)	64.9	na
CIS-1,2-DICHLOROETHENE	7 / 9	78%	1 - 1	1.9 - 14100	1,641	210	**YES**	17,514	14,100
ETHYLBENZENE	1 / 12	8%	1 - 100	1.6 - 1.6	5.5	700	NO(6)	46.1	na
ISOPROPYLBENZENE (CUMENE)	2 / 9	22%	1 - 100	14.5 - 19.8	10.2	8.4	**YES**	65.1	19.8
P-ISOPROPYLTOLUENE	2 / 9	22%	1 - 100	5.3 - 6.1	8.2	na	**YES(7)**	25.0	6.1
METHYL-TERT-BUTYL ETHER	1 / 11	9%	1 - 100	5.5 - 5.5	6.3	120,000	NO(6)	50.3	na
N-PROPYLBENZENE	3 / 9	33%	1 - 100	1 - 20	10.7	320	NO(6)	46.5	na
TETRACHLOROETHENE	1 / 9	11%	1 - 100	2.4 - 2.4	7.2	5.0	NO(6)	60.8	na
1,2,4-TRICHLOROBENZENE	1 / 9	11%	1 - 100	520 - 520	64.2	3,400	NO(6)	na	na
TRICHLOROETHENE	6 / 9	67%	1 - 10	2.6 - 3430	420	5.0	**YES**	4,178	3,430
TRICHLOROFLUOROMETHANE	1 / 9	11%	1 - 100	1.4 - 1.4	7.1	180	NO(6)	60.8	na
1,2,4-TRIMETHYLBENZENE	3 / 9	33%	1 - 10	1.7 - 102	13.8	24	**YES**	70.6	70.6
1,3,5-TRIMETHYLBENZENE	2 / 9	22%	1 - 100	2.9 - 4.2	7.7	25	NO(6)	38.6	na
VINYL CHLORIDE	4 / 9	44%	1 - 1	2.5 - 1110	181	2.0	**YES**	1,538	1,110
Semi-Volatile Organic Compounds (SVOCs)									
BENZO(A)ANTHRACENE	2 / 9	22%	1 - 10	1.2 - 2.1	1.8	0.029 c	**YES**	8.1	2.1
BENZO(A)PYRENE	1 / 9	11%	1 - 10	1.9 - 1.9	1.7	0.0029 c	**YES**	8.1	1.9
BENZO(B)FLUORANTHENE	2 / 9	22%	1 - 10	1.8 - 4.3	2.1	0.029 c	**YES**	9.0	4.3
BENZO(G,H,I)PERYLENE	1 / 9	11%	1 - 10	1.8 - 1.8	1.6	na	**YES(7)**	8.1	1.8
CHRYSENE	3 / 9	33%	1 - 10	1.3 - 11.1	2.4	2.9 c	**YES**	14.3	11.1
FLUORANTHENE	2 / 9	22%	1 - 10	2.3 - 5.5	2.3	150 n	NO(6)	9.8	na
INDENO(1,2,3-CD)PYRENE	1 / 9	11%	1 - 10	1.3 - 1.3	1.6	0.029 c	**YES**	8.1	1.3
PHENANTHRENE	2 / 9	22%	1 - 10	1.2 - 3	1.9	na	**YES(7)**	8.4	3

Table 3-6
Statistical Summary of Groundwater Data for the Streamlined Risk Evaluation
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (µg/L)		MEAN CONCENTRATION[1,2] (µg/L)	SCREENING VALUE[3] (µg/L)	COPC? [4]	UCL[1,2] (µg/L)	EXPOSURE POINT CONCENTRATION[5] (µg/L)
			NON-DETECTIONS	DETECTIONS					
PYRENE	4 / 9	44%	1 - 10	1.4 - 15.9	3.5	18 n	NO[6]	8.7	na
Metals									
BARIUM	9 / 9	89%	na - na	25.9 - 193	106	730 n	NO[6]	144	na

(1) Calculated using one-half the detection limit concentration for non-detected chemical measurements.

(2) Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.

(3) For Volatile Organic Chemicals, source: USEPA. 2002. OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. EPA 530-D-02-004.
For Semivolatile Organic Chemicals and Metals, source: USEPA. On-line. Region 6 Human Health Media-Specific Screening Levels. Most conservative (lowest) concentration selected for screening purposes; if based on non-cancer effects, one-tenth of the value was used.

(4) Selected as a COPC if the maximum detected concentration exceeds the screening value, or if one-half non-detect value exceeds the screening level and the frequency of detection is less than 5%.

(5) The exposure point concentration is equal to the lesser of the calculated UCL and the maximum detected value.

(6) Not selected as COPC because the maximum detected concentration is less than the screening value.

(7) Selected as a COPC because no screening value was available.

95% UCL = 95% upper confidence limit about the mean.

COPC = chemical of potential concern

na = not applicable

Table 3-7
Statistical Summary of Soil Gas Data for the Streamlined Risk Evaluation
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION		RANGE OF CONCENTRATIONS (ppbV) NON-DETECTIONS	RANGE OF CONCENTRATIONS (ppbV) DETECTIONS	MAXIMUM DETECTED CONCENTRATION (µg/m^3)	MEAN CONCENTRATION[1,2] (ppbV)	95% UCL (ppbV)		95% UCL (µg/m^3)
INSIDE CBI BUILDING (AREAS A-E)									
Volatile Organic Compounds (VOCs)									
Tedlar									
1,1-DICHLOROETHENE	2 / 52	4%	0.5 - 5	0.92 - 17	68.6	2.0	5.5	NP [a]	22.2
CIS-1,2-DICHLOROETHENE	35 / 52	67%	0.5 - 5	0.72 - 23,000	92,746	1,204	6,918	NP [a]	27,896
TETRACHLOROETHENE	46 / 52	88%	0.5 - 5	3.5 - 1,400	9,667	98.7	240	NP [b]	1,657
TRANS-1,2-DICHLOROETHENE	25 / 52	48%	0.5 - 5	0.61 - 440	1,774	36.8	57.1	NP [c]	230
TRICHLOROETHENE	52 / 52	100%		1.3 - 220,000	1,198,835	19,115	30,647	G [d]	167,003
VINYL CHLORIDE	1 / 52	2%	5 - 50	140 - 140	361	19.4		NC	
Summa									
1,1-DICHLOROETHENE	2 / 21	10%	0.05 - 10	0.19 - 11	44.4	1.4	7.8	NP [a]	31.5
CIS-1,2-DICHLOROETHENE	17 / 21	81%	0.05 - 0.25	0.05 - 10,000	40,324	703	2,779	NP [b]	11,206
TETRACHLOROETHENE	19 / 21	90%	0.5 - 17	0.1 - 850	5,869	140	336	NP [b]	2,320
TRANS-1,2-DICHLOROETHENE	15 / 21	71%	0.05 - 0.5	0.22 - 180	726	22.7	65.4	NP [b]	264
TRICHLOROETHENE	21 / 21	100%		0.78 - 110,000	599,418	12,406	30,046	G [d]	163,728
VINYL CHLORIDE	1 / 21	5%	0.05 - 10	71 - 71	183	4.4		NC	
INSIDE CBI BUILDING (AREAS F-H)									
Volatile Organic Compounds (VOCs)									
Tedlar									
TETRACHLOROETHENE	10 / 12	83%	0.5 - 0.5	0.63 - 50	345	9.9	28.3	NP [b]	195
TRICHLOROETHENE	11 / 12	92%	0.5 - 0.5	0.6 - 1,400	7,629	131	1,285.0	NP [a]	7,002
Summa									
CIS-1,2-DICHLOROETHENE	1 / 12	6%	0.05 - 0.05	0.12 - 0.12	0.48	0.041		NC	
TETRACHLOROETHENE	6 / 12	6%		0.21 - 47	325	11.2	52.5	G [e]	363
TRANS-1,2-DICHLOROETHENE	1 / 12	6%	0.05 - 0.1	0.05 - 0.05	0.20	0.033		NC	
TRICHLOROETHENE	6 / 12	6%		0.33 - 730	3,978	135	2,246	G [d]	12,239

Table 3-7
Statistical Summary of Soil Gas Data for the Streamlined Risk Evaluation
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF CONCENTRATIONS (ppbV) NON-DETECTIONS	RANGE OF CONCENTRATIONS (ppbV) DETECTIONS	MAXIMUM DETECTED CONCENTRATION (µg/m³)	MEAN CONCENTRATION[1,2] (ppbV)	95% UCL (ppbV)	95% UCL (µg/m³)
OUTSIDE CBI BUILDING (AREAS LA-LC)							
Volatile Organic Compounds (VOCs)							
1,1-DICHLOROETHENE	1 / 12 8%	5 - 5	7.6 - 7.6	30.6	2.93	NC	
CIS-1,2-DICHLOROETHENE	2 / 12 17%	5 - 5	6 - 2,600	10484	219.25	NC	
TETRACHLOROETHENE	1 / 12 8%	5 - 5	15 - 15	104	3.54	NC	
TRANS-1,2-DICHLOROETHENE	1 / 12 8%	5 - 5	120 - 120	484	12.3	NC	
TRICHLOROETHENE	12 / 12 100%		43 - 66,000	328301	5,702.67	NC	

[1] Calculated using one-half the detection limit concentration for non-detected chemical measurements.
[2] Calculated using USEPA's Pro-UCL software (USEPA, 2006), printouts presented in Appendix A.
95% UCL = 95% upper confidence limit about the mean.
na = not applicable

Prepared by / Date: KJC 02/04/09
Checked by / Date: JHP 02/10/09

NP - Nonparameteric
- [a] 99% KM (Chebyshev) UCL
- [b] 95% KM (Chebyshev) UCL
- [c] 95% KM (t) UCL

G - Gamma
- [d] 95% Adjusted Gamma UCL
- [e] 95% Approximate Gamma UCL

NC - Not Calculated

ppbV - parts per billion by volume
µg/m³ - micrograms per cubic meter

Table 4-1
Summary of Exposure Points
ACF Carter Carburetor Site
St. Louis, Missouri

Exposure Point	Future - Industrial/Commercial		Future - Recreational Soccer Field			
	Indoor Worker	Construction Worker	Outdoor Groundskeeper	Recreational Adolescent	Adult Staff Worker	Construction Worker
Exterior Soils - Surface Soil		X	X	X	X	X
Exterior Soils - Subsurface Soil		X				X
Diecast Area Soils - Surface Soil		X	X	X	X	X
Diecast Area Soils - Subsurface Soil		X				X
Soils Beneath Building - Surface Soil			X	X	X	X
Soils Beneath Building - Subsurface Soil						X
TCE Area Soils - Surface Soil		X	X	X	X	X
TCE Area Soils - Subsurface Soil		X				X
Interior Building Surfaces	X					
Groundwater		X				X
Indoor Air [(a)]	X					

[(a)] - Volatile organic compounds that may migrate to indoor air from groundwater.

Table 4-2
Summary of Human Exposure Parameters for the Streamlined Risk Evaluation - Soil
ACF Carter Carburetor Site
St. Louis, Missouri

Exposure Pathway	Parameter[a]	Future Construction Worker	Future Outdoor Groundskeeper	Future Recreational Adolescent	Future Adult Staff Worker
General	Body weight (BW)[b], kg	70	70	45	70
	Exposure frequency (EF)[f], days/year	90	190	156	156
	Exposure duration (ED)[f], years	0.35	25	12	25
	Averaging time - Noncancer[c] (AT_{NC}), days	126	9,125	4,380	9,125
	Averaging time - Cancer[d] (AT_C), days	25,550	25,550	25,550	25,550
Ingestion	Soil ingestion rate (IR)[h] (mg/day)	330	100	100	50
	Fraction ingested from contaminated source (FI), unitless	1	1	1	1
Inhalation	Exposure time (ET)[f], hour/day	8	1	2	4
	Particulate Emission Factor[g] (PEF)	9.46E+06	9.46E+08	9.46E+08	9.46E+08
	Volatilization Factor[g] (VF)	chemical-specific	chemical-specific	chemical-specific	chemical-specific
Dermal Absorption	Skin surface area, soil contact (SA)[b, e] (cm^2)	3,300	3,300	4,375	3,300
	Soil to skin adherence factor (AF)[e] (mg/cm^2)	0.3	0.2	0.3	0.2
	Chemical absorption factor - from soil (ABS)[e]:				
	Volatile organic compounds	0	0	0	0
	Arsenic	0.03	0.03	0.03	0.03
	Polychlorinated biphenyls (PCBs)	0.14	0.14	0.14	0.14

[a]Unless otherwise noted, source of parameters is site-specific in nature or from: USEPA. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume 1,* Human Health Evaluation Manual (Part A).

[b]USEPA. 1997c. *Exposure Factors Handbook.* Surface area for adolescent is based on head, hands, forearms, and lower legs for a 7 - 18 year old; body weight for adolescent based on a 7 - 18 year old.

[c]Averaging time of exposure for noncarcinogenic effects are calculated as follows: AT_{NC} = ED years x 365 days/year

[d]Averaging time of exposure for carcinogenic effects are calculated as follows: AT_C = 70 years x 365 days/year = 25,550 days

[e]USEPA. 2004. *RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment.*

[f] Refer to discussion in Section 4.3

[g] Refer to discussion in Section 4.4

[h] USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.

PJ = Professional judgement

Table 4-3
Summary of Human Exposure Parameters for the Streamlined Risk Evaluation - Indoor Building Surfaces and Indoor Air
ACF Carter Carburetor Site
St. Louis, Missouri

Exposure Pathway	Parameter[a]	Future Indoor Industrial/Commercial Worker
General	Body weight (BW)[b], kg	70
	Exposure frequency (EF)[k], days/year	250
	Exposure duration (ED)[k], years	25
	Averaging time - Noncancer[c] (AT_{NC}), days	9,125
	Averaging time - Cancer[d] (AT_C), days	25,550
Ingestion	Fraction ingested from contaminated source (FI), unitless	1
	Fraction interior dust transferred (FTSS)[i], surface to skin (%)	0.25
	Frequency of hand to mouth contact (FQ) (per/hour)[f]	1
	Exposure time (ET)[k], hour/day	8
	Skin Surface Area - fingers, interior dust contact (SA) (cm^2)[g]	30
	Salive extraction factor (SE) (%)[i]	0.25
	Exposure frequency for interior dust (EF) (days/year)[g]	12
Inhalation	Exposure time (ET), hour/day	8
	Resuspension factor of interior dust (RSF) (1/hour)[b]	0.00038
	Ventilation rate of building (VR) (per/hour)	1
Dermal	Skin surface area of palms, interior dust contact[b] (SA) (cm^2)	400
Absorption	Chemical absorption factor - from soil (ABS)[j]:	
	Polychlorinated biphenyls (PCBs)	0.14
	Skin contact time (SCT) (unitless)	1

[a]Unless otherwise noted, source of parameters is site-specific in nature or from: USEPA. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume 1,* Human Health Evaluation Manual (Part A).

[b]USEPA. 1997c. *Exposure Factors Handbook.*

[c]Averaging time of exposure for noncarcinogenic effects are calculated as follows: AT_{NC} = ED years x 365 days/year

[d]Averaging time of exposure for carcinogenic effects are calculated as follows: AT_C = 70 years x 365 days/year = 25,550 days

[e]See text discussion in Section 4.3.

[f]Michaud, et al. 1994. J Exp Anal Env Epidem, 4(2):197-227.

[g]USEPA. 1998. TSCA Megarule - technical support document (Support Document for the PCB Disposal Ammendments, Final Rule.)

[h]Calculated by: ED x EF x ET x 3600 sec/hour

[i]Hawley and Kim. 1985. "Re-entry guidelines: Binghampton State Office Building. New York State Dept. of Health, Bureau of Toxic Substances Assessment, Division of Health Risk Control. Albany, NY. Document -549P.

[j]USEPA. 2004. *RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment.*

[k] USEPA. 2002. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites.* OSWER 9355.4-24.

PJ = Professional judgement

Table 4-4
Summary of Human Exposure Parameters for the Streamlined Risk Evaluation - Groundwater
ACF Carter Carburetor Site
St. Louis, Missouri

Exposure Pathway	Parameter[a]	Future Construction Worker
General	Body weight (BW)[b], kg	70
	Exposure frequency (EF), days/year [PJ]	20
	Exposure duration (ED), years [f]	0.35
	Averaging time - Noncancer[c] (AT_{NC}), days	126
	Averaging time - Cancer[d] (AT_C), days	25,550
Ingestion	Groundwater ingestion rate (ml/day)[PJ]	NA
	Fraction ingested from contaminated source (FI), unitless	NA
Inhalation	Exposure time (ET), hour/day [PJ]	8
	Volatilization Factor (VF)	chemical-specific
Dermal	Skin surface area, groundwater contact (SA)[b, e] (cm^2)	5,670
Absorption	Skin contact time, groundwater contact (SCT)[PJ] (hours/day)	2

[a]Unless otherwise noted, source of parameters is site-specific in nature or from: USEPA. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume 1,* Human Health Evaluation Manual (Part A).

[b]USEPA. 1997c. *Exposure Factors Handbook.*

[c]Averaging time of exposure for noncarcinogenic effects are calculated as follows: AT_{NC} = ED years x 365 days/year

[d]Averaging time of exposure for carcinogenic effects are calculated as follows: AT_C = 70 years x 365 days/year = 25,550 days

[d]USEPA. 2004. *RAGS, Part E, Supplemental Guidance for Dermal Risk Assessment.*

[e]Surface area of hands, forearms, lower legs, and feet

[f] Refer to discussion in Section 4.3

PJ = Professional judgement. The scenario considers a construction worker who is engaged in utility trench and/or foundation work and spends the majority of each work-day over a total of four weeks performing tasks in the subsurface excavations. It is assumed that exposure routes to groundwater include dermal contact whereby skin is wet a total of 2 hours per day, and vapor inhalation 8 hours per day.

Table 5-1
Cancer Toxicity Data -- Oral/Dermal
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units		Source(s)	Date(s)
VOLATILES								
1,2-Dichloroethene (cis)	ND			ND		D	IRIS	August, 2008
1,2-Dichloroethene (trans)	ND			ND		ND	IRIS	August, 2008
1,2,4-Trimethylbenzene	ND			ND		ND		
Benzene	5.5E-02	$(mg/kg/day)^{-1}$	100%	5.5E-02	$(mg/kg/day)^{-1}$	Known carcinogen	IRIS	August, 2008
Isopropylbenzene	NA			NA		Cannot be determined	IRIS	August, 2008
Isopropyltoluene	ND			ND		ND		
Tetrachloroethene	5.4E-01	$(mg/kg/day)^{-1}$	100%	5.4E-01	$(mg/kg/day)^{-1}$	NA	CALEPA	January, 2008
Trichloroethene	1.3E-02	$(mg/kg/day)^{-1}$	100%	1.3E-02	$(mg/kg/day)^{-1}$	NA	CALEPA	January, 2008
Vinyl Chloride (adult only)	7.2E-01	$(mg/kg/day)^{-1}$	100%	7.2E-01	$(mg/kg/day)^{-1}$	Known carcinogen	IRIS	August, 2008
Vinyl Chloride (child and adult)	1.4E+00	$(mg/kg/day)^{-1}$	100%	1.4E+00	$(mg/kg/day)^{-1}$	Known carcinogen	IRIS	August, 2008
SEMIVOLATILES								
1,3-Dichlorobenzene	NA			NA		D	IRIS	August, 2008
Benzo(a)anthracene (ages 0<6) [b], [c]	3.9E+00	$(mg/kg/day)^{-1}$	89%	3.9E+00	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Benzo(a)anthracene (ages 6<16) [b], [c]	2.2E+00	$(mg/kg/day)^{-1}$	89%	2.2E+00	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Benzo(a)anthracene (ages 6<30) [b], [c]	1.3E+00	$(mg/kg/day)^{-1}$	89%	1.3E+00	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Benzo(a)anthracene (ages >16) [b], [c]	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Benzo(a)pyrene	7.3E+00	$(mg/kg/day)^{-1}$	89%	7.3E+00	$(mg/kg/day)^{-1}$	B2	IRIS	August, 2008
Benzo(b)fluoranthene	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Benzo(g,h,i)perylene	NA			NA		D	IRIS	August, 2008
Chrysene	7.3E-03	$(mg/kg/day)^{-1}$	89%	7.3E-03	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Indeno(1,2,3-cd)pyrene	7.3E-01	$(mg/kg/day)^{-1}$	89%	7.3E-01	$(mg/kg/day)^{-1}$	B2	NCEA	April, 2007
Phenanthrene	NA			NA		D	IRIS	August, 2008
PESTICIDES/PCBs								
Aroclor 1242	2.0E+00	$(mg/kg/day)^{-1}$	80%	2.0E+00	$(mg/kg/day)^{-1}$	See PCBs		
Aroclor 1248	2.0E+00	$(mg/kg/day)^{-1}$	80%	2.0E+00	$(mg/kg/day)^{-1}$	See PCBs		
Aroclor-1254	2.0E+00	$(mg/kg/day)^{-1}$	80%	2.0E+00	$(mg/kg/day)^{-1}$	See PCBs		
Aroclor 1260	2.0E+00	$(mg/kg/day)^{-1}$	80%	2.0E+00	$(mg/kg/day)^{-1}$	See PCBs		
INORGANICS/METALS								
Arsenic	1.5E+00	$(mg/kg/day)^{-1}$	95%	1.5E+00	$(mg/kg/day)^{-1}$	A	IRIS	August, 2008

Table 5-1
Cancer Toxicity Data -- Oral/Dermal
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral Cancer Slope Factor	
	Value	Units		Value	Units		Source(s)	Date(s)

Notes:

Checked by: JHP 08/04/08

In accordance with OSWER 9285.7-53, slope factors are identified from the following heirarchy of sources:

Tier 1:

IRIS = Integrated Risk Information System: August, 2008

Tier 2:

PPRTV = Preliminary Peer-Reviewed Reference Toxicity Value August, 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

Tier 3:

HEAST97= Health Effects Assessment Summary Tables: FY 1997 From HEAST FY 1997 Update

HEAST= Health Effects Assessment Summary Tables: HEAST 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

CALEPA - California Environmental Protection Agency January, 2008

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: April, 2007 Obtained from Region III RBC Table

(1) Values obtained from RAGS Volume 1 (Part E, Supplemental Guidance for Dermal Risk Assessment, Interim Guidance) (EPA, 2004)
Per this guidance, a value of 100% is used for analytes without published values.

(2) Adjusted Dermal SF = Oral SF / Oral to Dermal Adjustment Factor. Per RAGS Part E (USEPA, 2004), adjustments are only performed for chemicals that have an oral absorption efficiency of less than 50%.

PCB slope factors are applicable to Aroclors 1016, 1248, 1254, and 1260.

Weight of Evidence:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen

mg = milligram
kg = kilogram
BW = body weight
ND = no data available

[b] - Slope Factor for Benzo(a)Pyrene used for other carcinogenic PAHs, adjusted by Relative Potency Factors of 1.0 [benzo(a)pyrene,dibenz(a,h)anthracene]; 0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-c,d)pyrene]; 0.01 [benzo(k)fluoranthene]; 0.001 [chrysene].

[c] - Slope factors are developed in accordance with the EPA Memorandum: "Implementation of the Cancer Guidelines and Accompanying Supplemental Guidance - Science Policy Council Cancer Guidelines Implementation Workgroup Communication II: Performing Risk Assessments that include Carcinogens Described in the Supplemental Guidance as having a Mutagenic Mode of Action (June 14, 2006)
The EPA-published slope factor is multiplied by generic age-dependant adjustment factors (ADAFs) as follows:
Young children (<6 yrs of age): ADAF of 5.3 calculated as an age-weighted ADAF for children 0<2 (ADAF=10) and children 2<6 (ADAF=3), as follows: [(2 yrs x 10) + (3 yrs x 4)] / 6 yrs = 5.3
Older children (6 < 16 yrs of age): ADAF of 3 is the applicable value for this age range.
Adults (>16 yrs of age): ADAF of 1 is the applicable value for this age range.
Older Children/Adults (Age >6 - <30): ADAF of 1.8 calculated as an age-weighted ADAF for older children >6 - <16 (ADAF=3) and adults >16 (ADAF=1), as follows: [(10 yrs x 3) + (14 yrs x 1)] / 24 yrs = 1.8

Table 5-2
Cancer Toxicity Data -- Inhalation
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units		Source(s)	Date(s)
VOLATILES							
1,2-Dichloroethene (cis)	NA		NA		D	IRIS	August, 2008
1,2-Dichloroethene (trans)	ND		ND		ND	IRIS	August, 2008
1,2,4-Trimethylbenzene	ND		ND		ND		
Benzene	7.80E-06	$(ug/m^3)^{-1}$	2.8E-02	$(mg/kg/day)^{-1}$	Known human carcinogen	IRIS	August, 2008
Isopropylbenzene	NA		NA		Cannot be determined	IRIS	August, 2008
Isopropyltoluene	ND		ND		ND		
Tetrachloroethene	5.90E-06	$(ug/m^3)^{-1}$	2.00E-02	$(mg/kg/day)^{-1}$	NA	CALEPA	January, 2008
Trichloroethene	2.00E-06	$(ug/m^3)^{-1}$	7.00E-03	$(mg/kg/day)^{-1}$	NA	CALEPA	January, 2008
Vinyl Chloride (adult only)	4.40E-06	$(ug/m^3)^{-1}$	1.50E-02	$(mg/kg/day)^{-1}$	Known human carcinogen	IRIS	August, 2008
Vinyl Chloride (adult and child)	8.80E-06	$(ug/m^3)^{-1}$	3.10E-02	$(mg/kg/day)^{-1}$	Known human carcinogen	IRIS	August, 2008
SEMIVOLATILES							
1,3-Dichlorobenzene	NA		NA		D	IRIS	August, 2008
Benzo(a)anthracene	1.10E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	January, 2008
Benzo(a)pyrene	1.10E-03	$(ug/m^3)^{-1}$	3.9E+00	$(mg/kg/day)^{-1}$	B2	CALEPA	January, 2008
Benzo(b)fluoranthene	1.10E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	January, 2008
Benzo(g,h,i)perylene	NA		NA		D	IRIS	August, 2008
Chrysene	1.10E-06	$(ug/m^3)^{-1}$	3.9E-03	$(mg/kg/day)^{-1}$	B2	CALEPA	January, 2008
Indeno(1,2,3-cd)pyrene	1.10E-04	$(ug/m^3)^{-1}$	3.9E-01	$(mg/kg/day)^{-1}$	B2	CALEPA	January, 2008
Phenanthrene	NA		NA		D	IRIS	August, 2008
PESTICIDES/PCBs							
Aroclor 1242	5.70E-04	$(ug/m^3)^{-1}$	2.00E+00	$(mg/kg/day)^{-1}$	B2	See PCBs	
Aroclor 1248	5.70E-04	$(ug/m^3)^{-1}$	2.00E+00	$(mg/kg/day)^{-1}$	B2	See PCBs	
Aroclor 1254	5.70E-04	$(ug/m^3)^{-1}$	2.00E+00	$(mg/kg/day)^{-1}$	B2	See PCBs	
Aroclor 1260	5.70E-04	$(ug/m^3)^{-1}$	2.00E+00	$(mg/kg/day)^{-1}$	B2	See PCBs	
INORGANICS/METALS							
Arsenic	4.30E-03	$(ug/m^3)^{-1}$	1.50E+01	$(mg/kg/day)^{-1}$	A	IRIS	August, 2008

Table 5-2
Cancer Toxicity Data -- Inhalation
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation Cancer Slope Factor	
	Value	Units	Value	Units		Source(s)	Date(s)

Notes:

In accordance with OSWER 9285.7-53, unit risk values are identified from the following heirarchy of sources:

Checked by: JHP 08/04/08

Tier 1:

IRIS = Integrated Risk Information System: August, 2008

Tier 2:

PPRTV = Preliminary Peer-Reviewed Reference Toxicity Value August, 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

Tier 3:

HEAST-97= Health Effects Assessment Summary Tables: FY 1997 From HEAST FY 1997 Update

HEAST= Health Effects Assessment Summary Tables: HEAST 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

CALEPA - California Environmental Protection Agency January, 2008

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: April, 2007 Obtained from Region III RBC Table

(1) - Inhalation cancer dose-response values are typically published as unit risk values. Unit risk values may be converted to slope factors using the following equation (HEAST, 1997):

Adjustment = 70 kg [adult body weight] * 1000 ug/mg [conversion factor] / 20 m3/day [inhalation rate]

and: Inhalation Slope Factor = Unit Risk * Adjustment

For slope factors obtained from NCEA (published in USEPA Region III RBC Table), it is assumed that the value has been converted from a Unit Risk value. Therefore, the slope factor is converted back to a unit risk value as follows: 20 m3/day / 70 kg * 1000 ug/mg

PAHs, adjusted by Relative Potency Factors of 1.0 [benzo(a)pyrene, dibenz(a,h)anthracene]; 0.1 [benzo(a)anthracene, benzo(b)flouoranthene, indeno(1,2,3-c,d)pyrene]; 0.01 [benzo(k)fluoranthene]; 0.001 [chrysene].

PCB slope factors are applicable to Aroclors 1016, 1248, 1254, and 1260.

Weight of Evidence:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen

mg = milligram

ug = microgram

kg = kilogram

m^3 = cubic meter

BW = body weight

ND = no data available

Table 5-3
Non-Cancer Toxicity Data -- Oral/Dermal
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Adjusted Dermal RfD (2)		Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
VOLATILES										
1,2-Dichloroethene (cis)	chronic	1.0E-02	mg/kg/day	100%	1.0E-02	mg/kg/day			PPRTV	August, 2008
	subchronic	3.0E-01	mg/kg/day	100%	3.0E-01	mg/kg/day	Hematological	100/1	MRL	November, 2007
1,2-Dichloroethene (trans)	chronic	2.0E-02	mg/kg/day	100%	2.0E-02	mg/kg/day	Liver; increased serum alkaline phosphatase	1,000/1	IRIS	August, 2008
	subchronic	2.0E-01	mg/kg/day	100%	2.0E-01	mg/kg/day	Liver	100	MRL	November, 2007
1,2,4-Trimethylbenzene	chronic	ND			ND					
	subchronic	ND			ND					
Benzene	chronic	4.0E-03	mg/kg/day	100%	4.0E-03	mg/kg/day	Immune system; decreased lymphocyte count	300	IRIS	August, 2008
	subchronic	4.0E-03	mg/kg/day	100%	4.0E-03	mg/kg/day	Immune system; decreased lymphocyte count	300	Chronic	
Isopropylbenzene	chronic	1.0E-01	mg/kg/day	100%	1.0E-01	mg/kg/day	Kidney; increased kidney weight	1,000/1	IRIS	August, 2008
	subchronic	1.0E-01	mg/kg/day	100%	1.0E-01	mg/kg/day	Kidney; increased kidney weight	1,000/1	Chronic	
Isopropyltoluene	chronic	ND			ND					
	subchronic	ND			ND					
Tetrachloroethene	chronic	1.0E-02	mg/kg/day	100%	1.0E-02	mg/kg/day	Liver; hepatotoxicity	1,000/1	IRIS	August, 2008
	subchronic	1.0E-01	mg/kg/day	100%	1.0E-01	mg/kg/day	Liver; hepatotoxicity	100/1	HEAST97	FY 1997
Trichloroethene	chronic	3.0E-04	mg/kg/day	100%	3.0E-04	mg/kg/day	Liver and kidney		NCEA	April, 2007
	subchronic	3.0E-04	mg/kg/day	100%	3.0E-04	mg/kg/day	Liver and kidney		Chronic	
Vinyl Chloride	chronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	Liver; liver cell polymorphism	30/1	IRIS	August, 2008
	subchronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	Liver; liver cell polymorphism	30/1	Chronic	
Vinyl Chloride	chronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	Liver; liver cell polymorphism	30/1	IRIS	August, 2008
	subchronic	3.0E-03	mg/kg/day	100%	3.0E-03	mg/kg/day	Liver; liver cell polymorphism	30/1	Chronic	
SEMIVOLATILES										
1,3-Dichlorobenzene	chronic	ND			ND					
	subchronic	ND			ND					
Benzo(a)anthracene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Benzo(a)pyrene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Benzo(b)fluoranthene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Benzo(g,h,i)perylene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Chrysene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Indeno(1,2,3-cd)pyrene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
Phenanthrene	chronic	3.0E-02	mg/kg/day	89%	3.0E-02	mg/kg/day	Kidney; renal tubular pathology	3,000/1	Surrogate (2)	
	subchronic	3.0E-01	mg/kg/day	89%	3.0E-01	mg/kg/day	Kidney; renal tubular pathology	300/1	Surrogate (2)	
PESTICIDES/PCBs										
Aroclor 1242	chronic	2.0E-05	mg/kg/day	80%	2.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	
	subchronic	5.0E-05	mg/kg/day	80%	5.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	
Aroclor 1248	chronic	2.0E-05	mg/kg/day	80%	2.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	

Table 5-3
Non-Cancer Toxicity Data -- Oral/Dermal
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Adjusted Dermal RfD (2)		Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s)
	subchronic	5.0E-05	mg/kg/day	80%	5.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	
Aroclor-1254	chronic	2.0E-05	mg/kg/day	80%	2.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	IRIS	August, 2008
	subchronic	5.0E-05	mg/kg/day	80%	5.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	HEAST97	FY 1997
Aroclor 1260	chronic	2.0E-05	mg/kg/day	80%	2.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	
	subchronic	5.0E-05	mg/kg/day	80%	5.0E-05	mg/kg/day	Immune system; immunotoxicity	300/1	Surrogate	
INORGANICS/METALS										
Arsenic	chronic	3.0E-04	mg/kg/day	95%	3.0E-04	mg/kg/day	Skin; keratosis and hyperpigmentation	3/1	IRIS	August, 2008
	subchronic	3.0E-04	mg/kg/day	95%	3.0E-04	mg/kg/day	Skin; keratosis and hyperpigmentation	3/1	HEAST97	FY 1997

Notes:

Checked by: JHP 08/04/08

In accordance with OSWER 9285.7-53, chronic RfDs are identified from the following heirarchy of sources:

Tier 1:

IRIS = Integrated Risk Information System: August, 2008

Tier 2:

PPRTV = Preliminary Peer-Reviewed Toxicity Value: August, 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

Tier 3:

HEAST97= Health Effects Assessment Summary Tables: FY 1997 From HEAST FY 1997 Update

HEAST= Health Effects Assessment Summary Tables: HEAST 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

MRL = Minimum Risk Level (ATSDR: chronic MRLs): November, 2007

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: September, 200 Obtained from Region IX PRG Table

April, 2007 Obtained from Region III RBC Table

mg = milligram
kg = kilogram
surrogate - a value for a closely related chemical is used as the RfD
BW = body weight
chronic - the chronic value is used as the subchronic RfD
ND = no data available

Subchronic RfDs are obtained from:

- ATSDR: Intermitent MRLs
- HEAST: subchronic RfDs (from HEAST FY 1997)
- Equal to chronic RfDs when values are not published in HEAST or by ATSDR

(1) Values obtained from RAGS Volume 1 (Part E, Supplemental Guidance for Dermal Risk Assessment, Interim Guidance) (EPA, 2004)
Per this guidance, a value of 100% is used for analytes without published values.

(2) Adjusted Dermal RfD = Oral RfD x Oral to Dermal Adjustment Factor. Per RAGS Part E (USEPA, 2004), adjustments are only performed for chemicals that have an oral absorption efficiency of less than 50%.

Per USEPA Region I "Risk Updates, No. 5", (August, 1999), Non-carcinogenic PAHs without published RfDs should be evaluated using the published RfD for a structurally similar PAH.

Surrogate (1) - Value for acenaphthene used as a surrogate

Surrogate (2) - Value for pyrene used as a surrogate

RfD for Aroclor 1254 used as surrogate for other PCB congeners with no published RfDs

Table 5-4
Non-Cancer Toxicity Data - Inhalation
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1) Value	Inhalation RfC (1) Units	Extrapolated RfD (1) Value	Extrapolated RfD (1) Units	Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s) Source(s)	RfC: Target Organ(s) Date(s)
VOLATILES									
1,2-Dichloroethene (cis)	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
1,2-Dichloroethene (trans)	chronic	6.0E-02	mg/m3	1.7E-02	mg/kg/day			PPRTV	August 2008
	subchronic	8.0E-01	mg/m3	2.3E-01	mg/kg/day	Liver	1,000	MRL	November 2007
1,2,4-Trimethylbenzene	chronic	7.0E-03	mg/m3	1.7E-03	mg/kg/day			PPRTV	August 2008
	subchronic	7.0E-03	mg/m3	1.7E-03	mg/kg/day			Chronic	
Benzene	chronic	3.0E-02	mg/m3	8.6E-03	mg/kg/day	Immune system; decreased lymphocyte count	300/1	IRIS	August 2008
	subchronic	3.0E-02	mg/m3	8.6E-03	mg/kg/day	Immune system; decreased lymphocyte count	300/1	Chronic	
Isopropylbenzene	chronic	4.0E-01	mg/m3	1.1E-01	mg/kg/day	Endocrine; increased adrenal weight	1,000/1	IRIS	August 2008
	subchronic	4.0E-01	mg/m3	1.1E-01	mg/kg/day	Endocrine; increased adrenal weight	1,000/1	Chronic	
Isopropyltoluene	chronic	ND		ND					
	subchronic	ND		ND					
Tetrachloroethene	chronic	2.7E-01	mg/m3	7.7E-02	mg/kg/day	Nervous system	100	MRL	November 2007
	subchronic	2.7E-01	mg/m3	7.7E-02	mg/kg/day	Nervous system		Chronic	
Trichloroethene	chronic	1.0E-02	mg/m3	2.9E-03	mg/kg/day	Nervous system		NYSDOH	
	subchronic	1.0E-02	mg/m3	2.9E-03	mg/kg/day	Nervous system		Chronic	
Vinyl Acetate	chronic	2.0E-01	mg/m3	5.7E-02	mg/kg/day	Respiratory system; nasal lesions	30/1	IRIS	August 2008
	subchronic	2.0E-01	mg/m3	5.7E-02	mg/kg/day	Respiratory system; nasal lesions	30/1	Chronic	
Vinyl Chloride	chronic	1.0E-01	mg/m3	2.9E-02	mg/kg/day	Liver; liver cell polymorphism	30/1	IRIS	August 2008
	subchronic	1.0E-01	mg/m3	2.9E-02	mg/kg/day	Liver; liver cell polymorphism	30/1	Chronic	
SEMIVOLATILES									
1,3-Dichlorobenzene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Benzo(a)anthracene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Benzo(a)pyrene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Benzo(b)fluoranthene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Benzo(g,h,i)perylene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					

Table 5-4
Non-Cancer Toxicity Data - Inhalation
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (1)		Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s)
Chrysene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Indeno(1,2,3-cd)pyrene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
Phenanthrene	chronic	ND		ND				IRIS	August 2008
	subchronic	ND		ND					
PESTICIDES/PCBs									
Aroclor 1242	chronic	7.0E-05	mg/m3	2.0E-05	mg/kg/day	Immune system; immunotoxicity		IRIS	August 2008
	subchronic	1.8E-04	mg/m3	5.1E-05	mg/kg/day	Immune system; immunotoxicity			
Aroclor 1248	chronic	7.0E-05	mg/m3	2.0E-05	mg/kg/day	Immune system; immunotoxicity		IRIS	August 2008
	subchronic	1.8E-04	mg/m3	5.1E-05	mg/kg/day	Immune system; immunotoxicity			
Aroclor-1254	chronic	7.0E-05	mg/m3	2.0E-05	mg/kg/day	Immune system; immunotoxicity		IRIS	August 2008
	subchronic	1.8E-04	mg/m3	5.1E-05	mg/kg/day	Immune system; immunotoxicity			
Aroclor 1260	chronic	7.0E-05	mg/m3	2.0E-05	mg/kg/day	Immune system; immunotoxicity		IRIS	August 2008
	subchronic	1.8E-04	mg/m3	5.1E-05	mg/kg/day	Immune system; immunotoxicity			
INORGANICS/METALS									
Arsenic	chronic	1.5E-05	mg/m3	4.3E-06	mg/kg/day	Developmental; cardiovascular; CNS		REL	December 2008
	subchronic	1.5E-05	mg/m3	4.3E-06	mg/kg/day	Developmental; cardiovascular; CNS		Chronic	

Notes:

In accordance with OSWER 9285.7-53, chronic RfDs are identified from the following heirarchy of sources:

Checked by: JHP 08/04/08

Tier 1:

IRIS = Integrated Risk Information System: August 2008

Tier 2:

PPRTV = Preliminary Peer-Reviewed Toxicity Value: August 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

Tier 3:

HEAST97= Health Effects Assessment Summary Tables: FY 1997 From HEAST FY 1997 Update

HEAST= Health Effects Assessment Summary Tables: HEAST 2008 Obtained from Oak Ridge National Laboratory Regional Screening Levels for Chemical Contaminants at Superfund Sites

MRL = Minimum Risk Level (ATSDR: chronic MRLs): November 2007

REL - CALEPA December 2008

In addition, provisional RfDs developed by NCEA are presented for informational purposes and to be used on a case-by-case basis:

NCEA = National Center for Environmental Assessment: September 2004 Obtained from Region IX PRG Table

April 2007 Obtained from Region III RBC Table

ug - microgram
mg = milligram
m^3 - cubic meter
kg = kilogram
BW = body weight

Table 5-4
Non-Cancer Toxicity Data - Inhalation
ACF Carter Carburetor Site
St. Louis, Missouri

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC (1)		Extrapolated RfD (1)		Primary Target Organ or System / Critical Effect	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s)

Subchronic RfDs are obtained from:

- ATSDR: Intermitent MRLs
- HEAST: subchronic RfDs (from HEAST FY 1997)
- Equal to chronic RfDs when values are not published in HEAST or by ATSDR

chronic - the chronic value is used as the subchronic RfD

(1) - Inhalation non-cancer dose-response values are typically published as RfC values. RfC values may be converted to RfDs using the following equation (HEAST, 1997):

RfD (mg/kg-d) = RfC (mg/m^3) x 20 m^3/d / 70 kg, unless otherwise indicated

For RfDs obtained from NCEA (published in USEPA Region III RBC Table), it is assumed that the value has been converted from a RfC value. Therefore, the RfD is converted back to a RfC value as follows:

RfC (mg/m^3) = RfD (mg/kg/day) x 70 kg / 20 m^3/day

Table 6-1
Risk Assessment Summary - Construction Worker

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adult	Exterior to the CBI Building - Surface Soil	Incidental ingestion	3E-08	0.06
		Dermal contact	1E-08	0.03
		Dust inhalation	3E-11	0.00006
		Vapor inhalation	--	--
			4E-08	**0.09**
	Exterior to the CBI Building - Subsurface Soil	Incidental ingestion	2E-06	4
		Dermal contact	8E-07	2
		Dust inhalation	7E-09	0.02
		Vapor inhalation	3E-09	0.0004
			3E-06	**5**
Adult	Under the CBI Building - Surface Soil	Incidental ingestion	4E-08	0.09
		Dermal contact	2E-08	0.04
		Dust inhalation	4E-11	0.00008
		Vapor inhalation	--	--
			6E-08	**0.1**
	Under the CBI Building - Subsurface Soil	Incidental ingestion	5E-08	0.1
		Dermal contact	2E-08	0.04
		Dust inhalation	5E-11	0.00009
		Vapor inhalation	--	--
			7E-08	**0.1**
Adult	Former Die Cast Building Area - Surface Soil	Incidental ingestion	2E-03	4502
		Dermal contact	9E-04	1891
		Dust inhalation	2E-06	4
		Vapor inhalation	--	--
			3E-03	**6396**
	Former Die Cast Building Area - Subsurface Soil	Incidental ingestion	2E-03	3293
		Dermal contact	7E-04	1383
		Dust inhalation	2E-06	3
		Vapor inhalation	--	--
			2E-03	**4678**

Table 6-1
Risk Assessment Summary - Construction Worker

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adult	Trichloroethylene Impacted Area - Surface Soil	Incidental ingestion	8E-08	4
		Dermal contact	--	--
		Dust inhalation	4E-11	0.0004
		Vapor inhalation	3E-07	3
			3E-07	**7**
	Trichloroethylene Impacted Area - Subsurface Soil	Incidental ingestion	2E-07	2
		Dermal contact	--	--
		Dust inhalation	2E-11	0.0002
		Vapor inhalation	2E-07	1
			4E-07	**3**
Adult	Groundwater	Dermal contact	6E-06	5
		Volatile inhalation	3E-05	143
			3E-05	**148**

Prepared by / Date: KJC 12/15/08
Checked by / Date: MH 12/15/08

Table 6-2
Risk Assessment Summary - Outdoor Groundskeeper

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adult	Exterior to the CBI Building - Surface Soil	Incidental ingestion	5E-07	0.03
		Dermal contact	4E-07	0.03
		Dust inhalation	4E-12	0.0000003
		Vapor inhalation	--	--
			9E-07	**0.07**
Adult	Under the CBI Building - Surface Soil	Incidental ingestion	7E-07	0.05
		Dermal contact	6E-07	0.05
		Dust inhalation	6E-12	0.0000004
		Vapor inhalation	--	--
			1E-06	**0.09**
Adult	Former Die Cast Building Area - Surface Soil	Incidental ingestion	4E-02	2485
		Dermal contact	3E-02	2296
		Dust inhalation	3E-07	0.02
		Vapor inhalation	--	--
			7E-02	**4782**
Adult	Trichloroethylene Impacted Area - Surface Soil	Incidental ingestion	1E-06	0.9
		Dermal contact	--	--
		Dust inhalation	6E-12	0.0000008
		Vapor inhalation	2E-06	0.2
			3E-06	**1**

Prepared by / Date: KJC 12/15/08
Checked by / Date: MH 12/15/08

Table 6-3
Risk Assessment Summary - Recreational Adolescent

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adolescent	Exterior to the CBI Building - Surface Soil	Incidental ingestion	3E-07	0.04
		Dermal contact	5E-07	0.08
		Dust inhalation	3E-12	0.0000005
		Vapor inhalation	--	--
			8E-07	**0.1**
Adolescent	Under the CBI Building - Surface Soil	Incidental ingestion	4E-07	0.06
		Dermal contact	8E-07	0.1
		Dust inhalation	5E-12	0.0000007
		Vapor inhalation	--	--
			1E-06	**0.2**
Adolescent	Former Die Cast Building Area - Surface Soil	Incidental ingestion	2E-02	3174
		Dermal contact	4E-02	5833
		Dust inhalation	2E-07	0.04
		Vapor inhalation	--	--
			6E-02	**9007**
Adolescent	Trichloroethylene Impacted Area - Surface Soil	Incidental ingestion	8E-07	1
		Dermal contact	--	--
		Dust inhalation	5E-12	0.000001
		Vapor inhalation	1E-06	0.4
			2E-06	**2**

Prepared by / Date: KJC 12/15/08
Checked by / Date: MH 12/15/08

Table 6-4
Risk Assessment Summary - Adult Staff Worker

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adult	Exterior to the CBI Building - Surface Soil	Incidental ingestion	2E-07	0.01
		Dermal contact	4E-07	0.03
		Dust inhalation	1E-11	0.000001
		Vapor inhalation	--	--
			6E-07	**0.04**
Adult	Under the CBI Building - Surface Soil	Incidental ingestion	3E-07	0.02
		Dermal contact	5E-07	0.04
		Dust inhalation	2E-11	0.000001
		Vapor inhalation	--	--
			8E-07	**0.06**
Adult	Former Die Cast Building Area - Surface Soil	Incidental ingestion	1E-02	1020
		Dermal contact	3E-02	1885
		Dust inhalation	1E-06	0.07
		Vapor inhalation	--	--
			4E-02	**2906**
Adult	Trichloroethylene Impacted Area - Surface Soil	Incidental ingestion	5E-07	0.4
		Dermal contact	--	--
		Dust inhalation	2E-11	0.000003
		Vapor inhalation	6E-06	0.8
			6E-06	**1**

Prepared by / Date: KJC 12/15/08
Checked by / Date: MH 12/15/08

Table 6-5
Risk Assessment Summary - Indoor Commercial Worker

Streamlined Risk Evaluation
ACF Carburetor Site
St. Louis, Missouri

Receptor	Exposure Point	Exposure Route	Excess Lifetime Cancer Risk	Hazard Index
Adult	Inside CBI Building - First Floor	Incidental ingestion	3E-05	2
		Dermal contact	3E-05	2
		Dust inhalation	2E-04	17
			3E-04	**22**
Adult	Inside CBI Building - Second Floor	Incidental ingestion	2E-07	0.01
		Dermal contact	2E-07	0.01
		Dust inhalation	2E-09	0.1
			4E-07	**0.1**
Adult	Inside CBI Building - Fourth Floor	Incidental ingestion	2E-07	0.02
		Dermal contact	2E-07	0.02
		Dust inhalation	2E-09	0.1
			5E-07	**0.2**
Adult	Inside CBI Building - Pump Room	Incidental ingestion	3E-06	0.2
		Dermal contact	3E-06	0.2
		Dust inhalation	2E-08	2
			5E-06	**2**

Prepared by / Date: KJC 12/16/08
Revised by / Date: KJC 02/03/09
Checked by / Date: JHP 02/06/09

Table 6-6
Indoor Air Exposure Point Concentrations and Risks - Full-Time Indoor Worker
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

	SUB SLAB SOIL GAS DATA (µg/m³) [1]					INDOOR AIR EPC (µg/m³)		
CHEMICAL	FREQUENCY OF DETECTION		MAXIMUM DETECTED CONCENTRATION	95% UCL	EPC	Alpha[2] = 9.8E-03	Alpha[2] = 1.8E-03	Alpha[3] = 9.5E-05
INSIDE CBI BUILDING (AREAS A-E)								
Tedlar								
1,1-DICHLOROETHENE	2 / 52	4%	68.6	22.2	22.2	0.22	0.040	0.0021
CIS-1,2-DICHLOROETHENE	35 / 52	67%	92,746	27,896	27,896	273	50.2	2.7
TETRACHLOROETHENE	46 / 52	88%	9,667	1,657	1,657	16.2	3.0	0.16
TRANS-1,2-DICHLOROETHENE	25 / 52	48%	1,774	230	230	2.3	0.41	0.022
TRICHLOROETHENE	52 / 52	100%	1,198,835	167,003	167,003	1637	301	15.9
VINYL CHLORIDE	1 / 52	2%	361	NC	361	3.5	0.65	0.034
					Excess Lifetime Cancer Risk [4]	**3E-04**	**5E-05**	**3E-06**
					Hazard Index [4] [5]	**37 / 0.6**	**7 / 0.1**	**0.4 / 0.007**
Summa								
1,1-DICHLOROETHENE	2 / 21	10%	44.4	31.5	31.5	0.31	0.057	0.0030
CIS-1,2-DICHLOROETHENE	17 / 21	81%	40,324	11,206	11,206	110	20.2	1.1
TETRACHLOROETHENE	19 / 21	90%	5,869	2,320	2,320	22.7	4.2	0.22
TRANS-1,2-DICHLOROETHENE	15 / 21	71%	726	264	264	2.6	0.47	0.025
TRICHLOROETHENE	21 / 21	100%	599,418	163,728	163,728	1605	295	15.6
VINYL CHLORIDE	1 / 21	5%	183	NC	183	5.1	0.35	0.017
					Excess Lifetime Cancer Risk [4]	**3E-04**	**6E-05**	**3E-06**
					Hazard Index [4] [5]	**37 / 0.6**	**7 / 0.1**	**0.4 / 0.007**

Table 6-6
Indoor Air Exposure Point Concentrations and Risks - Full-Time Indoor Worker
Chemicals Reported with at Least One Detection
ACF Carter Carburetor Site, St. Louis, MO

CHEMICAL	SUB SLAB SOIL GAS DATA (µg/m³) [1] FREQUENCY OF DETECTION		MAXIMUM DETECTED CONCENTRATION	95% UCL	EPC	INDOOR AIR EPC (µg/m³) Alpha[2] = 9.8E-03	Alpha[2] = 1.8E-03	Alpha[3] = 1.5E-04
INSIDE CBI BUILDING (AREAS F-H)								
Tedlar								
TETRACHLOROETHENE	10 / 12	83%	345	195	195	1.9	0.35	0.029
TRICHLOROETHENE	11 / 12	92%	7,629	7,002	7,002	68.6	12.6	1.1
					Excess Lifetime Cancer Risk [4]	**1E-05**	**2E-06**	**2E-07**
					Hazard Index [4] [5]	**2 / 0.03**	**0.3 / 0.005**	**0.03 / 0.0005**
Summa								
CIS-1,2-DICHLOROETHENE	1 / 12	6%	0.48	NC	0.48	0.0047	0.00086	0.000072
TETRACHLOROETHENE	6 / 12	6%	325	363	325	3.2	0.59	0.049
TRANS-1,2-DICHLOROETHENE	1 / 12	6%	0.20	NC	0.20	0.0020	0.00036	0.000030
TRICHLOROETHENE	6 / 12	6%	3,978	12,239	3,978	39.0	7.2	0.60
					Excess Lifetime Cancer Risk [4]	**8E-06**	**1E-06**	**1E-07**
					Hazard Index [4] [5]	**0.9 / 0.02**	**0.2 / 0.003**	**0.01 / 0.0002**

(1) Data are presented in Table 3-7.
(2) Alpha is the attenuation coefficient representing the ratio of indoor air concentration to sub slab vapor concentration.
Value is from 2008 Data Set 1, Figure 12, from "U.S. EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors".
(3) Alpha is the attenuation coefficient representing the ratio of indoor air concentration to sub slab vapor concentration.
Value is derived from Site-specific modeling (Appendix C); attenuation factors differ by a factor of approximately two between building areas A - E and F - H.
(4) Risks are calculated for air concentrations corresponding to Alpha = 9.8E-03 in Appendix B.
Risks for air concentrations associated with other Alpha factors are calculated as follows: (Risk associated with Alpha = 9.8E-03) x [other Alpha factor] / (9.8E-03)
(5) USEPA has recommended two values to be used as RfC value for TCE (10 ug/m^3 and 600 ug/m^3). The HI values presented represent risks associated with each of the TCE RfC values

EPC = Exposure Point Concentration
95% UCL = 95% upper confidence limit about the mean.
NC = Not Calculated (due to low number of detected concentrations)
µg/m³ - micrograms per cubic meter

Prepared by / Date: JHP 02/26/09
Checked by / Date: KJC 03/03/09

Table 7-1
Remedial Action Goals for Soil - Summary
Carter Carburetor Site, St. Louis, Missouri

		Construction Worker				Outdoor Groundskeeper			
	EPC (mg/Kg)	Risk-Based RAGs ELCR = 10^{-6} (mg/Kg)	Risk-Based PRG ELCR = 10^{-5} (mg/Kg)	Risk-Based PRG ELCR = 10^{-4} (mg/Kg)	Risk-Based RAGs HI = 1 (mg/Kg)	Risk-Based PRG ELCR = 10^{-6} (mg/Kg)	Risk-Based PRG ELCR = 10^{-5} (mg/Kg)	Risk-Based PRG ELCR = 10^{-4} (mg/Kg)	Risk-Based RAGs HI = 1 (mg/Kg)
Trichlorothylene	370	1088	10881	108810	52.9				
PCBs [1]	4610	21.5	215	2151	10.5	0.98	9.8	98	14.0

		Recreational Adolescent				Adult Staff Worker			
	EPC (mg/Kg)	Risk-Based PRG ELCR = 10^{-6} (mg/Kg)	Risk-Based PRG ELCR = 10^{-5} (mg/Kg)	Risk-Based PRG ELCR = 10^{-4} (mg/Kg)	Risk-Based RAGs HI = 1 (mg/Kg)	Risk-Based PRG ELCR = 10^{-6} (mg/Kg)	Risk-Based PRG ELCR = 10^{-5} (mg/Kg)	Risk-Based PRG ELCR = 10^{-4} (mg/Kg)	Risk-Based RAGs HI = 1 (mg/Kg)
PCBs [1]	4610	1.1	10.7	107	7.4	1.6	15.9	159	23.0

[1] Aroclor 1248 values used for EPC and Risk-Based RAG calculations for Die Cast Area exposure unit. RAG should be applied to total PCB concentrations.

mg/Kg - milligrams per kilogram

EPC - Exposure Point Concentration
ELCR - Excess Lifetime Cancer Risk
HI - Hazard Index
RAG - Remedial Action Goal

Shading indicates the compound is not a chemical of concern for that receptor.

Prepared by / Date: KJC 12/17/08
Revised by / Date: KJC 02/10/09
Checked by / Date: JHP 02/10/09

Table 7-2
Remedial Action Goals for Groundwater - Summary
Carter Carburetor Site, St. Louis, Missouri

		Construction Worker			
	EPC (mg/L)	Risk-Based RAGs ELCR = 10^{-6} (mg/L)	Risk-Based PRG ELCR = 10^{-5} (mg/L)	Risk-Based PRG ELCR = 10^{-4} (mg/L)	Risk-Based RAGs HI = 1 (mg/L)
Trichloroethene	3.43	0.26	2.6	26.2	0.033
1,2,4-Trimethylbenzene	0.0706	NA	NA	NA	0.018
Vinyl Chloride	1.11	0.081	0.81	8.1	0.18

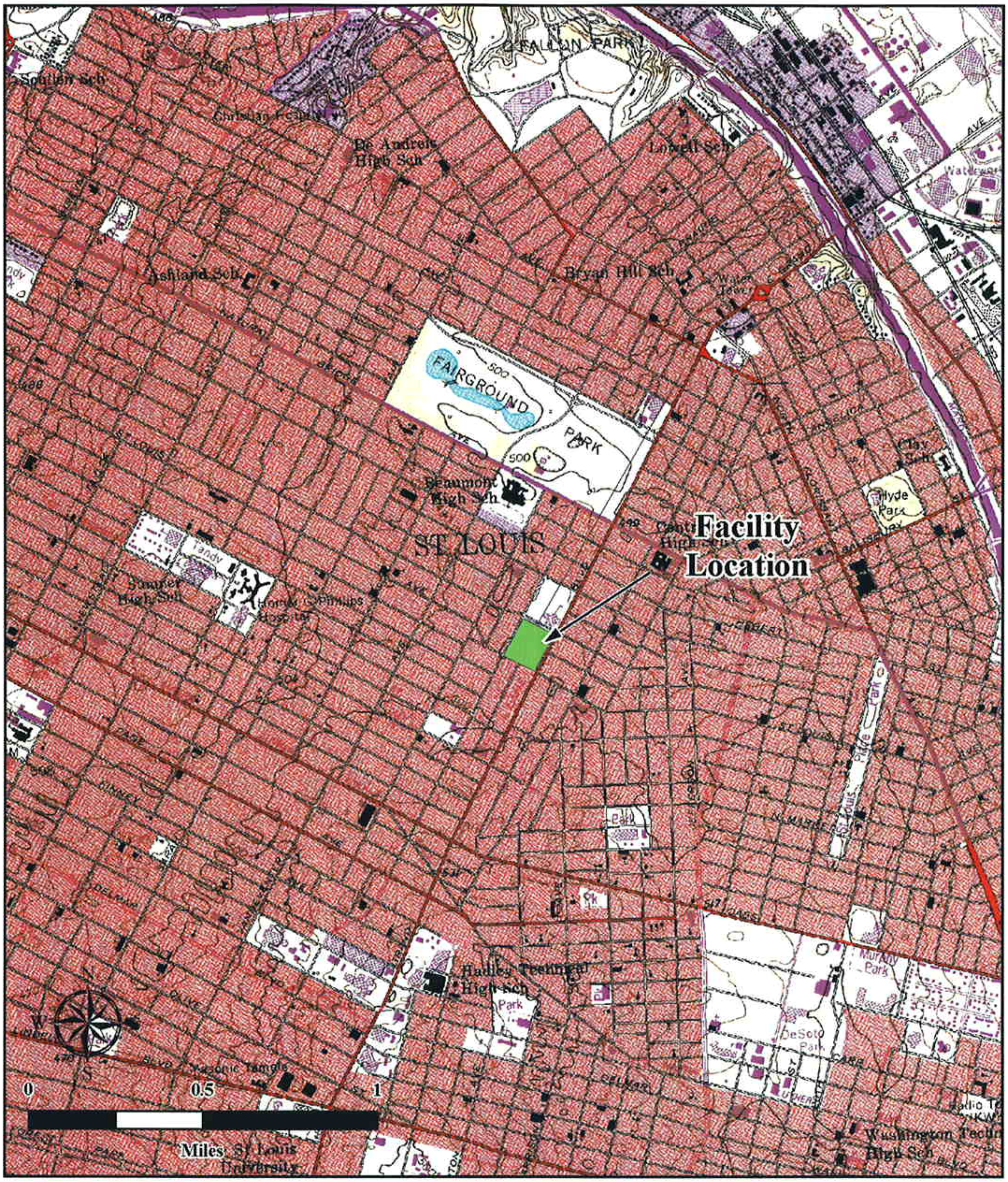
NA - Not Available

mg/L - milligrams per liter

EPC - Exposure Point Concentration
RAG - Remedial Action Goal
ELCR - Excess Lifetime Cancer Risk
HI - Hazard Index

Prepared by / Date: KJC 12/17/08
Revised by / Date: KJC 02/10/09
Checked by / Date: JHP 02/10/09

Figures



Legend

Facility Location

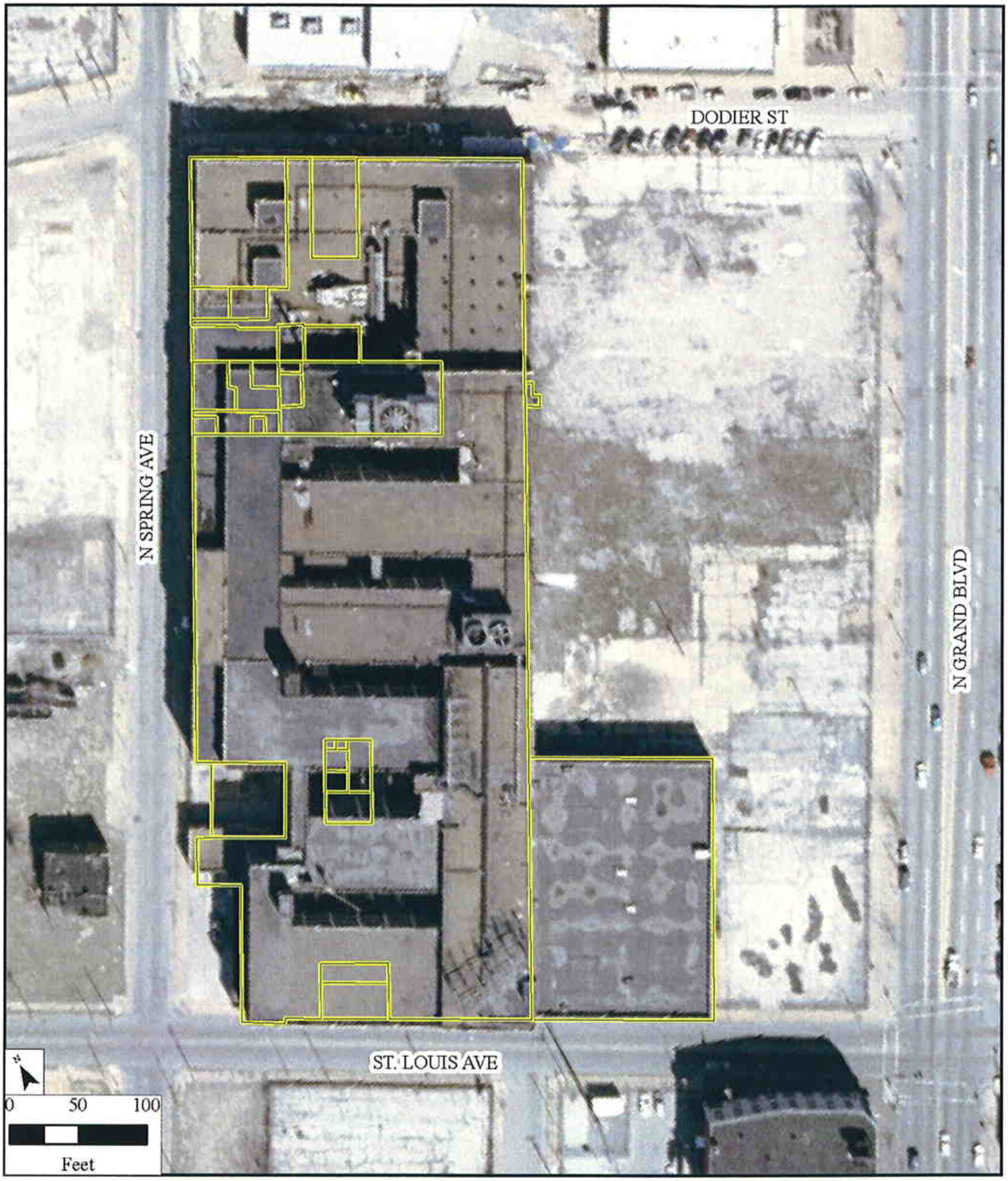
Drawn By: CCC | Approved by: EMW

Checked By: RRR | Date: April 1, 2008

MACTEC

Figure 2-1
Site Location Map
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\robin\fig2-1 location map.mxd



Legend

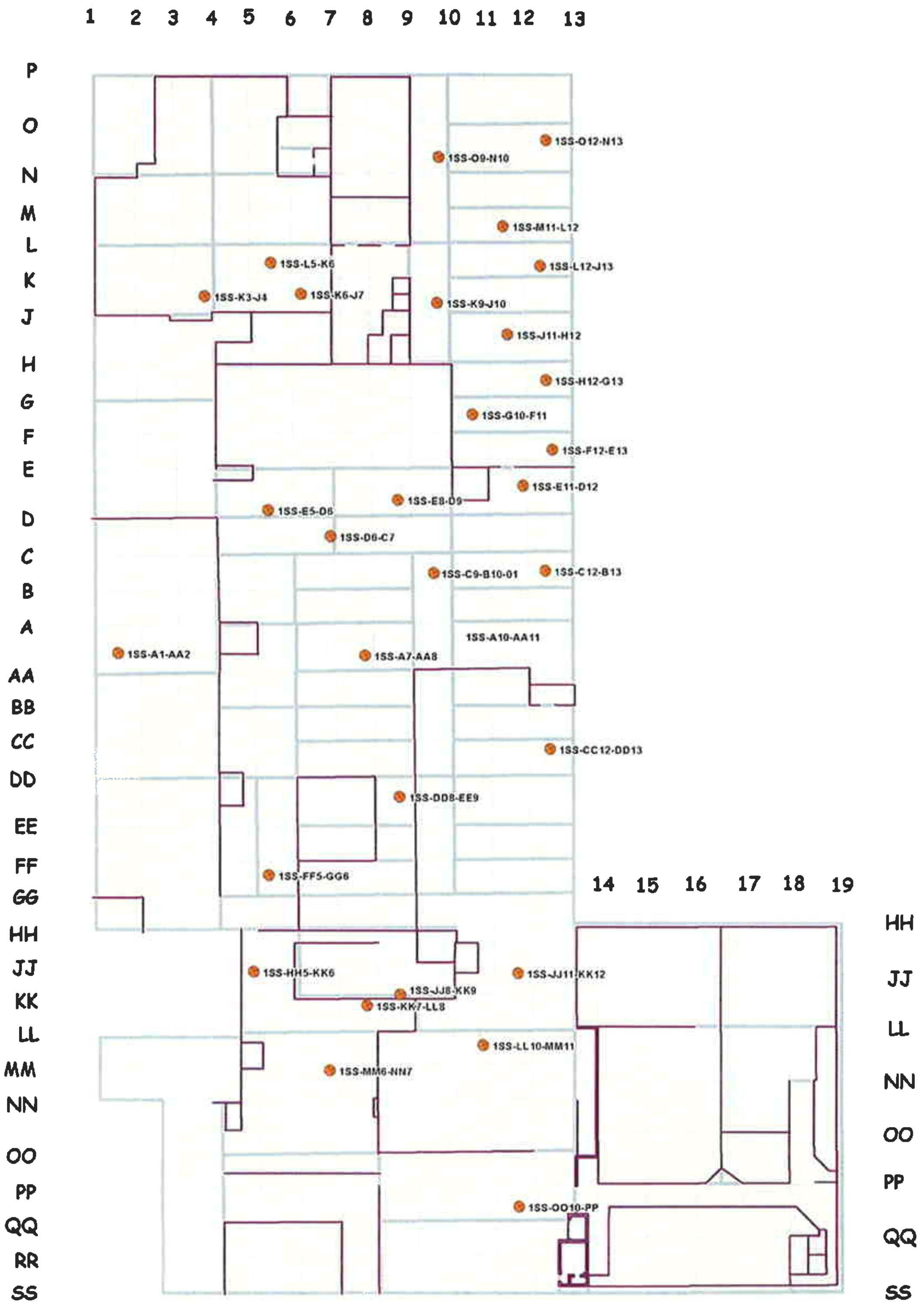
Drawn By: CCC Approved by: EMW

Checked By: RRR Date: April 1, 2008

MACTEC

Figure 2-2
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\fig2-2.mxd



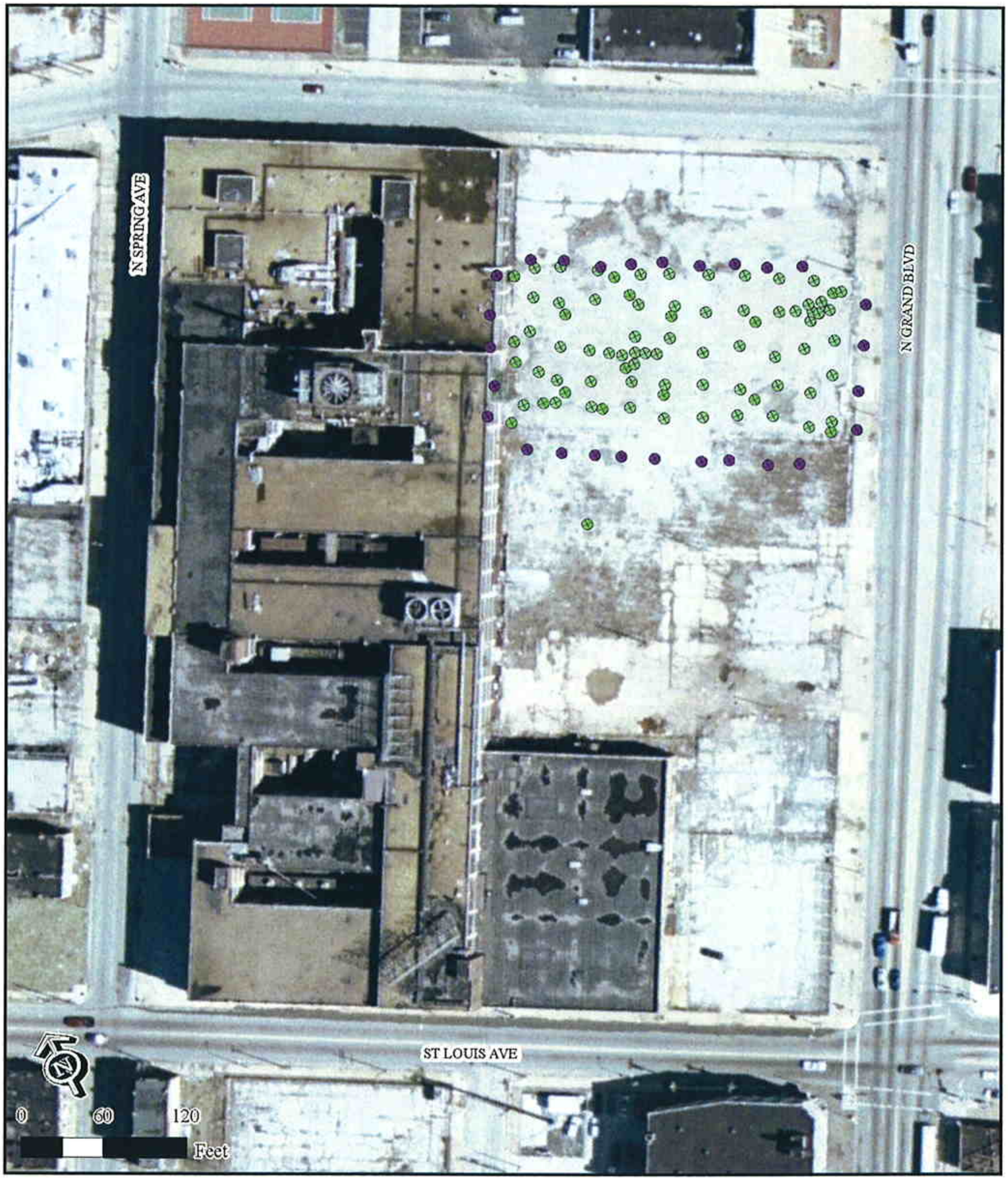
Legend

Soil Samples
Building Footprint

Drawn By: CCC Approved by: EMW
Checked By: RRR Date: April 10, 2008

MACTEC

Figure 3-1
Soil Samples Under Building
Carter Carburetor Site,
St. Louis, Missouri



Legend

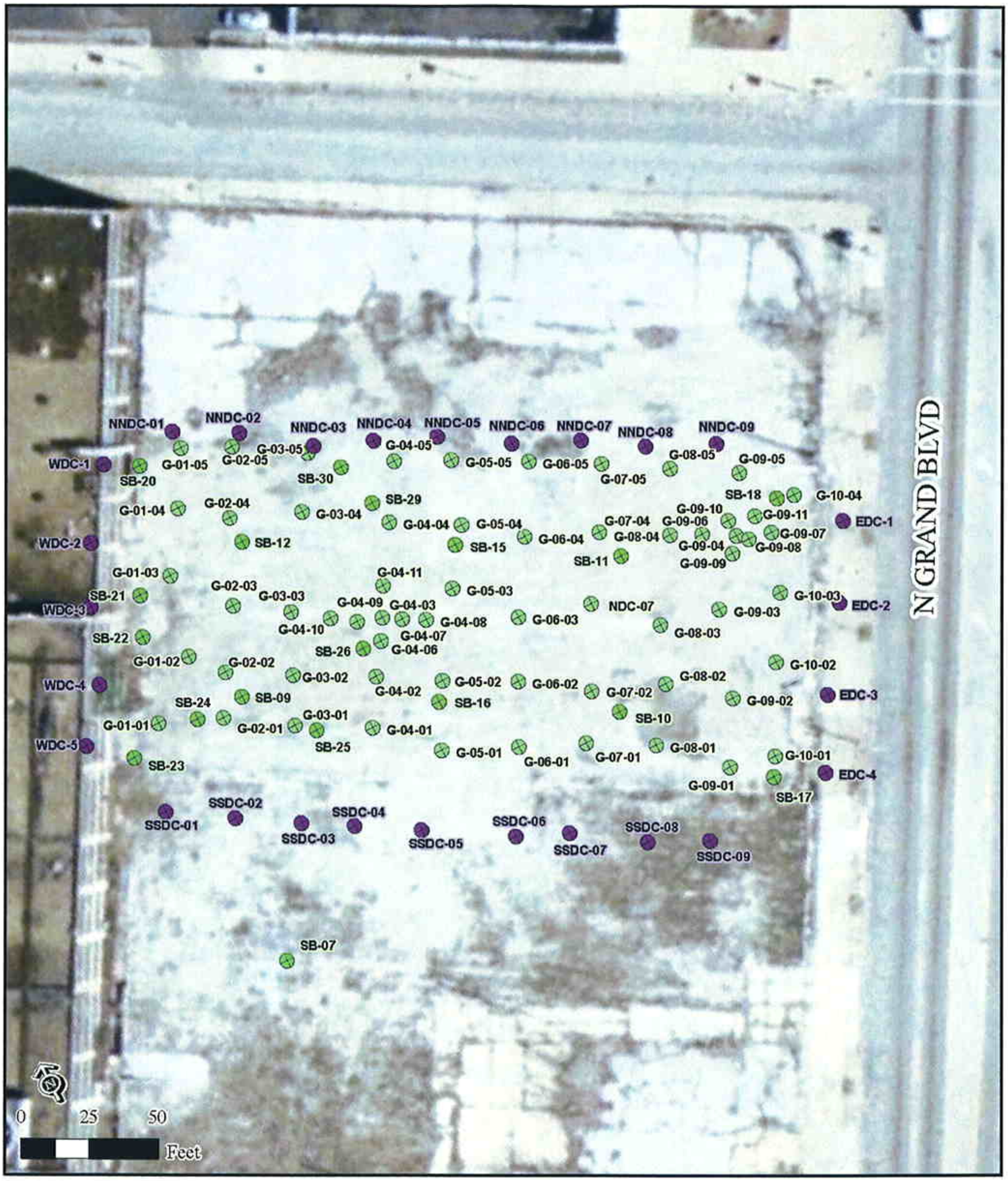
- ● Exterior Sample
- ⊕ Soil Samples

Drawn By: CCC	Approved by: EMW
Checked By: RRR	Date: April 10, 2008

MACTEC

Figure 3-2
North\ South Diecast Building and Exterior Soil Samples
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\figures\Robin\Figure 3-3A.mxd



Legend

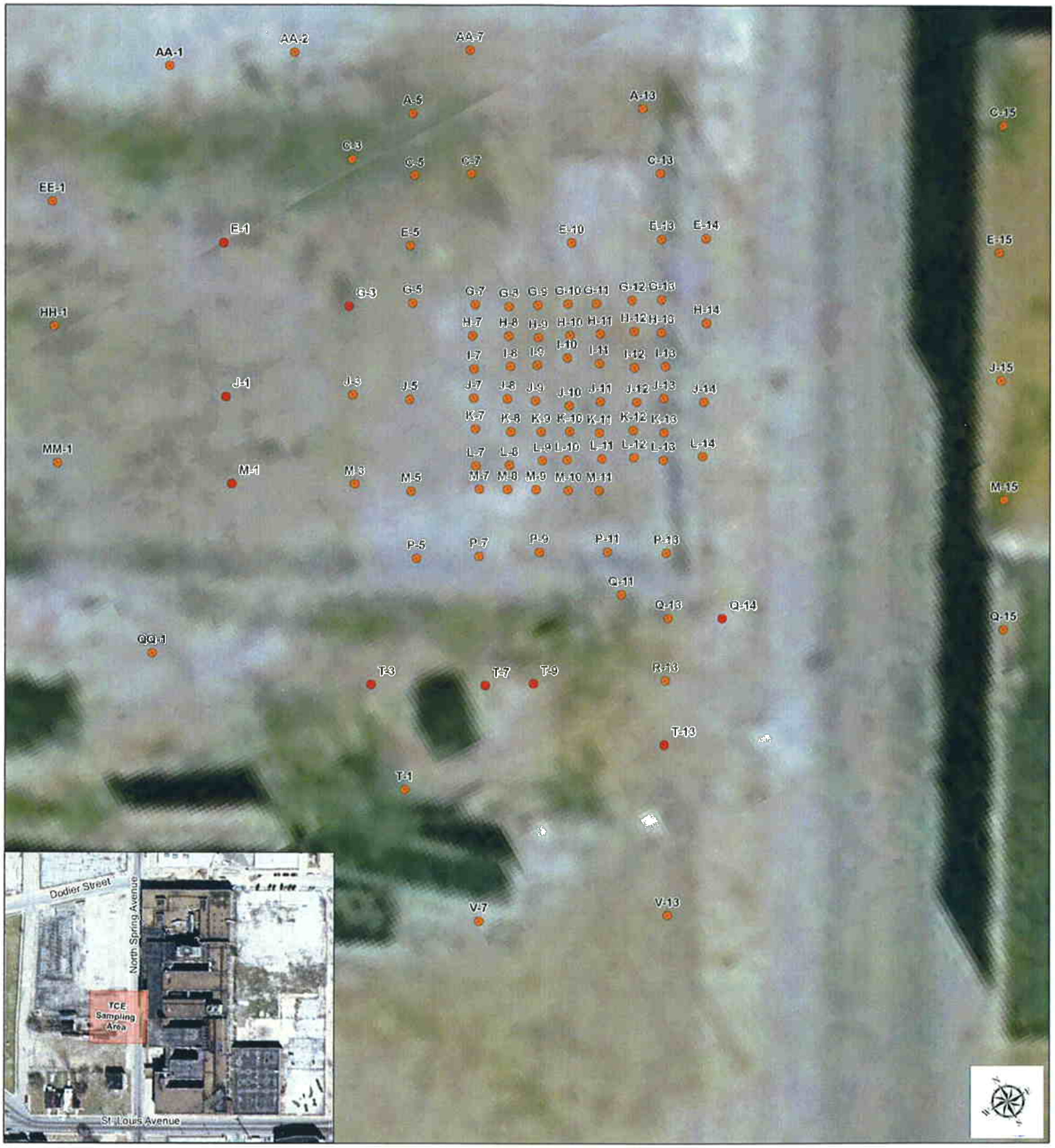
- Exterior Sample
- Soil Samples

Drawn By: CCC	Approved by: EMW
Checked By: RRR	Date: April 10, 2008

MACTEC

Figure 3-3
North\ South Diecast Building and Exterior Soil Samples
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\figures\Robin\Figure 3-3.mxd



Legend

● Soil Boring

0 12.5 25 50
Feet

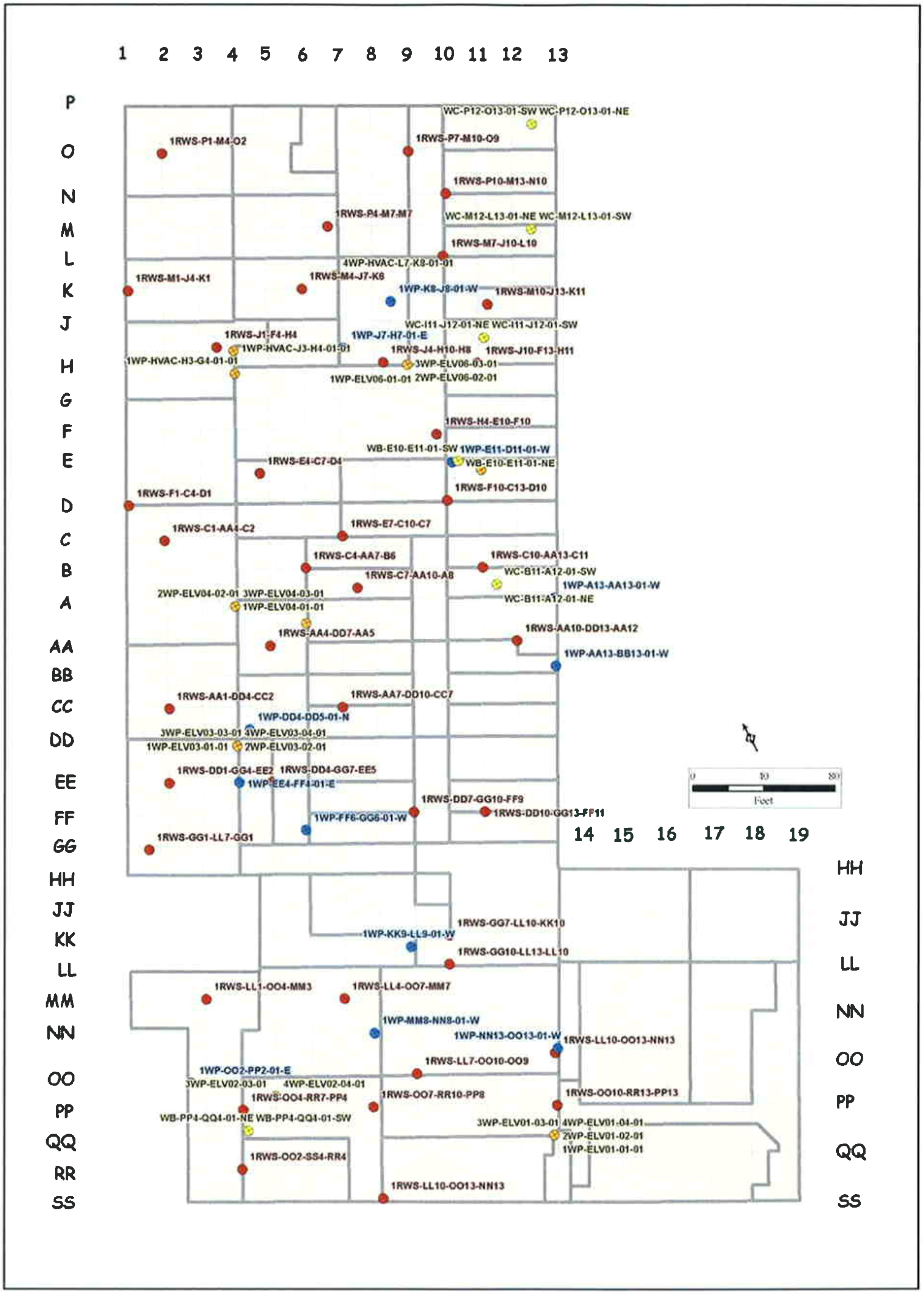
Drawn By: CCC Approved by: EDW

Checked By: RRR Date: April 10, 2008

MACTEC

Figure 3-4
TCE Area Soil Samples
Former Carter Carburetor Site
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\Figure 3-4.mxd



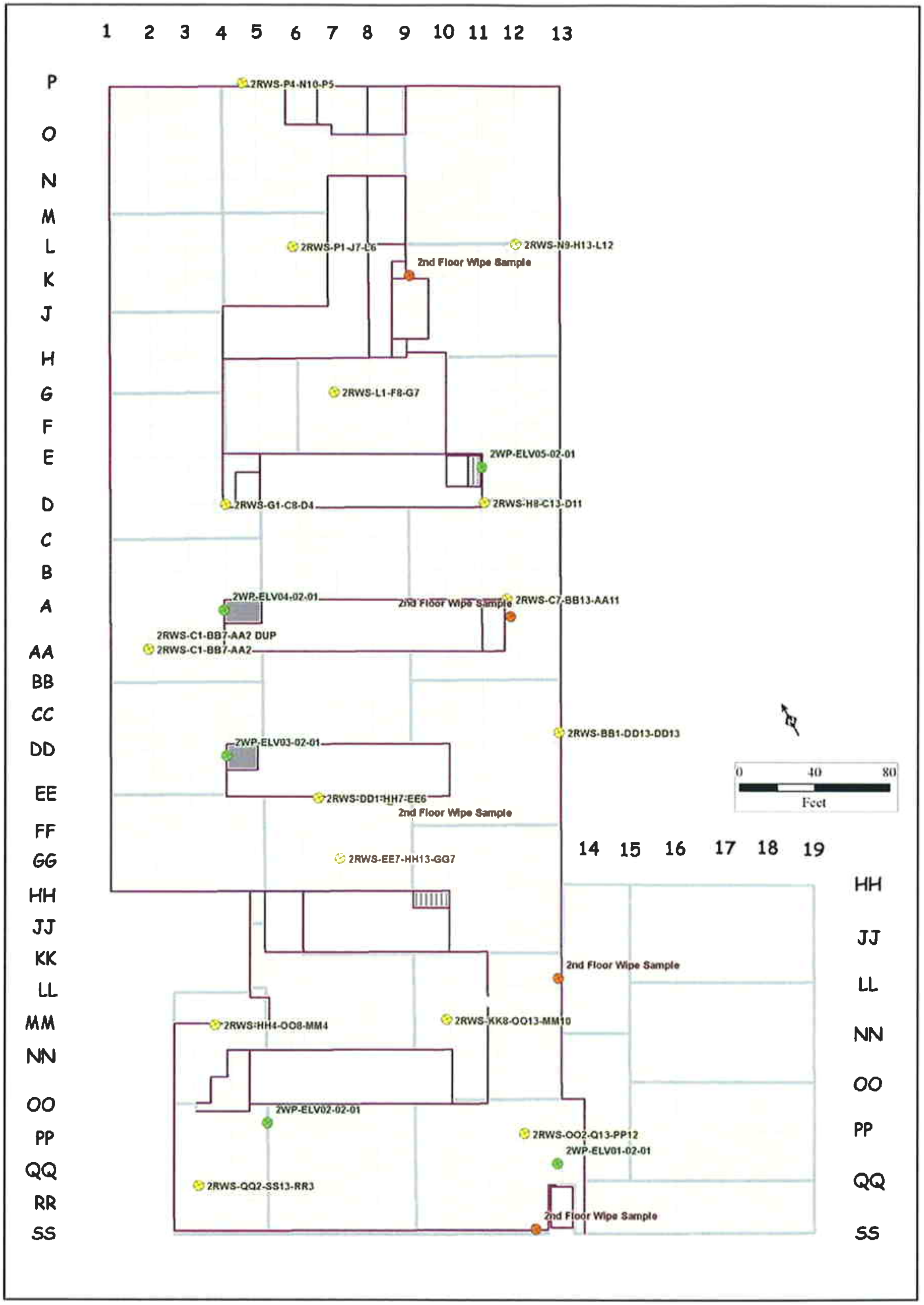
Legend

- Elevator-HVAC Wipe Samples
- Pilot Wipe Sample
- Wipe Sample
- Random Wipe Sample

Drawn By: CCC Approved by: EMW
Checked By: RRR Date: April 11, 2008

MACTEC

Figure 3-5
Interior Wipe Samples, 1st Floor
Former Carter Carburetor Site,
St. Louis, Missouri



Legend

- Elevator Wipe Sample
- Sample
- Random Sample

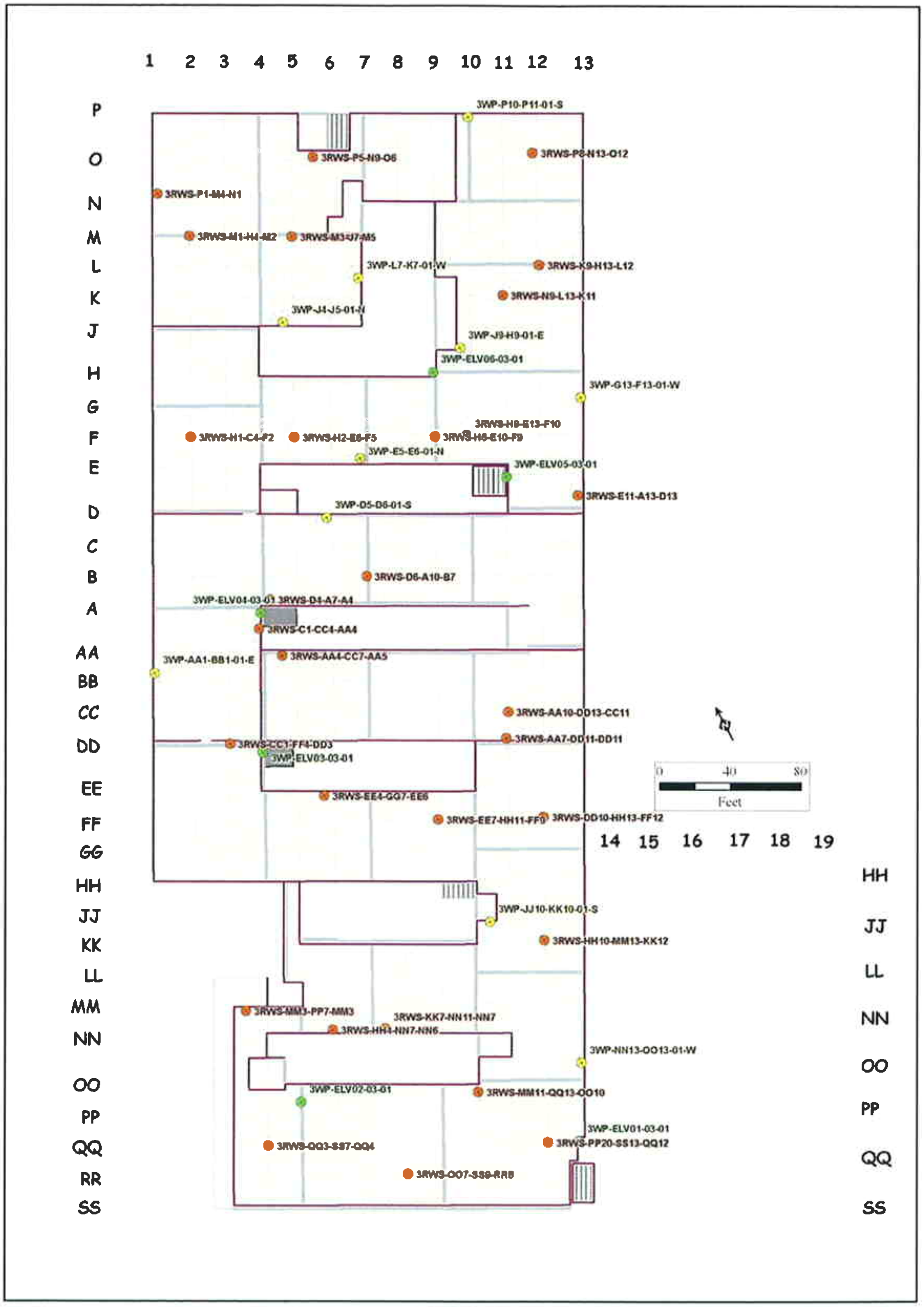
Drawn By: CCC   Approved by: EMW

Checked By: RRR   Date: April 15, 2008

MACTEC

Figure 3-6
Second Floor Wipe Samples
Former Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\Figure 3-6.mxd



Legend

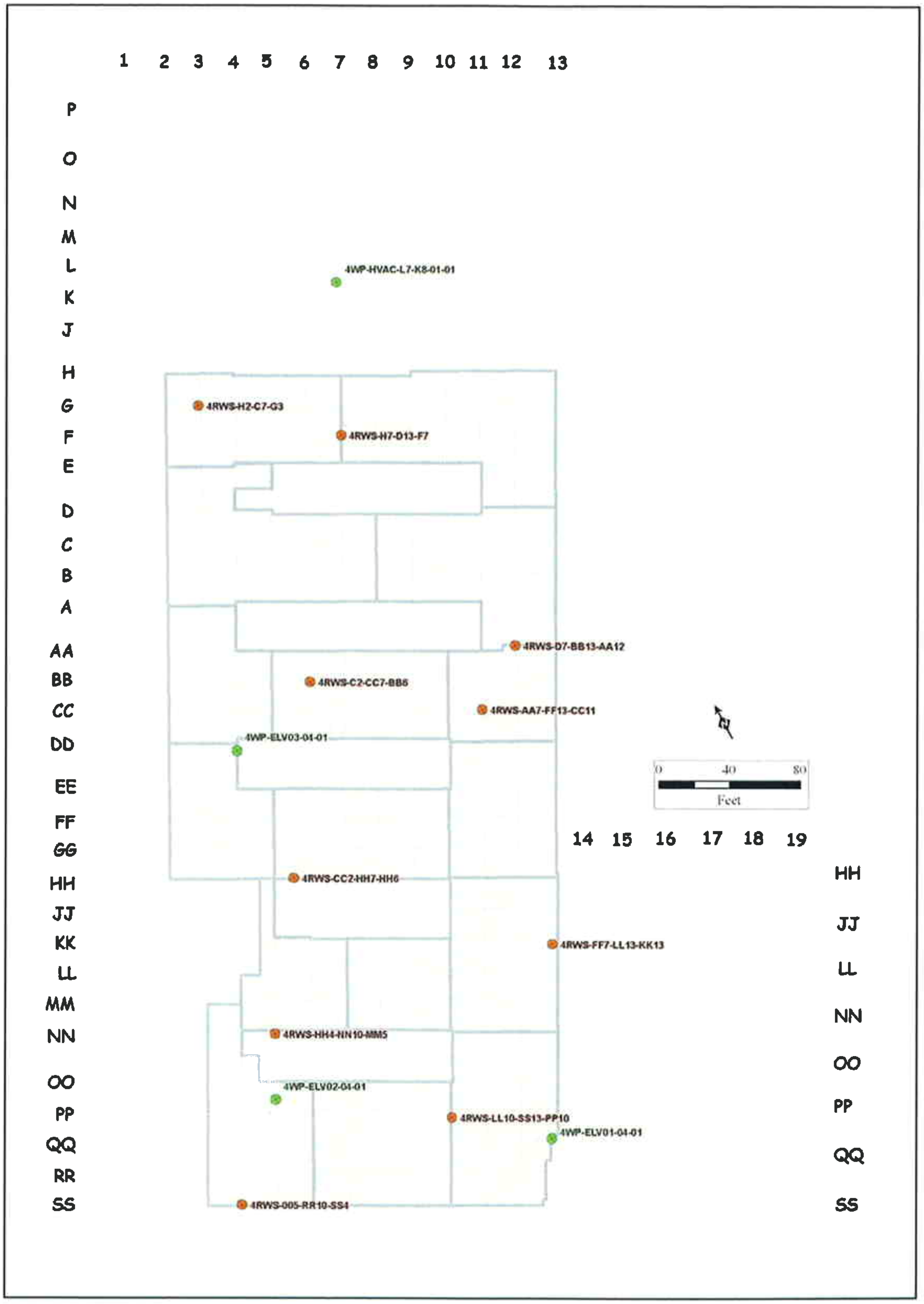
- Elevator Wipe Samples
- 3rd Floor Sample

Drawn By: CCC	Approved by: EMW
Checked By: RRR	Date: November 15, 2007

MACTEC

Figure 3-7
Third Floor Wipe Samples
Former Carter Carburetor Site,
St. Louis, Missouri

P:\I_Gis\3250035028\a_mxd\Robin\Figure 3-7.mxd



Legend

- Elevator\HVAC Wipe Sample
- Floor Sample

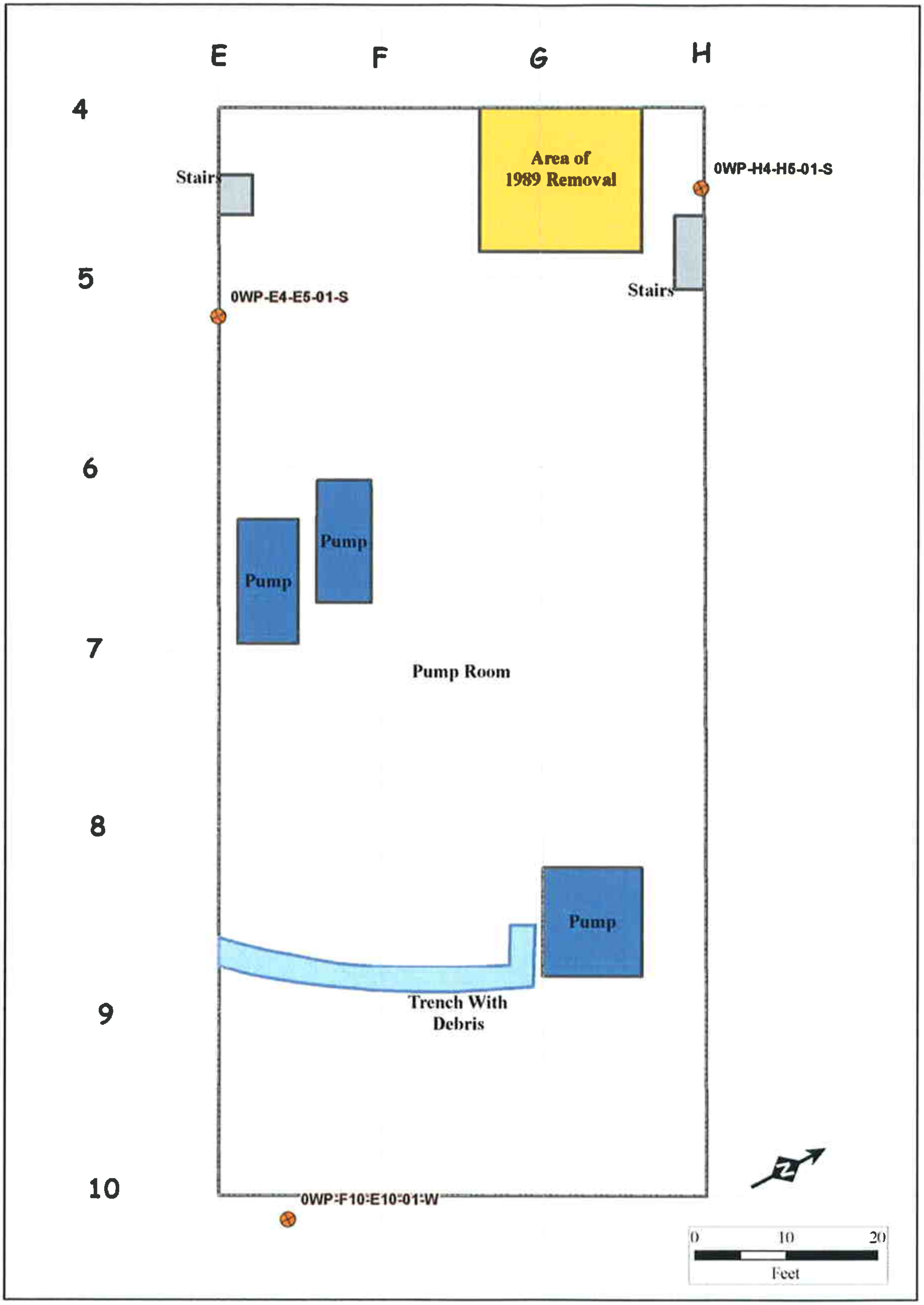
Drawn By: CCC   Approved by: EMW

Checked By: RRR   Date: April 15, 2008

MACTEC

Figure 3-8
Fourth Floor Wipe Samples
Former Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\figure 3-8.mxd



Legend

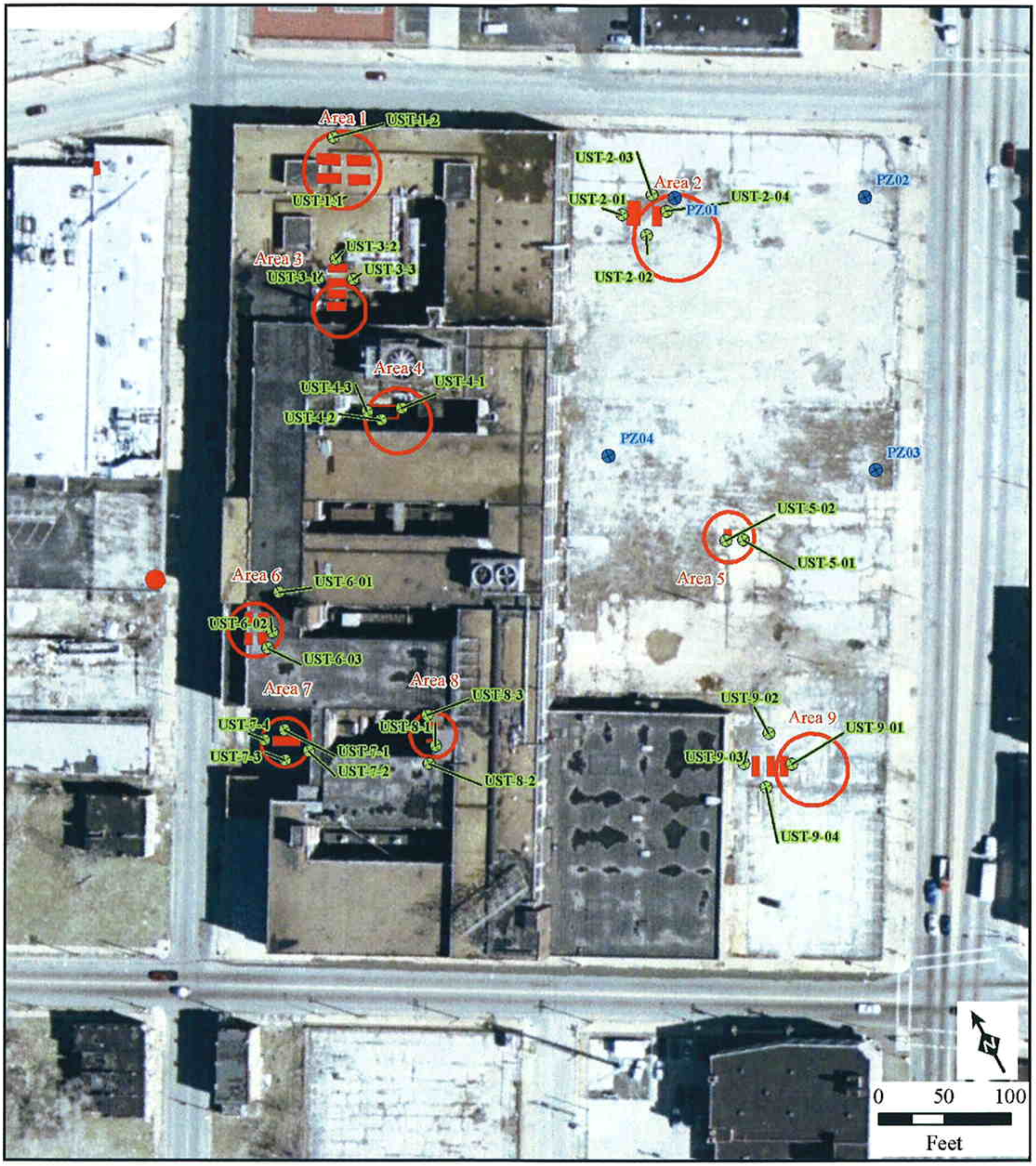
Wipe Sample — Grid Line

Drawn By: CCC — Approved by: EMW

Checked By: RRR — Date: April 15, 2008

MACTEC

Figure 3-9
Pump Room Wipe Samples
Carter Carburetor Site,
St. Louis, Missouri



Legend

- Piezometer
- Sample
- Storage Tanks

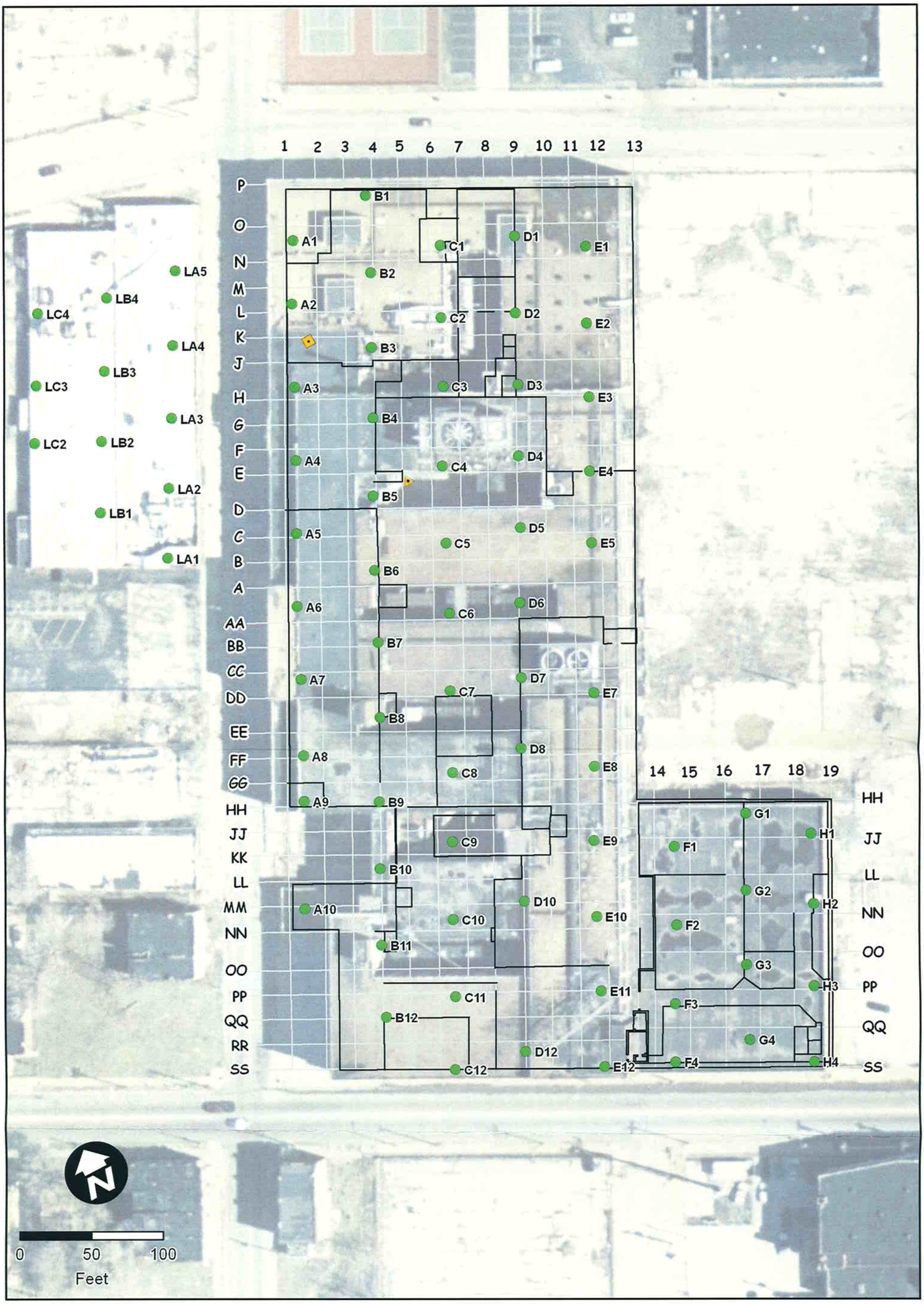
Drawn By: CCC Approved by: CLT

Checked By: RRR Date: April 18, 2008

MACTEC

Figure 3-10
Groundwater Sampling Locations
Carter Carburetor Site, St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Robin\Figure 3-10.mxd



Legend

- Soil Gas Samples
- Ambient (Indoor)
- Ambient (Rooftop)

Drawn By: CGS | Approved by: EMW

Checked By: CLT | February 17, 2008

MACTEC

Figure 3-11:
Soil Gas Sample Locations
Carter Carburetor Site,
St. Louis, Missouri

P:\1_Gis\3250035028\a_mxd\Figures\TCE\090217_EPA_TCE_Samples.mxd

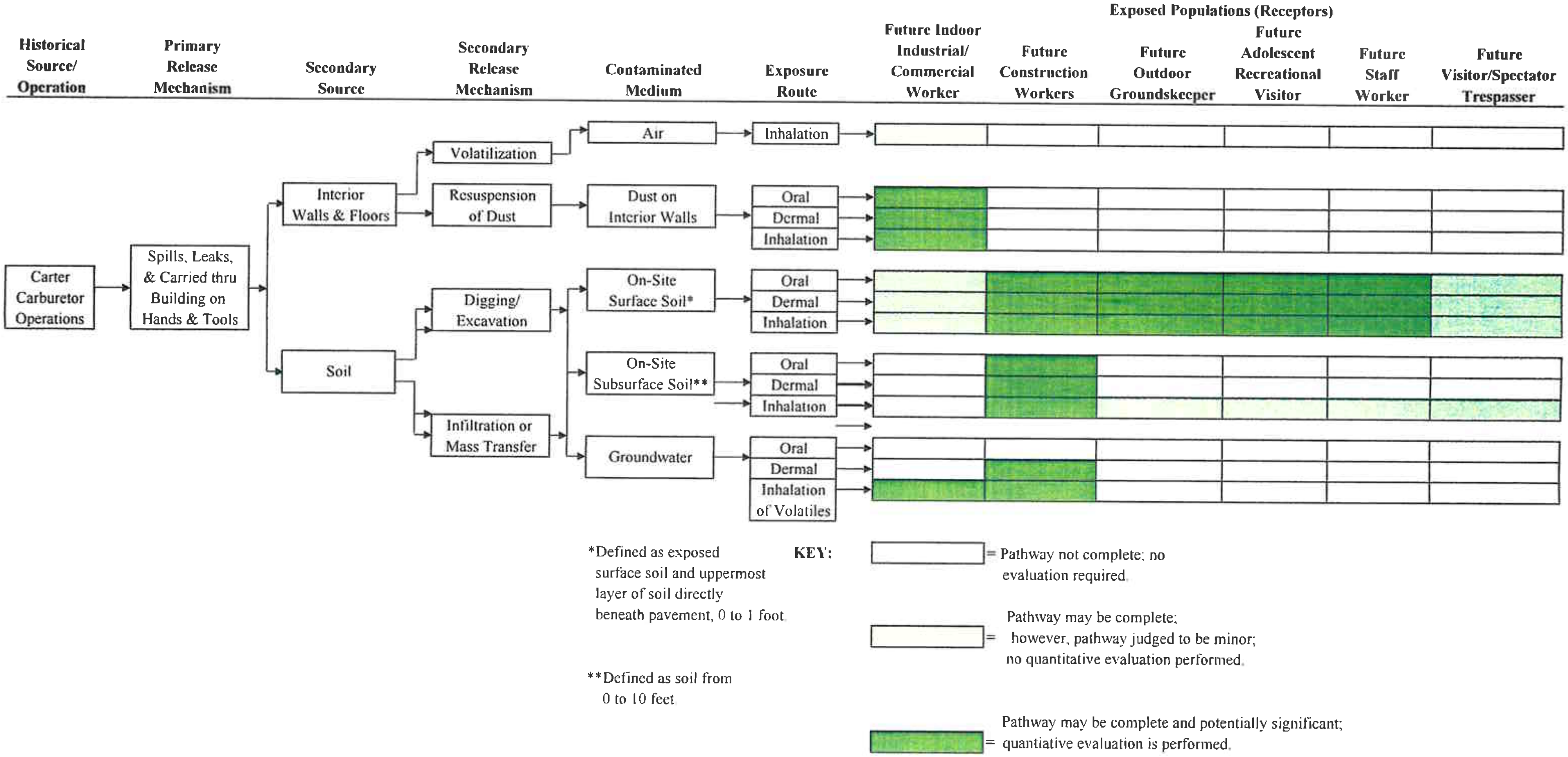


Figure 4-1. Conceptual Site Model for Carter Carburetor Site, St. Louis, Missouri.

Attachment 2
Capital and Present Value Cost Estimates

CBI Building Alternative 2 - Partial Removal and Replacement Alternative
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, remove and replace PCB impacted building materials, and rehabilitate building so that it can be returned to productive use.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Power Wash Walls/floors, treat water	LS	$810,549	1	$810,549
Debris Removal and Disposal	LS	$176,325	1	$176,325
Building Rehabilitation				
Repair Roof	LS	$811,008	1	$811,008
Repair/Replace Windows/Doors	LS	$836,655	1	$836,655
Rehab Interior Walls/Columns	LS	$785,000	1	$785,000
Rehab Exterior Walls	LS	$426,753	1	$426,753
Remove and Replace Floor Slabs				
First Floor (80%)	sf	$30	112,134	$3,381,961
2nd (1%), 3rd (50%), 4th (10%) Floors	sf	$38	67,475	$2,535,036
Transportation and Disposal				
TSCA Waste	ton	$209	1021	$213,389
Confirmation Sampling				
Confirmation Sampling	ea	$75	555	$41,625
Permitting and Reporting				
Permitting and Reporting	LS	$121,183	1	$121,183
Total Value of Capital Costs				$12,239,484

Notes:

TSCA - Toxic Substance Control Act
PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

CBI Building Alternative 3 - Partial Demolition and Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish CBI structure, leave floor slab in place, install and maintain impermeable cap in compliance with TSCA.				
	Unit	**Unit Price**	**Quantity**	**Cost**
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Secure Property	lf	$14.18	2001	$28,368
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$176,325.00	1	$176,325
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
Building Demolition w/o First Floor Slab	ton	$48.00	35,250	$1,692,000
On-site Resize of Material	ton	$9.83	35,250	$346,331
Transport and Dispose - TSCA	ton	$209.00	0	$0
Transport and Dispose - Non-hazardous	ton	$42.01	35,250	$1,480,853
Rehabilitate Willco Plastics Building Common Wall	LS	$220,000.00	1	$220,000
Cover System (Soil Cap)				
Site Preparation	LS	$518,000	1	$518,000
Cover System (Soil Cap)	LS	$1,696,000	1	$1,696,000
Stormwater Controls	LS	$64,000	1	$64,000
Engineering and Design	%	$2,278,000	12%	$273,360
Permitting	%	$2,551,360	5%	$127,568
Confirmation Sampling				
Confirmation Sampling	ea	75	4230	$317,250
Permitting and Reporting				
Permitting and Reporting	LS	$9,354,737	1%	$93,547
Subtotal				$9,448,284
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$32,021	5	$160,105
Cover System - Annual Cost, years 6-30	LS/yr	$13,277	25	$331,925
Cover System - Periodic Costs, once /15 years	LS/event	$63,261	2	$126,522
Stormwater Controls - Annual Costs	LS/yr	$2,343	30	$70,290
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$46,079	2	$92,158
Permitting and Reporting- Annual Cap Costs	LS	$5,000	29	$145,000
Regulatory Oversight	LS/yr	$2,000	29	$58,000
Subtotal				$984,000
Slab Disposal Cost (if required, not included in Total Costs)				
Mob/Demob	LS	$49,682.00	1	$49,682
Site Preparation	LS	$518,000	1	$518,000
Transport and Dispose - TSCA	ton	$209.00	3,680	$769,120
Transport and Dispose - Non-hazardous	ton	$42.01	1,578	$66,292
Subtotal				$2,831,822,694
Total Value of Capital and O&M Costs, Non-Discounted				$10,432,284

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet
% - percent

O&M - operation and maintenance
gal - gallon
cf - cubic feet
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -CBI Building Alternative 3 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 6	Project Mgmt at	Technical Support at	Contingency at		
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Oversight (1-30)	Concrete Slab Disposal (year 30)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 52,666
2	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 49,221
3	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 46,001
4	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 42,991
5	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 40,179
6	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 19,440
7	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 18,168
8	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 16,980
9	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 15,869
10	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 14,831
11	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 13,860
12	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 12,954
13	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 12,106
14	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 11,314
15	$ -	$ 2,343	$ 13,277	$ 46,079	$ 63,261	$ 4,500	$ -	$ 6,473	$ 12,946	$ 38,838	$ 187,717	$ 68,037
16	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 9,882
17	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 9,236
18	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 8,632
19	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 8,067
20	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 7,539
21	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 7,046
22	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 6,585
23	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 6,154
24	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,752
25	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,375
26	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,024
27	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,695
28	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,388
29	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,101
30	$ -	$ 2,343	$ 13,277	$ 46,079	$ 63,261	$ 4,500	$ 835,412	$ 48,244	$ 96,487	$ 289,462	$ 1,399,064	$ 183,791
Total	$160,105	$70,290	$331,925	$92,158	$126,522	$135,000	$835,412	$87,571	$175,141	$525,424	**$ 2,540,000** rounded up	**$ 711,000** rounded up

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

PV Discount FPV Discount Rate (i)	0.07
PV = non-discounted cost x $1/((1+i)^t)$	

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

8/6/2010

CBI Building Alternative 4 - CBI Building Rehabilitation/Epoxy Encapsulation
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, double epoxy coat PCB impacted building materials. Any rehabilitation of building except for roof repair and window and door repair is responsibility of building owner.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Power Wash Walls/floors, Treat Water	LS	$810,549	1	$810,549
Debris Removal and Disposal	LS	$176,325	1	$176,325
Building Rehabilitation				
Repair Roof	LS	$811,008	1	$811,008
Repair/Replace Windows/Doors	LS	$836,655	1	$836,655
Install Vapor Intrusion Mitigation System	sf	$2.50	77,500	$193,750
Apply Epoxy Coat and Concrete Overlay				
First Floor	sf	$3.20	134,000	$428,800
Double Coat Columns	sf	$3.20	123,800	$396,160
Second, Third, Fourth Floor - Double Epoxy Coat	sf	$3.20	228,908	$732,504
Wall Surfaces, Double Epoxy Coat	sf	$3.20	160,000	$512,000
First Floor Concrete Overlay - 6-10 inches thick	sf	$6.00	134,000	$804,000
Transportation and Disposal				
TSCA Waste	ton	$209	100	$20,900
Confirmation Sampling				
Confirmation Sampling	ea	$75	750	$56,250
Permitting and Reporting				
Permitting and Reporting	LS	$78,789	1	$78,789
Subtotal				$7,957,690
Annual Maintenance, Inspection, Reapplication of Epoxy				
Quarterly Inspection, Annual Costs	LS	$2,500.00	30	$75,000
Annual Maintenance		$6,683	30	$200,490
Regulatory Oversight	LS/year	$2,000	30	$60,000
Repeat Application of Surface Coat after 7.5 years, 4x in 30 years (low traffic areas, 75%of 2nd, 3rd, and 4th floors plus columns and walls)	sf	$1.60	1,182,564	$1,892,102
Repeat Application of Surface Coat after 3.75 years, 8x in 30 years, (high traffic areas, 25% of 2nd, 3rd, and 4th floors)	sf	$1.60	457,816	$732,506
Subtotal				$2,960,098
Building Demolition Costs at End of Useful Life				
Building Demolition Cost	LS	$8,826,627.00	1	$8,826,627
Project Management at 5%		5%	$8,826,627.00	$441,331
Technical Support at 10%		10%	$9,267,958.35	$926,796
Contingency at 30%		30%	$10,194,754.19	$3,058,426
Subtotal				$13,253,180
Total Value of Capital and O&M Costs, Non-Discounted				$24,170,969

Notes:

PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

O&M - operation and maintenance

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -CBI Building Alternative 4 - Building Rehabilitation/Epoxy Encapsulation
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Project Mgmt at	Technical Support at	Contingency at		
(t)	Quarterly Inspection and Regulatory Oversight, Annual Cost	Annual Maintenance (VI system, Epoxy, Concrete)	Periodic Re-application in Low Traffic Areas (7.5, 15, 22.5, and 30 yrs.)	Periodic Re-application in High Traffic Areas (every 3.75 years)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 24,238
2	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 22,652
3	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 129,548
4	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 19,785
5	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 18,491
6	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 17,281
7	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 525,967
8	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 15,094
9	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 14,107
10	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 80,676
11	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 12,321
12	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 11,515
13	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 10,762
14	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 10,058
15	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 306,118
16	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 8,785
17	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 8,210
18	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 46,954
19	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 7,171
20	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 6,702
21	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 6,264
22	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 190,635
23	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 5,471
24	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 5,113
25	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 29,241
26	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 4,466
27	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 4,174
28	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 3,901
29	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 3,645
30	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 110,951
Total	$135,000	$401,580	$1,892,102	$732,506	$158,059	$316,119	$948,356	**$ 4,584,000** rounded up	**$ 1,661,000** rounded up

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

CBI Building Alternative 5 - Demolition
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish CBI structure, including first floor slab.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Demolish CBI, Including First Floor Slab	cf	$0.39	5601666	$2,160,002
Secure Property	lf	$14.18	2001	$28,368
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$176,325.00	1	$176,325
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
CBI Building Demolition				
On-site Resize of Material	ton	$9.83	62500	$614,063
Transport and Dispose - TSCA (15% of total)	ton	$209.00	9375	$1,959,375
Transport and Dispose - Non-hazardous (85% of total)	ton	$42.01	53125	$2,231,781
Confirmation Sampling				
Confirmation Sampling	ea	75	8,333	$624,975
Permitting and Reporting				
Permitting and Reporting	LS	$10,209,571	1.00%	$102,096
Total Value of Capital Costs				$10,311,667

Notes:

Mob/Demob - mobilization/demobilization
TSCA - Toxic Substance Control Act
LS - lump sum
lf - linear feet

gal - gallon
% - percent
ea - each
cf - cubic feet

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 2 - Mechanical Removal (Scabbling/Scarification)
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, mechanically remove PCB impacted concrete floor materials, double epoxy coat impacted building materials (if present). Rehabilitation of building is limited to roof, window and door repair.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors, Treat Water	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Building Rehabilitation				
Repair Roof	LS	$71,288	1	$71,288
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Scabbling/Scarification				
First Floor, average of three passes per impacted area, 1/8" removed per pass	sf	$38.25	26,000	$994,500
Double Coat Columns with Epoxy	sf	$2.10	6,912	$14,503
Second Floor, average of three passes per impacted area, 1/8" removed per pass	sf	$38.25	6,000	$229,500
Transportation and Disposal				
Concrete Waste	ton	$42	934	$39,228
Confirmation Sampling				
Confirmation Sampling	ea	$75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$1,694,499	1.00%	$16,945
Subtotal				$1,711,444
Annual Maintenance, Inspection and Repeat Epoxy Application				
Quarterly Inspection, Annual Costs, Plus Sampling Labor	LS	$8,400	30	$252,000
Annual Maintenance		$670	30	$20,100
Annual Sampling of Scabbled Areas, one sample per 500 sf., x 30 years	ea	$75	1,590	$119,250
Repeat Aapplication of Surface Coat after 7.5 years, 4x in 30 years	sf	$1.03	6,912	$7,144
Regulatory Oversight	LS	$2,000.00	30	$60,000
Subtotal				$458,494
Total Value of Capital and O&M Costs, Non-Discounted				$2,169,937

Notes:

PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -Willco Plastics Building Alternative 2 - Scabbling/Scarification
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year (t)	Item 1 Quarterly Inspection, Annual Cost (1-30)	Item 2 Annual Maintenance and Sampling (1-30)	Item 3 Annual Reporting (1-30)	Item 4 Annual Regulatory Oversight (1-30)	Project Mgmt at 0.05	Technical Support at 0.10	Contingency at 0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 23,776
2	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 22,220
3	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 20,767
4	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 19,408
5	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 18,139
6	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 16,952
7	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 15,843
8	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 14,806
9	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 13,838
10	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 12,933
11	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 12,086
12	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 11,296
13	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 10,557
14	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 9,866
15	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 9,221
16	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 8,617
17	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 8,054
18	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 7,527
19	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 7,034
20	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 6,574
21	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 6,144
22	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,742
23	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,367
24	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,015
25	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,687
26	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,381
27	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,094
28	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,826
29	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,576
30	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,342
Total	$252,000	$139,350	$75,000	$60,000	$26,318	$52,635	$157,905	**$ 764,000** rounded up	**$ 316,000** rounded up

PV Discount RatPV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.

2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 3 -Building Rehabilitation/Epoxy Encapsulation
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, Double epoxy coat PCB impacted building materials. Any rehabilitation of building except for roof repair and window and door repair is left up to building owner.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors, Treat Water	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Building Rehabilitation				
Repair Roof	LS	$71,288	1	$71,288
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Initial Apply Epoxy Coat				
First Floor- Double Epoxy Coat	sf	$3.20	26,000	$83,200
Double Coat Columns	sf	$3.20	6,912	$22,118
Second Floor - Double Epoxy Coat	sf	$3.20	6,000	$19,200
Confirmation Sampling				
Confirmation Sampling	ea	$75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$541,286	1.00%	$5,413
Subtotal				$546,699
Annual Maintenance, Inspection and Reapplication of Epoxy				
Quarterly Inspection, Annual Costs	LS	$2,500.00	30	$75,000
Annual Maintenance		$670.00	30	$20,100
Regulatory Oversight	LS	$2,000.00	30	$60,000
Repeat Application of Surface Coat after 3.75 years, 8x in 30 years (high traffic areas = 25% of floor surface)	sf	$1.60	64,000	$102,400
Repeat Application of Surface Coat after 7.5 years, 4x in 30 years (low traffic areas and columns)	sf	$1.60	123,648	$197,837
Subtotal				$455,337
Building Demolition Costs at End of Useful Life				
Building Demolition Cost	LS	$1,741,531	1	$1,741,531
Project Management at 5%		5%	$1,741,530.86	$87,077
Technical Support at 10%		10%	$1,828,607.40	$182,861
Contingency at 30%		30%	$2,011,468.14	$603,440
Subtotal				$2,614,909
Total Value of Capital and O&M Costs, Non-Discounted				$3,616,945

Notes:

LS - lump sum
sf - square feet
ea - each
O&M - operation and maintenance

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -Willco Plastics Building Alternative 3 - Building Rehabilitation/Epoxy Encapsulation
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Project Mgmt at	Technical Support at	Contingency at		
(t)	Quarterly Inspection and Regulatory Oversight Annual Cost	Annual Maintenance	Periodic Re-application in Low Traffic Areas (7.5, 15, 22.5, and 30 yrs.)	Periodic Re-application in High Traffic Areas (every 3.75 years)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 7,006
2	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 6,548
3	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 21,270
4	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 5,719
5	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 5,345
6	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,995
7	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 60,888
8	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,363
9	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,078
10	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 13,246
11	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,562
12	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,329
13	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,111
14	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,907
15	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 35,437
16	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,539
17	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,373
18	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 7,709
19	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,073
20	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,937
21	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,811
22	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 22,069
23	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,581
24	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,478
25	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 4,801
26	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,291
27	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,206
28	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,127
29	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,054
30	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 12,844
Total	$135,000	$20,100	$197,837	$102,400	$22,767	$45,534	$136,601	**$ 661,000** rounded up	**$ 248,000** rounded up

PV Discount RatPV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 4 - Partial Removal and Replacement Alternative
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, remove and replace PCB impacted building materials, and rehabilitate building so that it can be returned to productive use.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Mob/Demob	LS	$49,682.00	1	$49,682
Water Recovery/Treatment	gal	$2.65	50,000	$132,500
Building Rehabilitation				
Repair Roof	LS	$125,188	1	$125,188
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Rehabilitate Willco Plastics/CBI Building Common Wall	LS	$220,000.00	1	$220,000
Remove/Replace Impacted Floor				
First Floor (approx. 10% of floor)	sf	$40	2,510	$100,802
Second Floor (approx. 2% of floor)	sf	$48	507	$24,118
Transportation and Disposal				
TSCA Waste	ton	$209	0	$0
Transport and Dispose - Non-hazardous (75% of total)	ton	$42.01	110	$4,621
Confirmation Sampling				
Confirmation Sampling	ea	$75	35	$2,625
Permitting and Reporting				
Permitting and Reporting	LS	$997,516	1.00%	$9,975
Total Value of Capital Costs				$1,007,491

Notes:

PCB - polychlorinated biphenols
TSCA - Toxic Substance Control Act
LS - lump sum
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 5 - Partial Demolition and Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish Willco Plastics structure, leave floor slab in place, install and maintain soil cap in compliance with TSCA.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$112,350	1	$112,350
Secure Property	lf	$14.18	800	$11,342
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$18,900	1	$18,900
Power Wash Walls/Floors, Treat Water	LS	$86,730	1.00	$86,730
Building Demolition w/o First Floor Slab & Foundations	cf	$0.39	1,040,000	$401,024
On-site Resize of Material	ton	$9.83	7891	$77,529
Transport and Dispose - TSCA (5%)	ton	$209.00	395	$82,555
Transport and Dispose - Non-hazardous (95%)	ton	$42.01	7496	$314,907
Confirmation Sampling				
Confirmation Sampling	ea	$75	280	$21,000
Permitting and Reporting				
Permitting and Reporting	LS	$1,176,019	1.00%	$11,760
Cover System (Soil Cap)				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design	%	$512,000	12%	$61,440
Permitting	%	$573,440	5%	$28,672
Subtotal				$1,789,891
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608
Permitting and Reporting- Annual Cap Costs	LS/yr	$2,500	30	$75,000
Regulatory Oversight	LS/yr	$2,000	30	$60,000
Subtotal O&M				$191,000
Total Value of Capital and O&M Costs, Non-Discounted				$1,980,891

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet

% - percent
O&M - operation and maintenance
cf - cubic feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA - Willco Plastics Building Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Project Mgmt at	Technical Support at	Contingency at		
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 15,817
2	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 14,782
3	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 13,815
4	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,912
5	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,067
6	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,498
7	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,007
8	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,549
9	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,120
10	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,720
11	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,346
12	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,996
13	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,669
14	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,364
15	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 16,071
16	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,811
17	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,562
18	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,329
19	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,111
20	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,908
21	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,718
22	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,540
23	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,374
24	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,218
25	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,073
26	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,938
27	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,811
28	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,692
29	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,582
30	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 5,825
Total	$33,415	$14,670	$69,275	$19,234	$26,406	$135,000	$14,900	$29,800	$89,400	**$ 433,000** rounded up	**$ 180,000** rounded up

PV Discount FPV Discount Rate (i)	**0.07**
PV = non-discounted cost x 1/((1+i)^t)	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

8/6/2010

Willco Plastics Building Alternative 6 - Demolition
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish Willco Plastics structure, including first floor slab.

	Unit	Unit Price	Quantity	Cost
Willco Plastics Building Demolition				
Asbestos Abatement	LS	$112,350	1	$112,350
Demolish Willco	cf	$0.39	1,040,000	$401,024
Secure Property	lf	$14.18	800	$11,342
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$18,900	1	$18,900
On-site Resize of Material	ton	$9.83	14040	$137,943
Transport and Dispose - TSCA (5% of total)	ton	$209.00	702	$146,718
Transport and Dispose - Non-hazardous (95% of total)	ton	$42.01	13338	$560,329
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
Confirmation Sampling				
Confirmation Sampling	ea	75	280	$21,000
Permitting and Reporting				
Permitting and Reporting	LS	$1,724,288	1.00%	$17,243
Total Value of Capital Costs				$1,741,531

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
lf - linear feet
% - percent

gal - gallon
cf - cubic feet
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 2 - Soil Excavation and Off-Site Disposal
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials, transport for off-site disposal, backfill with suitable fill.

Die Cast Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Stockpile Surface Gravel - (245' x 120' x 2')(2178 cy x 1.4 tons/cy)	tons	3.16	3049.2	$9,635
Impacted Area Excavation and Loading (245' x120' x 23')	cy	6.01	25044	$150,514
Dewater Excavation and Treat/Dispose	gal	2.65	90,000	$238,500
Sheet Pile Installation	lf	2,537	516	$1,308,963
Backfill				
Purchase Backfill	cy	14.00	25,044	$350,616
Place Backfill	cy	7.50	25,044	$187,830
Transportation, Treatment, and Disposal				
TSCA Landfill T&D (25,044 cy x 1.4 tons/cy)	ton	209.00	35062	$7,327,958
Confirmation Sampling				
Confirmation Sampling	ea	75	500	$37,500
Permitting and Reporting				
Permitting and Reporting	LS	$96,019	1	$96,019
Total Value of Capital Costs				$9,707,536

Notes:

TSCA - Toxic Substance Control Act
cy - cubic yard
LS - lump sum
gal - gallon

T&D - transportation and disposal
lf - linear feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

8/6/2010

Die Cast Area Alternative 3 - Excavate to 10', Backfill, Install Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials to 10' below ground surface (nominal limits of construction), transport for off-site disposal, backfill with suitable fill, install soil cap.

Die Cast Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Stockpile Surface Gravel - (245' x 120' x 2')(2178 cy x 1.4 tons/cy)	tons	3.16	3049.2	$9,635
Impacted Area Excavation and Loading (245' x120' x 10')	cy	6.01	10,900	$65,509
Dewater Excavation and Treat/Dispose	gal	2.65	90,000	$238,500
Backfill				
Purchase Backfill	cy	14.00	10,900	$152,600
Place Backfill	cy	7.50	10,900	$81,750
Transportation, Treatment, and Disposal				
TSCA Landfill T&D (10,900 cy x 1.4 tons/cy)-soil	ton	209.00	15,260	$3,189,340
TSCA Landfill T&D (545 cy x 2.1 tons/cy)-concrete floor	ton	209.00	1,145	$239,201
TSCA Landfill T&D (272 cy x 2.1 tons/cy)-concrete footings	ton	209.00	571	$119,381
TSCA Landfill T&D (30 cy x 2.1 tons/cy)-concrete knee walls	ton	209.00	63	$13,167
Confirmation Sampling				
Confirmation Sampling	ea	75	315	$23,625
Permitting and Reporting-Excavation and Disposal				
Permitting and Reporting	LS	$4,132,708	1.00%	$41,327
Cap Installation				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design (12%)	%	$61,440	1	$61,440
Permitting (5%)	%	$28,672	1	$28,672
Subtotal				$4,701,002
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$6,683	5	$33,415
Cover System - Annual Cost, years 6-30	LS/yr	$2,771	25	$69,275
Cover System - Periodic Costs, once /15 years	LS/event	$13,203	2	$26,406
Stormwater Controls - Annual Costs	LS/yr	$489	30	$14,670
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$9,617	2	$19,234
Permitting and Reporting				
Permitting and Reporting-Annual	LS/yr	$2,500	30	$75,000
Regulatory Oversight - Annual	LS/yr	$2,000	30	$60,000
Subtotal O&M				$204,585
Total Value of Capital and O&M Costs, Non-Discounted				$4,905,587

Notes:

TSCA - Toxic Substance Control Act
T&D - transportation and disposal
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
% - percent

O&M - operation and maintenance
gal - gallon
cy - cubic yard
sf - square feet
ea - each

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 4 - ISTD/VE
ACF Carter Carburetor Facility
EE/CA Cost Estimate

In-place treatment of impacted subsurface materials.				
	Unit	**Unit Price**	**Quantity**	**Cost**
Die Cast Area				
ISTD - (245' X 120' X 26')	cy	275.52	28,311	$7,800,000
Confirmation Sampling				
Confirmation Sampling	ea	75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$7,807,500	1.00%	$78,075
Total Value of Capital Costs				$7,885,575

Notes:

ISTD/VE - in-situ thermal desorption/vapor extraction
cy - cubic yard
ea - each
LS - lump sum
% - percent

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 5 - Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Install and maintain a protective cover system over impacted areas.

	Unit	Unit Price	Quantity	Cost
Die Cast Area				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design (12%)	%	$61,440	1	$61,440
Permitting (5%)	%	$28,672	1	$28,672
Subtotal				$602,112
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$6,683	5	$33,415
Cover System - Annual Cost, years 6-30	LS/yr	$2,771	25	$69,275
Cover System - Periodic Costs, once /15 years	LS/event	$13,203	2	$26,406
Stormwater Controls - Annual Costs	LS/yr	$489	30	$14,670
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$9,617	2	$19,234
Permitting and Reporting				
Permitting and Reporting - Annual	LS/yr	$2,500	30	$75,000
Regulatory Oversight - Annal	LS/yr	$2,000	30	$60,000
Subtotal				$298,000
Total Value of Capital and O&M Costs, Non-Discounted				$900,112

Notes:

O&M - operation and maintenance

LS - lump sum

LS/year -lump sum per year

LS/event - lump sum per event

% - percent

O&M - operation and maintenance

updated: 8/6/10

Created by: CLT

Reviewed by: EMW

EE/CA - Die Cast Area Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Project Mgmt at	Technical Support at	Contingency at		
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 15,817
2	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 14,782
3	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 13,815
4	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,912
5	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,067
6	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,498
7	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,007
8	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,549
9	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,120
10	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,720
11	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,346
12	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,996
13	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,669
14	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,364
15	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 16,071
16	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,811
17	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,562
18	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,329
19	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,111
20	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,908
21	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,718
22	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,540
23	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,374
24	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,218
25	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,073
26	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,938
27	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,811
28	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,692
29	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,582
30	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 5,825
Total	$33,415	$14,670	$69,275	$19,234	$26,406	$135,000	$14,900	$29,800	$89,400	**$ 433,000** rounded up	**$ 180,000** rounded up

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

PV Discount PV Discount Rate (i)	0.07
PV = non-discounted cost x $1/((1+i)^t)$	

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

TCE AST Area Alternative 2 - Soil Excavation and Off-Site Disposal
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials, transport for off-site disposal, backfill with suitable fill.

TCE Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Impacted Area Excavation and Loading (100' x100' x 25')	cy	6.01	9259	$55,647
Dewater Excavation and Treat/Dispose	gal	1.25	50,000	$62,500
Sheet Pile Installation	lf	2,537	100	$253,675
Backfill				
Purchase Backfill	cy	14.00	9,259	$129,626
Place Backfill	cy	7.50	9,259	$69,443
Transportation, Treatment, and Disposal				
On-Site Treatment to Land Ban (9259 cy x 1.4 ton/cy) and T&D	ton	225.00	12,962	$2,916,450
Confirmation Sampling				
Confirmation Sampling	ea	95	186	$17,670
Permitting and Reporting				
Permitting and Reporting	LS	$3,505,010	1.00%	$35,050
Total Value of Capital Costs				$3,540,060

Notes:

T&D - transportation and disposal
cy - cubic yard
gal - gallon
lf - linear feet
ea - each
LS - lump sum

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

TCE Area Alternative 3 - Excavate to 10', Backfill, Install Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials to 10' below ground surface (nominal limits of construction), transport for off-site disposal, backfill with suitable fill, install soil cap.

TCE Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Impacted Area Excavation and Loading (100' x100' x 10')	cy	6.01	3,704	$22,261
Dewater Excavation and Treat/Dispose	gal	1.25	25,000	$31,250
Backfill				
Purchase Backfill	cy	14.00	3,704	$51,856
Place Backfill	cy	7.50	3,704	$27,780
Transportation, Treatment, and Disposal				
On-Site Treatment to Land Ban (3704 cy x 1.4 ton/cy) and T&D	ton	225.00	5,186	$1,166,760
Confirmation Sampling				
Confirmation Sampling	ea	95	75	$7,125
Permitting and Reporting				
Permitting and Reporting	LS	$1,307,032	1.00%	$13,070
TCE Area - Cover System (Soil Cap)				
Site Preparation	LS	$39,000	1	$39,000
Cover System (Soil Cap)	LS	$125,000	1	$125,000
Stormwater Controls	LS	$22,000	1	$22,000
Engineering and Design (12%)	%	$22,320	1	$22,320
Permitting (5%)	%	$10,416	1	$10,416
Subtotal				$1,538,838
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608
Permitting and Reporting				
Permitting and Reporting-Annual	LS/yr	$1,250	30	$37,500
Regulatory Oversight - Annual	LS/yr	$2,000	30	$60,000
Subtotal				$153,500
Total Value of Capital and O&M Costs, Non-Discounted - Excavation and Cap Only				$1,692,338
TCE Area - GWCA System installation and O&M Cost - see table for TCE Alternative 5				

Notes:

T&D - transportation and disposal
cy - cubic yard
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
gal - gallon
ea - each
O&M - operation and maintenance
% - percent
GWCA - groundwater corrective action

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

TCE AST Area Alternative 4 - ISTD/VE
ACF Carter Carburetor Facility
EE/CA Cost Estimate

In-place treatment of impacted subsurface materials.				
	Unit	**Unit Price**	**Quantity**	**Cost**
TCE Area				
ISTD - (100' X 100' X 25')	cy	215.8	9259	$1,998,092
Confirmation Sampling				
Confirmation Sampling	ea	95	50	$4,750
Permitting and Reporting				
Permitting and Reporting	LS	$2,002,842	1.00%	$20,028
Total Value of Capital Costs				$2,022,871

Notes:

ISTD/VE - in-situ thermal desorption/vapor extraction

cy - cubic yard

ea - each

LS - lump sum

% - percent

updated: 8/6/10

Created by: CLT

Reviewed by: EMW

TCE AST Area Alternative 5 - Impermeable Cap and GWCA System
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Install and maintain a protective cover system over impacted areas. TCE impacted area includes groundwater corrective action system (active or passive) to minimize off-site migration of impacted groundwater.

	Unit	Unit Price	Quantity	Cost
TCE Area - Cover System (Soil Cap)				
Site Preparation	LS	$39,000	1	$39,000
Cover System (Soil Cap)	LS	$125,000	1	$125,000
Stormwater Controls	LS	$22,000	1	$22,000
Engineering and Design (12%)	%	$22,320	1	$22,320
Permitting (5%)	%	$10,416	1	$10,416
Subtotal - Capital Costs				$218,736
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608
Permitting and Reporting				
Permitting and Reporting-Annual	LS/yr	$1,250	30	$37,500
Regulatory Oversight	LS/yr	$2,000	30	$60,000
Subtotal - O&M Costs				$153,500
Install and Maintain Impermeable Cap				$372,236

	Unit	Unit Price	Quantity	Cost Pump and Treat	Cost Passive Barrier
TCE Area - GWCA System					
Monitoring Well Installation	LS	$4,000	5	$20,000	
Extraction Well Installation	LS	$12,500	3	$37,500	
Pumps, Motors, Piping, Vaults	LS	$16,250	3	$48,750	
Control Shed	LS	$15,000	1	$15,000	
Air Stripper	LS	$30,000	1	$30,000	
Installation Labor	hr	$90	320	$28,800	
Engineering and Design (12%)	%	$21,606	1	$21,606	
Permitting (5%)	%	$9,003	1	$9,003	
Project Management (10%)				$21,066	
Subtotal - Capital Costs				$231,724	$450,000
Operation, Maintenance, and Monitoring Costs					
GWCA-Sampling Labor	LS/yr	$6,000	1	$6,000	$6,000
Analytical Costs	LS/yr	$7,200	1	$7,200	$7,200
GWCA Maintenance Costs	LS/yr	$28,800	1	$28,800	
Equipment Costs	LS/yr	$5,250	1	$5,250	$5,250
Permitting and Reporting-Annual	LS/yr	$10,920	1	$10,920	$10,920
Project Management (10%)	LS/yr	$5,817	1	$5,817	$5,817
Regulatory Oversight	LS/yr	$2,000	1	$2,000	$2,000
Subtotal-Annual				$65,987	$35,187
Subtotal - O&M Costs		$65,987	30	$1,979,610	$1,055,610
Passive Barrier Re-Injection Costs (5 yr. intervals)	LS/event	$120,000	6		$720,000
Install and Operate GWCA System (Active/Passive)				$2,211,334	$2,225,610

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet
% - percent
GWCA - groundwater corrective action

TCE - trichloroethylene
O&M - operation and maintenance
gal - gallon
cf - cubic feet
sf - square feet
ea - each
hr - hour

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -TCE AST Area Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Project Mgmt at	Technical Support at	Contingency at		
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 9,437
2	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 8,820
3	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 8,243
4	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 7,704
5	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 7,200
6	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 5,430
7	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 5,075
8	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,743
9	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,433
10	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,143
11	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,872
12	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,618
13	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,382
14	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,160
15	$ -	$ 168	$ 952	$ 3,304	$ 4,536	$ 4,500	$ 673	$ 1,346	$ 4,038	$ 19,517	$ 7,074
16	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,760
17	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,580
18	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,411
19	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,253
20	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,106
21	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,968
22	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,839
23	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,719
24	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,607
25	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,501
26	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,403
27	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,311
28	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,226
29	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,145
30	$ -	$ 168	$ 952	$ 3,304	$ 4,536	$ 4,500	$ 673	$ 1,346	$ 4,038	$ 19,517	$ 2,564
Total	$11,480	$5,040	$23,800	$6,608	$9,072	$135,000	$9,550	$19,100	$57,300	**$ 277,000** rounded up	**$ 115,000** rounded up

PV Discount PV Discount Rate (i)	0.07
PV = non-discounted cost x 1/((1+i)^t)	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA - TCE AST Area Alternative 5 - GWCA System Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Project Mgmt at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	GWCA-Sampling Labor	Annual Analytical Costs	GWCA Maintenance Costs	Equipment Costs	Annual Permitting, Reporting, and Regulatory	0.1	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 78,727
2	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 73,577
3	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 68,763
4	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 64,265
5	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 60,061
6	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 56,131
7	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 52,459
8	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 49,027
9	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 45,820
10	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 42,822
11	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 40,021
12	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 37,403
13	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 34,956
14	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 32,669
15	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 30,532
16	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 28,534
17	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 26,668
18	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 24,923
19	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 23,293
20	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 21,769
21	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 20,345
22	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 19,014
23	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 17,770
24	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 16,607
25	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 15,521
26	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 14,505
27	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 13,556
28	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 12,670
29	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 11,841
30	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 11,066
Total	$180,000	$216,000	$864,000	$157,500	$387,600	$180,510	$541,530	**$ 2,528,000** rounded up	**$ 1,046,000** rounded up

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

EE/CA -TCE AST Area - Alternative 5 - ISCO Barrier 5 yr Reinjection Interval
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 7	Item 8	Item 9	Project Mgmt at	Technical Support at	Total Non-Discounted Cost	Total Present Value
(t)	Quarterly GW Sampling, Annual Cost	Periodic Re-Injection	Regulatory Oversight	0.05	0.10		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 30,514
2	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 28,518
3	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 26,652
4	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 24,908
5	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 121,868
6	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 21,756
7	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 20,333
8	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 19,002
9	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 17,759
10	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 86,890
11	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 15,512
12	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 14,497
13	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 13,549
14	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 12,662
15	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 61,951
16	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 11,060
17	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 10,336
18	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 9,660
19	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 9,028
20	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 44,170
21	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 7,885
22	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 7,369
23	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 6,887
24	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 6,437
25	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 31,493
26	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 5,622
27	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 5,254
28	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 4,911
29	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 4,589
30	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 22,454
Total	$799,560	$721,440	$60,000	$ 76,050	$ 152,100	**$ 1,810,000** rounded up	**$ 704,000** rounded up

Note:

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 8/6/10

Created by: CLT
Reviewed by: EMW

MACTEC

engineering and constructing a better tomorrow

Weatherford.Jeffrey@epamail.epa.gov

August 9, 2010

Jeffrey Weatherford
U.S. Environmental Protection Agency
212 Little Bussen Drive
Fenton, Missouri 63026

RE: Carter Carburetor Superfund Site St. Louis, Missouri, Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. CERCLA-07-2005-0372.

Dear Mr. Weatherford:

As required under paragraph 49A of the Settlement Agreement, the following is the Respondent's response to comments contained within the "Notice of Disapproval of the Draft Engineering Evaluation/Cost Analysis" letter received by ACF Industries, LLC and dated June 9, 2010. As a preliminary matter, ACF and MACTEC believe that our proposed remedy as provided for in the December 22, 2009 draft EE/CA is fully protective of public health and the environment and is the most cost effective remedy for this Site. ACF provides the following:

The comment section of the letter begins with the second paragraph of the disapproval letter. The text of the letter has been reproduced (*in italics*), with ACF's response to the comment following the EPA's comment. In order to facilitate the review of responses, the following format will be used to identify to author of the comment and/or response and date of the response.

MACTEC E&C Draft EE/CA (5/9/2009)

EPA Response 1 (8/24/2009)

MACTEC E&C Draft EE/CA (12/22/2009)

EPA Response 2 (6/9/2010)

MACTEC Draft Final EE/CA 8/9/2010)

EPA Response 2 (6/9/2010)

Text: One of the two remaining significant concerns is the EE/CA Report's preferred alternative of epoxy encapsulation in the CBI and Willco building areas. For a number of reasons, EPA has determined that it cannot accept the epoxy encapsulation as the preferred response action to be implemented at the site. Nevertheless, we have provided

comments related to this alternative so that it can be considered during the public comment period. We have not been able to identify any superfund sites where this type of interim response action has been implemented. Because epoxy encapsulation is an interim response action has been implemented. Because epoxy encapsulation is an interim response action any agreement entered into by EPA for implementation of this alternative would require the establishment of a trust fund to cover the eventual disposal/treatment costs, either at the end of the useful life of the buildings or at a time when the buildings are no longer being used. Use of the epoxy encapsulation in the PCB-contamination context under 40 C.F.R. Section 761.30(p) seems to have been designed for and used in the electrical utility field where a continued use of the PCB-contaminated facility is apparent. The Region does not believe the epoxy encapsulation is an appropriate response action for this superfund site, especially in light of fact that future use of the facility is uncertain. In addition, the Agency is currently reconsidering the epoxy encapsulation authorization under the above-referenced PCB regulation based upon potential health risks (see advanced notice of proposed rulemaking, April 7, 2010 Federal Register, page 17657).

The other significant issue is the level of PCBs that can be allowed to remain in soils beneath the die cast buildings. EPA cannot accept Alternative 5 for the die cast area as the preferred alternative without a significant reduction in the subsurface levels of PCBs. As discussed in the comments below, after review of Respondent's sample data, the general geology of the area, and the science of environmental fate and transport of PCBs EPA has concluded there is a potential for PCBS and their preponderance to bio-accumulate and bio-magnify in organisms, it is possible that the PCBs beneath the die cast present an endangerment to the environment.

EPA Response 1 (8/24/2009)

General Comment 1: *Respondent's document was well organized and provided much of the information needed to assist EPA in the review. EPA appreciates Respondent's continued attention to this site and willingness to work with EPA on the best cleanup solution for this site.*

After review of all the information concerning this site and keeping in mind the risks, EPA has arrived at a different conclusion than Respondent concerning what the preferred alternatives should be at two or three of the four areas at the site evaluated in the EE/CA. Due to a number of factors, EPA believes the cost *estimates for the EE/CA recommended alternative of epoxy encapsulation at the CBI and Willco Plastics Buildings are considerably understated.*

One such factor is the cost of maintaining and replacing the epoxy coatings in each building. Even though EPA's policies indicate costs should only be determined for 30 years into the future, it is highly likely that re-application of the epoxy will be required for decades. In any agreement with Respondent to perform the EPA selected response action, a provision will be required to ensure that funds would be available to perform maintenance and epoxy replacement as long as the PCBs remain a cause of concern. Such provision will take the form of a trust fund or similar financial mechanism. In fact, it is likely the financial mechanism will also include the funds necessary to ensure the disposal of contaminated wastes once either building reaches the end of its useful life[1]

MACTEC E&C Draft EE/CA (12/22/2009)

Response: Respondent has revised the cost of epoxy application and has included the updated calculations in Attachment 2, Capital and Present Value Cost Estimates. Additionally, Respondent has changed the alternatives to incorporate EPA comments. Thus, we ask that EPA review the alternatives in light of the revisions. After EPA reviews the revised Draft Engineering Evaluation and Cost Analysis (EE/CA), should EPA determine that a trust fund or other financial mechanism is necessary, Respondent will agree to some form of financial mechanism, the details of which to be determined during the consent decree negotiations.

EPA Response 2 (6/9/2010)

EPA Response: EPA's original comment concerned the undervaluation of the epoxy encapsulation alternatives because of the need to establish a financial mechanism to cover the costs of maintaining and replacing the epoxy coatings over a probably very long period of time (scores of years) and to provide funds necessary to ultimately demolish the buildings or treat the PCBs at the end of its useful life[2] or other point in time. In response to EPA's comment concerning the need for a financial mechanism, it appears Respondent developed in Attachment 2 a present worth cost number for both the CBI and Willco buildings to cover the ultimate demolition/disposal costs at the end of 60 years. However, it is the Region's position that a fully-funded financial instrument must be in place at the completion of the building response action or soon thereafter. The cost of this financial mechanism must be included in calculating the total cost of each epoxy encapsulation alternative.

[1] The additional maintenance/disposal costs comment also applies to any of the alternatives that leave hazardous substances in place and which must be monitored or maintained beyond 30 years.

<u>MACTEC Draft Final EE/CA 8/9/2010)</u>

<u>Response: The total cost of the financial mechanisms will be included in the epoxy encapsulation alternatives.</u>

EPA Response 2 (6/9/2010)

2. (New General Comment): As stated above, EPA cannot accept as the preferred alternative the impermeable cap alternative proposed by Respondent for the die cast area with no reduction in contaminant levels. In selecting the preferred alternative for the die cast area, Respondent must develop an alternative which will reduce the contaminants in accordance with the following criteria:

From 0 to 10 feet below ground surface (bgs): PCB cleanup must meet either of the following criteria:

- **The removal action goal shall be less than 1 milligram per kilogram (mg/kg) with no accompanying restrictions;**
- **The removal action goal shall be the calculated values in the streamlined risk evaluation portion of the EE/CA with accompanying institutional controls to assure future land use; or**
- **The removal action goal shall be between 25 and 100 mg/kg combined with a protective cover, long-term monitoring and institutional controls per the PCB cleanup regulations at 40 CFR Part 761 (a){Self-implementing on-site cleanup and disposal of PCB remediation waste}.**

From 10 feet bgs to bedrock: PC cleanup must meet either of the following criteria:

- **The removal action goal shall meet the soil to groundwater levels for PCBs published in EPA Region 3 Risk Based Concentration Tables (http://www.epa.gov/reg3hscd/risk/human/);**
- **The removal action goal shall be less than 1 milligrams per kilogram (mg/kg) with no accompanying restrictions;**
- **The removal action goal shall be between 25 and 100 mg/kg combined with a protective cover, long-term monitoring (including groundwater monitoring) and institutional controls per the PCB cleanup regulations at 40 CFR Part 761(a) {Self-implementing on-site cleanup and disposal of PCB remediation waste}; or**
- **The removal action goal shall be calculated based on the following risk based scenario: Assume that PCBs are migrating directly to the Mississippi River at levels that**

exceed the national recommended water quality criteria for chronic protection of aquatic life (currently 0.014 micrograms per liter) via contamination infiltration into the nearest sewer line or via solution cavities in the Karst bedrock. Using conservative fate and transport parameters, calculate an on-site removal action goal that would lower the PCB concentration reaching the river to below the most current published national recommended water quality criteria at http://ww.epa.gov/waterscience/driteria/wqctable/. This calculation and all specific references and assumptions must be submitted to EPA for review and approval.

MACTEC Draft Final EE/CA 8/9/2010)

Response: The preferred alternative for the Die Cast area is the ISTD/VE alternative with the goal of meeting the unrestricted use contaminant level of 1 mg/kg. The results of the ISTD/VE process will be measured by collecting confirmation samples after the completion of the process. If PCB levels within the treated material are not found to be above 1 mg/kg, no further action will be necessary. However, if PCBs are present above the 1 mg/kg no further action level but below the SRE derived value of 10.7 mg/kg, institutional controls (environmental covenants and/or deed restrictions) shall be put in place to ensure protection of human health and the environment. If PCBs are present between 25 mg/kg and 100 mg/kg, a protective cover will be installed with long term monitoring (including groundwater monitoring) along with institutional controls in accordance with the PCB cleanup regulations at 40 CFR Part 761(a).

Specific Comments

Section 1.3.2-Site Investigations

EPA Response 3 (6/9/2010)

3. (New Comment): We believe it would be appropriate to include sample contaminant levels in the bullets and throughout this section of the Report where samples or contaminants are referenced. If more than one sample was taken, a range could be provided as in the fourth bullet which relates to MDNR's investigation.

MACTEC Draft Final EE/CA 8/9/2010)

Response: In order to provide a ready reference for the sample contaminant levels, MACTEC has inserted Tables 2.1 thru 2.6.

Section 2.0-Site Characterization

EPA Response 4 (6/9/2010)

4. (New Comment) Section 2.1.2, Groundwater Sampling, Last Paragraph: This paragraph indicates groundwater sample analysis was limited, based on the "known" contents of the USTs. In addition, Respondent's text seems to imply that all groundwater samples were analyzed for PCBs, yet the figures and tables in the cited UST report show that only one sample (collected from PZ-01) was analyzed for PCBs. PZ-01 appears to be located hydraulically up-gradient of the die cast areas, according to Respondent's estimate of the groundwater flow direction. Also, PCBs were detected in groundwater near the USTs which previously contained Pydraul® and waste oil as documented in the following report: "Preliminary Assessment/Site Inspection for the Carter Carburetor Site", Ecology and Environment, Inc., April 26, 1996.

Respondent has chosen a protective cover as the preferred alternative for the die cast area, primarily based on groundwater data showing that PCBs are not migrating from the die cast area. However, Respondent has not presented any actual data which adequately supports this claim. If respondent has collected down-gradient groundwater samples which were analyzed for PCBs, they should be specifically mentioned in this section of the report.

MACTEC Draft Final EE/CA 8/9/2010)

Response: Groundwater samples were collected from four piezometers installed by others with the analytical results documented in the "Limited Groundwater Investigation Report for the Former Carter Carburetor Site St. Louis, Missouri", October, 2005. The results of the analyses indicate that lateral migration of PCB-impacted groundwater has not occurred, if PCB-impacted groundwater is even present at the site. The impact noted within the groundwater samples collected during the 1996 Ecology and Environment may have been due to the inclusion of particulate matter within the water samples since the samples were collected from

temporary borings and not collected from wells which had been installed with well screen and filter pack within the annular space. Thus, these groundwater results for PCBs may be due to soil impacts within the groundwater sample.

Specific Comments

EPA Response 1 (8/24/2009)

1. *Section 2.3, Hydrogeology, Page 12, First Paragraph, First Full Sentence: The EE/CA claims that direct connection to deeper bedrock aquifers is not expected. However, Respondent has provided no factual data to EPA which completely supports this claim. To the best of EPA's knowledge, the deeper bedrock aquifers were not sampled. Respondent should further discuss this hypothesis by providing or referring to existing data which can better support this claim.*

MACTEC E&C Draft EE/CA (12/22/2009)

Response: The text has been revised to include relevant data from existing sources. The sources include the Miller and Vandike 1997 Publication, "*Groundwater Resources of Missouri*", Water Resources Report No. 46; the Miller et al. 1974 publication, "Water Resources: St. Louis Area, Missouri", Water Resources Report No. 30; and the Thomas Thompson 1995 revised publication, "The Stratigraphic Succession in Missouri", Missouri Department of Natural Resources (revised) Volume 40. Additional data was obtained from the Missouri Center for applied Research and Environmental Systems (CARES) Map Room.

The bedrock at the site consists of the Cherokee Group, which is primarily shale beds interlayered with minor carbonate and sandstone beds. The rock layers within the Cherokee Group are described as relatively impermeable with yields ranging from 0 – 10 gallon per minute. The impermeable/low yield nature of the Cherokee Group indicates that the unit acts as a confining layer, limiting or eliminating the vertical transport of groundwater. Underlying the Cherokee Group is the St. Louis Limestone, which is a finely crystalline limestone greater than 100 feet thick in the St. Louis region. Finely crystalline limestone is typically relatively impermeable and acts as an aquitard, further restricting the vertical and horizontal movement of groundwater.

EPA Response 1 (6/9/2010)

EPA Response: ***There still appears to be a lack of site-specific data to show connections or lack of connections to deeper aquifers. In addition, Respondent's assumptions about the local geology are not in agreement with current geological assessments of the State of Missouri. According to the Missouri Department of Natural Resources, Division***

of Geology and Land Survey (http://tin.er.usgs.gov/geology/state/state.php?state=MO), the bedrock at the site and east of the site is the St. Louis Limestone of the Meramecian Series and not the Cherokee Group of the Desmoinesian series. This was also confirmed using the Missouri Center for Applied Research and Environmental Systems (CARES) map room at (http://ims.missouri.edu/moims2008/). Also, Respondents well logs indicate that limestone is the bedrock and this is further stated in section 2.2.2 of the EE/CA. In addition, there is more than ample evidence to suggest that the limestone in this area has been subject to solution activity and can be best described as Karst Geology. For example, there are numerous known sinkholes in the area surrounding the site as shown on Respondent's figure 1-1 of the EE/CA and several more identified by the State of Missouri at this website: (http:/www.dnr.mo.gov/env/wrc/springsandcaves.htm). This evidence suggest that the limestone in this area has been subject to solution activity which would render the limestone formation highly permeable along solution channels or fractures, thus potentially providing a relatively high flow pathway for contaminant migration from the site.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. Respondent has changed the text to reflect the additional data provided by the EPA.

EPA Response 2 (8/24/2009)

6. (Specific Comment No. 2) Section 2.4.3, Groundwater, Pages 14 and 15: Please insert a sentence or phrase where appropriate in this section to clearly state that groundwater can present an exposure pathway through vapor intrusion.

MACTEC E&C Draft EE/CA (12/22/2009)

Response: The text in this section has been revised to state that groundwater can present an exposure pathway through vapor intrusion into the building.

EPA Response 2 (6/9/2010)

EPA Response*: Please delete the segment at the end of this sentence: "into the building." Respondent has not established the extent of vapor intrusion issues at the site.*

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted, the phrase "into the building" will be deleted.

EPA Response 7 (6/9/2010)

7. (New Comment) Section 2.4 – Nature and Extent of Contamination: For the sake of clarity, please provide analytical results or ranges of results where appropriate, to give a better understanding of the extent of contamination present in the areas described.

MACTEC Draft Final EE/CA 8/9/2010)

Response: In order to provide an easy reference for the analytical results or ranges of analytical results, summary tables have been added (Tables 2.1 thru 2.6).

EPA Response 8 (6/9/2010)

8. (New Comment) Section 2.4.3, Groundwater, Page 15: The City's ordinance would be one form of an acceptable institutional control (IC), but ordinances can change. A site specific IC in the form of an environmental covenant will be required to ensure ground water will not be used for any purpose. In several places throughout the report, reference is made to deed restrictions. Since property activity and use restrictions will more than likely be contained in an environmental covenant, we suggest each reference to site restrictions state, "...deed restriction and/or environmental covenant..."

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. The change(s) have been incorporated into the Report.

Section 4.0 – Identification and Screening of Response Technologies

EPA Response 9 (6/9/2010)

9. (New Comment) Section 4.2l, Institutional Controls, Various Sections: Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a response action. Typically, several ICs are used at a site (referred to as layering) to achieve response action objectives. For this site, the principal IC for the alternatives that leave hazardous substances in place will be in the form of an environmental covenant which will restrict site activities and uses necessary to minimize exposure and protect the response action. The EE/CA Report identifies fencing and other means of limiting access as ICs. Fencing, sealing off certain portions of the site, and other similar access restrictions are engineered controls and are not ICs. These paragraphs should be revised to correctly define ICs and identify the possible ICs and their accompanying restrictions for the various alternatives. On its web site, EPA has several guidances which define ICs and describe various ICs which can be considered for a site (for example, see Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P, dated September 2000). Sections 5.1.2, 5.1.3, and 5.1.4 do seem to provide some examples of appropriate ICs, but do not identify an environmental covenant. Please be sure the ICs in this Section and Section 5 of the Report are tailored for each alternative and are consistent with each other.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. The change(s) have been incorporated into the Report.

EPA Response 10 (6/9/2010)

10. (New Comment) Section 4.2.2.6, Partial Removal and Replacement of PCB-Impacted Building Materials: Respondent has stated that PCB levels are likely the result of tracking or dust in the Willco building, since no PCB operations were conducted in the Willco building by Carter Carburetor. Thus, removal of eighty percent of the first floor and twenty percent of the second floor could be unwarranted. The Respondent should describe in detail

either in this section or the extent of contamination section the basis for these removal amounts.

MACTEC Draft Final EE/CA 8/9/2010)

Response: The eighty percent and twenty percent estimates are based on models of extent of surface impacts on the first and second floors of the Willco building. Prior to the removal and replacement of the floors, the Willco building will be power washed and the floors will be resampled to verify the extent of contamination. The work plan will incorporate the actual methods to be used to remove or eliminate exposure to surface contamination, which may include any or all of the following in appropriate combinations: power washing; solvent cleaning, scabbling of the concrete surface to an appropriate depth; installation of a concrete overlay of the impacted areas; and/or removal and replacement of portions of the floor.

EPA Response 11 (8/24/2009)

11. (Specific Comment No. 8) Section 4.2.3.8, ISTD/VE Combined, Page 33: EPA has serious doubts about the ability of this technology to safely vaporize PCBs in-situ. EPA recommends this technology not be retained for further evaluation.

MACTEC E&C Draft EE/CA (12/22/2009)

ACF Response: After further review of relevant information, the EPA has reconsidered their initial position on the use of ISTD/VE for the destruction of PCBs in-situ. This technology is retained for further evaluation.

EPA Response 11 (6/9/2010)

EPA Response*: EPA apologizes for the misunderstanding. EPA scientists have reviewed this technology and agree that it is acceptable for further evaluation as an alternative.*

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted.

Section 5.0 – Evaluation and Cost Analysis of Individual Alternatives

EPA Response 12 (6/9/2010)

12. (New Comment) Each Cost Subsection in Section 5.0: For ease in reviewing each alternative evaluation, we believe the present worth cost of each alternative should be specifically identified in each respective 'cost' subsection.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted, the present worth cost of each alternative will be identified in each respective 'cost' subsection.

EPA Response 13 (6/9/2010)

13. (New Comment): Each Administrative Feasibility Subsection Discussing Permits: Section 121(e)(1) of CERCLA, 42 U.S.C. Section 9621(e)(1), state that, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite...". For alternatives in the Report that contain a demolition or construction component, usually in the administrative feasibility evaluation discussion, it is stated that those activities would require a permit (for example, see Section 5.1.6). That is not the case if the demolition or construction activity is conducted entirely onsite. Even though a specific permit is not required for onsite response actions, the substantive requirements of the laws, regulations or ordinances pertaining to the demolition or construction activities would have to be complied with.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. The text within the administrative feasibility discussions for the alternatives has been amended to include the notation that Federal, State, and Local permit requirements will be substantively adhered to, removing the statement that permits are required.

EPA Response 14 (6/9/2010)

14. (New Comment) Short Term Implementation Risks for CBI and Willco Building Alternatives: Based upon currently available technologies, implementation of the encapsulation alternative will eventually require the demolition of the CBI, and perhaps the Willco buildings, or the treatment of the

PCB-contaminated materials, at some point in the future. At that time, depending upon the make-up of the community over time, the short-term implementation risks will be the same as the current demolition alternative. EPA agrees that implementation of the interim encapsulation technology, when viewed by itself, has less of an impact on the community with regard to short-term implementation risks. However, the evaluation of the short-term implementation risks associated with the encapsulation technology must be revised to include recognition that the building(s) may eventually have to be demolished, or the PCBs contained therein treated, and thus there is little difference between the encapsulation and demolition alternatives with respect to short term implementation risks.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. The text which deals with the short-term implementation risks has been amended to include the EPAs interpretation of short term implementation risks.

EPA Response 15 (6/9/2010)

15. (New Comment) Section 5.2 Willco Plastics Building Removal Alternative Comparative Evaluation: *See comment 10.*

MACTEC Draft Final EE/CA 8/9/2010)

Response: See response to comment 10.

EPA Response 15 (6/9/2010)

16. (New Comment) Section 5.1 CBI Building: The present worth cost of Alternative 3 (Partial Removal and Replacement of Impacted Building Materials) is approximately $4.8 million more than Alternative 5 (Total Building Demolition). The difference appears to be related to a cover system, O&M Costs and slab disposal for Alternative 3. It may be appropriate to include a brief explanation of the difference in the narrative.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. The text in Section 5.1 has been revised to include a discussion of the higher estimated costs associated with the implementation of Alternative 3 (Partial Removal and Replacement of Impacted Building Materials)

compared with the estimated cost for Alternative 5 (Total Building Demolition).

Section 5.3 – Die Cast Area Soil Removal Alternative Comparative Evaluation

EPA Response 15 (6/9/2010)

17. (New Comment) Sections 5.3.2 Alternative 2 – Excavation and Off-Site Disposal Alternative and 5.3.4 Alternative 4 – ISTD/VE Alternative: Please identify the levels of PCBs that would remain following implementation of these alternatives. The excavation and treatment levels are relevant to the cost and length of time for implementation.

MACTEC Draft Final EE/CA 8/9/2010)

Response: The PCB levels which will remain following implementation of these alternatives have been included in the text of the appropriate sections. For a further discussion of the PCB levels which will remain following implementation, see response to General Comment 2. (New Comment).

EPA Response 1 (8/24/2009)

18. (Specific Comment No. 16) Section 5.3.5.1, Effectiveness, Page 57: Respondent has not adequately demonstrated the effectiveness of this alternative in meeting the objectives stated in the AOC. Respondent should provide data or refer to existing data to ensure the alternative will: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater".

MACTEC E&C Draft EE/CA (12/22/2009)

ACF Response: This section has been revised to include data and references to data contained in previous submittals which show that the contaminants of concern in this area have not and are not migrating into surrounding soils, air, surface waters, and groundwater.

EPA Response 2 (6/9/2010)

EPA Response: The fate and transport of the PCBs in the area of the site has not been adequately demonstrated. Based on the data collected by EPA and by Respondent; numerous references which describe the fate and transport of PCBs; and knowledge of the general geology, EPA contends PCBs have and are migrating vertically into the

groundwater and will continue to migrate from the site for many years, if not mitigated. Furthermore, there is a probability that PCBs have and are migrating to the Mississippi River either by groundwater infiltration into the combined sewer system or directly through the deeper bedrock aquifers. This assumption is based on several factors including information obtained from the following references:

"Preliminary Assessment/Site Inspection for the Carter Carburetor Site: Ecology and Environment, Inc., April 26, 1996.

This document reports on the results of a sampling investigation which shows PCBs were detected in subsurface soils, sewer line sediments, and groundwater. This document also provides a geologic cross section, which identifies the St. Louis Limestone as the underlying bedrock at the site.

"Final Environmental Field Investigation Report for Former Carter Carburetor Site St. Louis Missouri Facility", MACTEC Engineering and Consulting, Inc., August 2003.

This document describes in detail how gasoline, diesel fuel, chlorinated solvents, and other petroleum hydrocarbons are intermingled with the PCBs beneath the former die cast buildings. The well logs included with this report describe areas with liquid oil and strong oily and solvent odors. This data shows conclusively that PCBs have migrated "into surrounding soils" and it is likely that migration has continued into the bedrock aquifer.

"Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site", MACTEC Engineering and Consulting, Inc., October 2005:

This document shows high level PCB concentrations from below the die cast building floors all the way to bedrock at depths greater than Respondent's estimate of groundwater depth. It appears, based on this report that the PCBs are intermingled with solvents and are sitting in the groundwater.

"EPA's Clean-Up Information (Clu-In) Website": http://www.clu-in.org/contaminantfocus/default.focus/sec/Polychlorinated_Biphenyls_(PCBs)/cat/Chemistry_and_Behavior/

This website provides links to several reference documents concerning the available scientific knowledge of PCBs. A link from this website to a "table showing the various chemical and physical properties of Aroclors", shows that PCBs are somewhat soluble in water and "very soluble" when mixed with organic solvents.

"Environmental Transport and Transportation of Polychlorinated Biphenyls"; U.S. EPA, Office of Toxic Substances, EPA 560-5-83-025, 206 pp, 193, NTIS: PB84-142579

"An Illustrated Handbook of DNAPL Transport and Fate in the Subsurface", Environment Agency UK, June 2003

These references show that PCBs alone will form a Dense Non-Aqueous Phase Liquid (DNAPL) in the environment. However, the references also suggest that mixtures of PCBs with other materials will highly influence both the chemical and physical properties of the individual chemicals which could have a profound effect on the fate and transport of the mixture.

Respondent should also refer to a specific case study title: "Investigation of a Site with PCB DNAPL in Fractured Rock", available on EPA's web site at: http://www.epa.gov/tio/tsp/download/2003_meeting_fall/farrar.pdf

This reference describes a release of PCBs and TCE into the groundwater at a site in New York State. PCBs were detected at harmful concentrations in groundwater deep within the shale bedrock and within sediments in the nearby Hudson River. This case study calls into question Respondent's claim that PCB's are immobile, adhere to soil and that clay/shale layers act as barriers that prevent PCB migration.

In addition, PCB levels in soil and debris greater than 50 parts per million are required to be disposed of in a landfill specifically designed for PCB waste. Such landfills are required to have impermeable bottom liners, leachate collection systems, leak monitoring systems and an impermeable cap to ensure PCBs do not migrate into the environment.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted. Respondent agrees that if left unmitigated, the migration of PCBs is a possibility, although based on the non-detection of PCBs within PZ-02 and PZ-04 (documented in *Limited Groundwater Investigation Report for the Former Carter Carburetor Site St. Louis, Missouri", October, 2005.)* with solvents present within the sample and the non-detection of PCBs within PZ-03 (located downgradient of the impacted area), lateral movement of PCBs in groundwater has not apparently occurred to date.

Section 6.0 – Recommended Alternatives

EPA Response 19 (6/9/2010)

19. (New Comment) Section 6.1 – CBI Building Recommended Alternative: For the reasons discussed above, EPA cannot accept the epoxy encapsulation alternative as the preferred alternative and directs the Respondent to select or develop a different alternative as the preferred alternative.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted.

EPA Response 20 (6/9/2010)

20. (New Comment) Section 6.2 – Willco Plastics Building Recommended Alternative: For the reasons discussed above, EPA cannot accept the epoxy encapsulation alternative as the preferred alternative and directs the Respondent to select or develop a different alternative as the preferred alternative.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted.

EPA Response 21 (6/9/2010)

21. (New Comment) Section 6.3 – Die Cast Recommended Alternative: For the reasons discussed above, EPA cannot accept the impermeable cap alternative for the Die Cast area as the preferred alternative without significant reduction in the subsurface levels of PCBs. EPA directs the Respondent

to select or develop another alternative as the preferred alternative in accordance with this comment letter that will adequately address the mobility of wastes from the site by reducing the PCBs to levels that are protective of human health and to prevent further migration of PCBs into the environment.

MACTEC Draft Final EE/CA 8/9/2010)

Response: So noted.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Chris Tedder, P.G.
Principal Scientist

Eugene M. Watson
Senior Project Manager

Copies to: Mr. Richard Hyink, ACF Industries LLC
Mr. Greg Bach, MDNR Project Manager

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

June 9, 2010

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Rich Hyink
Director - Safety and Environment
ACF Industries, LLC
100 Clark Street
St. Charles, MO 63301-2088

Re: Carter Carburetor Superfund Site St. Louis, Missouri, Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. CERCLA-07-2005-0372.

Dear Mr. Hyink:

This letter is written in response to ACF Industry's (hereinafter "Respondent") re-submittal of the draft Engineering Evaluation/Cost Analysis (EE/CA) for the Carter Carburetor Site in St. Louis, Missouri. Where appropriate, EPA's comments to the revised EE/CA Report refer to EPA's original comment number, followed by Respondent's comment, followed by EPA's Response to Respondent's comment. New comments are designated as such.

One of the two remaining significant concerns is the EE/CA Report's preferred alternative of epoxy encapsulation in the CBI and Willco building areas. For a number of reasons, EPA has determined that it cannot accept the epoxy encapsulation as the preferred response action to be implemented at the site. Nevertheless, we have provided comments related to this alternative so that it can be considered during the public comment period. We have not been able to identify any superfund sites where this type of interim response action has been implemented. Because epoxy encapsulation is an interim response action, any agreement entered into by EPA for implementation of this alternative would require the establishment of a trust fund to cover the eventual disposal/treatment costs, either at the end of the useful life of the buildings or at a time when the buildings are no longer being used. Use of the epoxy encapsulation in the PCB-contamination context under 40 C.F.R. Section 761.30(p) seems to have been designed for and used in the electrical utility field where a continued use of the PCB-contaminated facility is apparent. The Region does not believe the epoxy encapsulation is an appropriate response action for this superfund site, especially in light of fact that future use of the facility is uncertain. In addition, the Agency is currently reconsidering the epoxy encapsulation authorization under the above-referenced PCB regulation based upon potential health risks (see advanced notice of proposed rulemaking, April 7, 2010 Federal Register, page 17657).

The other significant issue is the level of PCBs that can be allowed to remain in soils beneath the die cast buildings. EPA cannot accept Alternative 5 for the die cast area as the preferred alternative without a significant reduction in the subsurface levels of PCBs. As discussed in the comments below, after review of Respondent's sample data, the general geology of the area, and the science of environmental fate and transport of PCBs, EPA has concluded there is a potential for PCBs to migrate from the site via the groundwater pathway. Furthermore, based on the persistence of PCBs and their preponderance to bio-accumulate and bio-magnify in organisms, it is possible that the PCBs beneath the die cast area present an endangerment to the environment.

General Comments

1. (General Comment No. 1): Respondent's document was well organized and provided much of the information needed to assist EPA in the review. EPA appreciates Respondent's continued attention to this site and willingness to work with EPA on the best cleanup solution for this site.

After review of all the information concerning this site and keeping in mind the risks, EPA has arrived at a different conclusion than Respondent concerning what the preferred alternatives should be at two or three of the four areas at the site evaluated in the EE/CA. Due to a number of factors, EPA believes the cost estimates for the EE/CA recommended alternative of epoxy encapsulation at the CBI and Willco Plastics Buildings are considerably understated.

One such factor is the cost of maintaining and replacing the epoxy coatings in each building. Even though EPA's policies indicate costs should only be determined for 30 years into the future, it is highly likely that re-application of the epoxy will be required for decades. In any agreement with Respondent to perform the EPA selected response action, a provision will be required to ensure that funds would be available to perform maintenance and epoxy replacement as long as the PCBs remain a cause of concern. Such provision will take the form of a trust fund or similar financial mechanism. In fact, it is likely the financial mechanism will also include the funds necessary to ensure the disposal of contaminated wastes once either building reaches the end of its useful life.[1]

ACF Response: Respondent has revised the cost of epoxy application and has included the updated calculations in Attachment 2, Capital and Present Value Cost Estimates. Additionally, Respondent has changed the alternatives to incorporate EPA comments. Thus, we ask that EPA review the alternatives in light of the revisions. After EPA reviews the revised Draft Engineering Evaluation and Cost Analysis (EE/CA), should EPA determine that a trust fund or other financial mechanism is necessary, Respondent

---

[1] The additional maintenance/disposal costs comment also applies to any of the alternatives that leave hazardous substances in place and which must be monitored or maintained beyond 30 years.

will agree to some form of financial mechanism, the details of which to be determined during the consent decree negotiations.

EPA Response: EPA's original comment concerned the under valuation of the epoxy encapsulation alternatives because of the need to establish a financial mechanism to cover the costs of maintaining and replacing the epoxy coatings over a probable very long period of time (scores of years) and to provide funds necessary to ultimately demolish the buildings or treat the PCBs at the end of its useful life[2] or other point in time. In response to EPA's comment concerning the need for a financial mechanism, it appears Respondent developed in Attachment 2 a present worth cost number for both the CBI and Willco buildings to cover the ultimate demolition/disposal costs at the end of 60 years. However, it is the Region's position that a fully-funded financial instrument must be in place at the completion of the building response action or soon thereafter. The cost of this financial mechanism must be included in calculating the total cost of each epoxy encapsulation alternative.

2. (New General Comment): As stated above, EPA cannot accept as the preferred alternative the impermeable cap alternative proposed by Respondent for the die cast area with no reduction in contaminant levels. In selecting the preferred alternative for the die cast area, Respondent must develop an alternative which will reduce the contaminants in accordance with the following criteria:

From 0 to 10 feet below ground surface (bgs): PCB cleanup must meet either of the following criteria:

- The removal action goal shall be less than 1 milligram per kilogram (mg/kg) with no accompanying restrictions;

- The removal action goal shall be the calculated values in the streamlined risk evaluation portion of the EE/CA with accompanying institutional controls to assure future land use; or

- The removal action goal shall be between 25 and 100 mg/kg combined with a protective cover, long-term monitoring and institutional controls per the PCB cleanup regulations at 40 CFR Part 761 (a) {Self-implementing on-site cleanup and disposal of PCB remediation waste}.

From 10 feet bgs to bedrock: PCB cleanup must meet either of the following criteria:

- The removal action goal shall meet the soil to groundwater levels for PCBs published in EPA Region 3 Risk Based Concentration Tables (http://www.epa.gov/reg3hscd/risk/human/);

[2] The requirement for a financial mechanism applies to each EE/CA alternative that leaves significant levels of hazardous substances in place for a long period of time.

- The removal action goal shall be less than 1 milligrams per kilogram (mg/kg) with no accompanying restrictions;

- The removal action goal shall be between 25 and 100 mg/kg combined with a protective cover, long-term monitoring (including groundwater monitoring) and institutional controls per the PCB cleanup regulations at 40 CFR Part 761 (a) {Self-implementing on-site cleanup and disposal of PCB remediation waste}; or

- The removal action goal shall be calculated based on the following risk based scenario: Assume that PCBs are migrating directly to the Mississippi River at levels that exceed the national recommended water quality criteria for chronic protection of aquatic life (currently 0.014 micrograms per liter) via contamination infiltration into the nearest sewer line or via solution cavities in the Karst bedrock. Using conservative fate and transport parameters, calculate an on-site removal action goal that would lower the PCB concentration reaching the river to below the most current published national recommended water quality criteria at http://www.epa.gov/waterscience/criteria/wqctable/. This calculation and all specific references and assumptions must be submitted to EPA for review and approval.

Specific Comments

Section 1.3.2 – Site Investigations

3. (New Comment): We believe it would be appropriate to include sample contaminant levels in the bullets and throughout this section of the Report where samples or contaminants are referenced. If more than one sample was taken, a range could be provided as in the fourth bullet which relates to MDNR's investigation.

Section 2.0 – Site Characterization

4. (New Comment) Section 2.1.2, Groundwater Sampling, Last Paragraph: This paragraph indicates groundwater sample analysis was limited, based on the "known" contents of the USTs. In addition, Respondent's text seems to imply that all groundwater samples were analyzed for PCBs, yet the figures and tables in the cited UST report show that only one sample (collected from PZ-01) was analyzed for PCBs. PZ-01 appears to be located hydraulically up-gradient of the die cast areas, according to Respondent's estimate of the ground water flow direction. Also, PCBs were detected in groundwater near the USTs which previously contained Pydraul® and waste oil as documented in the following report: *"Preliminary Assessment/Site Inspection for the Carter Carburetor Site"*, Ecology and Environment, Inc., April 26, 1996.

Respondent has chosen a protective cover as the preferred alternative for the die cast area, primarily based on groundwater data showing that PCBs are not migrating from the die cast area. However, Respondent has not presented any actual data which adequately supports this claim. If Respondent has collected down-gradient groundwater samples which were analyzed for PCBs, they should be specifically mentioned in this section of the report.

5. (Specific Comment No. 1) Section 2.3, Hydrogeology, Page 12, First Paragraph, First Full Sentence: The EE/CA claims that direct connection to deeper bedrock aquifers is not expected. However, Respondent has provided no factual data to EPA that completely supports this claim. To the best of EPA's knowledge, the deeper bedrock aquifers were not sampled. Respondent should further discuss this hypothesis by providing or referring to existing data which can better support this claim.

ACF Response: The text has been revised to include relevant data from existing sources. The sources include the Miller and Vandike 1997 Publication, "Groundwater Resources of Missouri", Water Resources Report No. 46; the Miller et al. 1974 publication, "Water Resources: St. Louis Area, Missouri", Water Resources Report No. 30; and the Thomas Thompson 1995 revised publication, "The Stratigraphic Succession in Missouri", Missouri Department of Natural Resources (revised) Volume 40. Additional data was obtained from the Missouri Center for applied Research and Environmental Systems (CARES) Map Room.

The bedrock at the site consists of the Cherokee Group, which is primarily shale beds inter-layered with minor carbonate and sandstone beds. The rock layers within the Cherokee Group are described as relatively impermeable with yields ranging from 0 – 10 gallon per minute. The impermeable/low yield nature of the Cherokee Group indicates that the unit acts as a confining layer, limiting or eliminating the vertical transport of groundwater. Underlying the Cherokee Group is the St. Louis Limestone, which is a finely crystalline limestone greater than 100 feet thick in the St. Louis region. Finely crystalline limestone is typically relatively impermeable and acts as an aquitard, further restricting the vertical and horizontal movement of groundwater.

EPA Response: There still appears to be a lack of site-specific data to show connections or lack of connections to deeper aquifers. In addition, Respondent's assumptions about the local geology are not in agreement with current geological assessments of the State of Missouri. According to the Missouri Department of Natural Resources, Division of Geology and Land Survey (http://tin.er.usgs.gov/geology/state/state.php?state=MO), the bedrock at the site and east of the site is the St. Louis Limestone of the Meramecian Series and not the Cherokee Group of the Desmoinesian series. This was also confirmed using the Missouri Center for Applied Research and Environmental Systems (CARES) map room at (http://ims.missouri.edu/moims2008/). Also, Respondent's well logs indicate that limestone is the bedrock and this is further stated in section 2.2.2 of the EE/CA. In addition, there is more than ample evidence to suggest that the limestone in this area has been subject to solution activity and can be best described as Karst Geology. For example, there are numerous known sinkholes in the area surrounding the site as shown on Respondent's figure 1-1 of the EE/CA and several more identified by the State of Missouri at this website: (http://www.dnr.mo.gov/env/wrc/springsandcaves.htm). This evidence suggests that the limestone in this area has been subject to solution activity which would render the limestone formation highly permeable along solution channels or fractures, thus potentially providing a relatively high flow pathway for contaminant migration from the site.

6. (Specific Comment No. 2) Section 2.4.3, Groundwater, Pages 14 and 15: Please insert a sentence or phrase where appropriate in this section to clearly state that groundwater can present an exposure pathway through vapor intrusion.

ACF Response: The text in this section has been revised to state that groundwater can present an exposure pathway through vapor intrusion into the building.

EPA Response: Please delete the segment at the end of this sentence: "into the building." Respondent has not established the extent of vapor intrusion issues at the site.

7. (New Comment) Section 2.4 - Nature and Extent of Contamination: For the sake of clarity, please provide analytical results or ranges of results where appropriate, to give a better understanding of the extent of contamination present in the areas described.

8. (New Comment) Section 2.4.3, Groundwater, Page 15: The City's ordinance would be one form of an acceptable institutional control ("IC"), but ordinances can change. A site specific IC in the form of an environmental covenant will be required to ensure ground water will not be used for any purpose. In several places throughout the Report, reference is made to deed restrictions. Since property activity and use restrictions will more than likely be contained in an environmental covenant, we suggest each reference to site restrictions state, "... deed restriction and/or environmental covenant ...".

Section 4.0 – Identification and Screening of Response Technologies

9. (New Comment) Section 4.2., Institutional Controls, Various Sections: Institutional controls (ICs) are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a response action. Typically, several ICs are used at a site (referred to as layering) to achieve response action objectives. For this site, the principal IC for the alternatives that leave hazardous substances in place will be in the form of an environmental covenant which will restrict site activities and uses necessary to minimize exposure and protect the response action. The EE/CA Report identifies fencing and other means of limiting access as ICs. Fencing, sealing off certain portions of the site, and other similar access restrictions are engineered controls and are not ICs. These paragraphs should be revised to correctly define ICs and identify the possible ICs and their accompanying restrictions for the various alternatives. On its web site, EPA has several guidances which define ICs and describe various ICs which can be considered for a site (for example, see Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P, dated September 2000). Sections 5.1.2, 5.1.3, and 5.1.4 do seem to provide some examples of appropriate ICs, but do not identify an environmental covenant. Please be sure the ICs in this Section and

Section 5 of the Report are tailored for each alternative and are consistent with each other.

10. (New Comment) Section 4.2.2.6, Partial Removal and Replacement of PCB-Impacted Building Materials: Respondent has stated that PCB levels are likely the result of tracking or dust in the Willco building, since no PCB operations were conducted in the Willco building by Carter Carburetor. Thus, removal of eighty percent of the first floor and twenty percent of the second floor could be unwarranted. Respondent should describe in detail either in this section or the extent of contamination section the basis for these removal amounts.

11. (Specific Comment No. 8) Section 4.2.3.8, ISTD/VE Combined, Page 33: EPA has serious doubts about the ability of this technology to safely vaporize PCBs in-situ. EPA recommends this technology not be retained for further evaluation.

ACF Response: After further review of relevant information, the EPA has reconsidered their initial position on the use of ISTD/VE for the destruction of PCBs in-situ. This technology is retained for further evaluation.

EPA Response: EPA apologizes for the misunderstanding. EPA scientists have reviewed this technology and agree that it is acceptable for further evaluation as an alternative.

Section 5.0 – Evaluation and Cost Analysis of Individual Alternatives

12. (New Comment) Each Cost Subsection in Section 5.0: For ease in reviewing each alternative evaluation, we believe the present worth cost of each alternative should be specifically identified in each respective 'cost' subsection.

13. (New Comment) Each Administrative Feasibility Subsection Discussing Permits: Section 121(e)(1) of CERCLA, 42 U.S.C. Section 9621(e)(1), states that, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely onsite ...". For alternatives in the Report that contain a demolition or construction component, usually in the administrative feasibility evaluation discussion, it is stated that those activities would require a permit (for example, see Section 5.1.6). That is not the case if the demolition or construction activity is conducted entirely onsite. Even though a specific permit is not required for onsite response actions, the substantive requirements of the laws, regulations or ordinances pertaining to the demolition or construction activities would have to be complied with.

14. (New Comment) Short-term Implementation Risks for CBI and Willco Building Alternatives: Based upon currently available technologies, implementation of the encapsulation alternative will eventually require the demolition of the CBI, and perhaps the Willco buildings, or the treatment of the PCB-contaminated materials, at some point in the future. At that time, depending upon the make-up of the community over time, the short-term implementation risks will be the same as the current demolition alternative. EPA agrees that implementation of the interim encapsulation technology, when viewed by itself, has less of an impact on the community with regard to short- term implementation risks. However, the evaluation of the short-term implementation risks associated with the encapsulation technology must be revised to include recognition that the building(s) may eventually have to be demolished, or the PCBs contained therein treated, and thus there is little difference between the encapsulation and demolition alternatives with respect to short term implementation risks.

15. (New Comment) Section 5.2 Willco Plastics Building Removal Alternative Comparative Evaluation: See comment 10.

16. (New Comment) Section 5.1 CBI Building: The present worth cost of Alternative 3 (Partial Removal and Replacement of Impacted Building Materials) is approximately $4.8 million more than Alternative 5 (Total Building Demolition). The difference appears to be related to a cover system, O&M Costs and slab disposal for Alternative 3. It may be appropriate to include a brief explanation of the difference in the narrative.

Section 5.3 – Die Cast Area Soil Removal Alternative Comparative Evaluation

17. (New Comment) Sections 5.3.2 Alternative 2 – Excavation and Off-Site Disposal Alternative and 5.3.4 Alternative 4 – ISTD/VE Alternative: Please identify the levels of PCBs that would remain following implementation of these alternatives. The excavation and treatment levels are relevant to the cost and length of time for implementation.

18. (Specific Comment No. 16) Section 5.3.5.1, Effectiveness, Page 57: Respondent has not adequately demonstrated the effectiveness of this alternative in meeting the objectives stated in the AOC. Respondent should provide data or refer to existing data to ensure the alternative will: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater."

ACF Response: This section has been revised to include data and references to data contained in previous submittals which show that the contaminants of concern in this area have not and are not migrating into surrounding soils, air, surface waters, and groundwater.

EPA Response: The fate and transport of the PCBs in the area of the site has not been adequately demonstrated. Based on the data collected by EPA and by Respondent; numerous references which describe the fate and transport of PCBs; and knowledge of the general geology, EPA contends PCBs have and are migrating vertically into the groundwater and will continue to migrate from the site for many years, if not mitigated. Furthermore, there is a probability that PCBs have and are migrating to the Mississippi River either by groundwater infiltration into the combined sewer system or directly through the deeper bedrock aquifers. This assumption is based on several factors including information obtained from the following references:

"Preliminary Assessment/Site Inspection for the Carter Carburetor Site", Ecology and Environment, Inc., April 26, 1996.

This document reports on the results of a sampling investigation which shows PCBs were detected in subsurface soils, sewer line sediments, and groundwater. This document also provides a geologic cross section, which identifies the St. Louis Limestone as the underlying bedrock at the site.

"Final Environmental Field Investigation Report for Former Carter Carburetor Site St. Louis Missouri Facility", MACTEC Engineering and Consulting, Inc., August 2003:

This document describes in detail how gasoline, diesel fuel, chlorinated solvents, and other petroleum hydrocarbons are intermingled with the PCBs beneath the former die cast buildings. The well logs included with this report describe areas with liquid oil and strong oily and solvent odors. This data shows conclusively that PCBs have migrated "into surrounding soils" and it is likely that this migration has continued into the bedrock aquifer.

"Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site", MACTEC Engineering and Consulting, October 2005:

This document shows high level PCB concentrations from below the die cast building floors all the way to bedrock at depths greater than Respondent's estimate of groundwater depth. It appears, based on this report that the PCBs are intermingled with solvents and are sitting in the groundwater.

"EPA's Clean-Up Information (Clu-In) Website": http://www.clu-in.org/contaminantfocus/default.focus/sec/Polychlorinated_Biphenyls_(PCBs)/cat/Chemistry_and_Behavior/

This website provides links to several reference documents concerning the available scientific knowledge of PCBs. A link from this website to a "table showing the various chemical and physical properties of Aroclors", shows that PCBs are somewhat soluble in water and "very soluble" when mixed with organic solvents.

"Envrionmental Transport and Transportation of Polychlorinated Biphenyls"; U.S. EPA, Office of Toxic Substances, EPA 560-5-83-025, 206 pp, 1983, NTIS: PB84-142579

"*An Illustrated Handbook of DNAPL Transport and Fate in the Subsurface*", Environment Agency UK, June 2003

These references show that PCBs alone will form a Dense Non-Aqueous Phase Liquid (DNAPL) in the environment. However, the references also suggest that mixtures of PCBs with other materials will highly influence both the chemical and physical properties of the individual chemicals which could have a profound effect on the fate and transport of the mixture.

Respondent should also refer to a specific case study titled: *"Investigation of a Site with PCB DNAPL in Fractured Rock"*, available on EPA's web site at: http://www.epa.gov/tio/tsp/download/2003_meeting_fall/farrar.pdf

This reference describes a release of PCBs and TCE into the groundwater at a site in New York State. PCBs were detected at harmful concentrations in groundwater deep within the shale bedrock and within sediments in the nearby Hudson River. This case study calls into question Respondent's claim that PCB's are immobile, adhere to soil and that clay/shale layers act as barriers that prevent PCB migration.

In addition, PCB levels in soil and debris greater than 50 parts per million are required to be disposed of in a landfill specifically designed for PCB waste. Such landfills are required to have impermeable bottom liners, leachate collection systems, leak monitoring systems and an impermeable cap to ensure PCBs do not migrate into the environment.

Section 6.0 – Recommended Alternatives

19. (New Comment) Section 6.1 - CBI Building Recommended Alternative: For the reasons discussed above, EPA cannot accept the epoxy encapsulation alternative as the preferred alternative and directs the Respondent to select or develop a different alternative as the preferred alternative.

20. (New Comment) Section 6.2 – Willco Plastics Building Recommended Alternative: For the reasons discussed above, EPA cannot accept the epoxy encapsulation alternative as the preferred alternative and directs the Respondent to select or develop a different alternative as the preferred alternative.

21. (New Comment) Section 6.3 - Die Cast Recommended Alternative: For the reasons discussed above, EPA cannot accept the impermeable cap alternative for the Die Cast area as the preferred alternative without a significant reduction in the subsurface levels of PCBs. EPA directs the Respondent to select or develop another alternative as the preferred alternative in accordance with this comment letter that will adequately address the mobility of wastes from the site by reducing the PCBs to levels that are protective of human health and to prevent further migration of PCBs into the environment.

In accordance with the AOC, section VIII, paragraph 52 (A), Respondent is directed to please correct the deficiencies and resubmit the EE/CA within 30 days of receipt of this letter. Thank you for your timely submittal of documents and your continued cooperation in addressing the environmental issues at this site. Please call me at (636) 326-4720, with any questions or comments.

Sincerely:

Jeffrey G. Weatherford, P.E.
Superfund Division

cc: Dennis Hinkson, MDNR
Jonathan Garoutte, MDHSS
Scott Pemberton, CNSL

Weatherford.Jeffrey@epamail.epa.gov

December 22, 2009

Jeffrey Weatherford
U.S. Environmental Protection Agency
212 Little Bussen Drive
Fenton, Missouri 63026

RE: Carter Carburetor Superfund Site St. Louis, Missouri, Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. CERCLA-07-2005-0372.

Dear Mr. Weatherford:

As required under paragraph 49A of the Settlement Agreement, the following is the Respondent's response to comments contained within the "Notice of Disapproval of the Draft Engineering Evaluation/Cost Analysis" letter received by ACF Industries, LLC and dated August 21, 2009.

General Comment 1: Respondent's document was well organized and provided much of the information needed to assist EPA in the review. EPA appreciates Respondent's continued attention to this site and willingness to work with EPA on the best cleanup solution for this site.

After review of all the information concerning this site and keeping in mind the risks, EPA has arrived at a different conclusion than Respondent concerning what the preferred alternatives should be at two or three of the four areas at the site evaluated in the EE/CA. Due to a number of factors, EPA believes the cost estimates for the EE/CA recommended alternative of epoxy encapsulation at the CBI and Willco Plastics Buildings are considerably understated.

One such factor is the cost of maintaining and replacing the epoxy coatings in each building. Even though EPA's policies indicate costs should only be determined for 30 years into the future, it is highly likely that re-application of the epoxy will be required for decades. In any agreement with Respondent to perform the EPA selected response action, a provision will be required to ensure that funds would be available to perform maintenance and epoxy replacement as long as the PCBs remain a cause of concern. Such provision will take the form of a trust fund or similar financial mechanism. In fact, it is likely the financial mechanism will also include the funds necessary to ensure the disposal of contaminated wastes once either building reaches the end of its useful life[1]

Response: Respondent has revised the cost of epoxy application and has included the updated calculations in Attachment 2, Capital and Present Value Cost Estimates. Additionally, Respondent has changed the alternatives to incorporate EPA comments. Thus, we ask that EPA review the alternatives in light of the revisions. After EPA reviews the revised Draft Engineering Evaluation and Cost Analysis (EE/CA), should EPA determine that a trust fund or other financial mechanism is necessary, Respondent will agree to some form of financial mechanism, the details of which to be determined during the consent decree negotiations.

[1] The additional maintenance/disposal costs comment also applies to any of the alternatives that leave hazardous substances in place and which must be monitored or maintained beyond 30 years.

General Comment 2: Institutional controls (ICs) are mentioned with several of the alternative response actions at each of areas of the site addressed in the EE/CA. However, the specific types of ICs that would be necessary for a particular response alternative are not sufficiently identified. The specific institutional controls should be developed in the Draft EE/CA Report to the extent necessary to ensure human health and the environment are protected for the alternatives that will require ICs.

Response: Respondent has identified the ICs necessary to ensure human health and the environment and has included them within the text of the revised EE/CA. The alternative appropriate ICs have been added to the opening section of each alternative discussion (i.e., Section 5.1.2, 5.1.3, 5.1.4, etc.). The ICs include changing the zoning of the site to preclude use of the site as daycare/school for children or for use as residential property; filing of "deed restrictions"/activity and use limitations (AULs) with the City of St. Louis Recorder; and notification to the City of St. Louis Building Division of AULs and zoning changes at the site. The AULs are anticipated to include restrictions/prohibitions on excavations within the site boundaries; the necessity of preparing, updating, and following Operation and Management Plans for the Site; and frequency of inspections for the response alternative. T

General Comment 3: The estimated time frames for the implementation of the various alternatives that have been evaluated in the EE/CA seem to be missing. Please include time frames for each alternative response action.

Response: The estimated time frames for the implementation of the various alternatives evaluated have been included in the revised Draft EE/CA.

<u>**Specific Comments**</u>

1. **Section 2.3, Hydrogeology, Page 12, First Paragraph, First Full Sentence:** The EE/CA claims that direct connection to deeper bedrock aquifers is not expected. However, Respondent has provided no factual data to EPA which completely supports this claim. To the best of EPA's knowledge, the deeper bedrock aquifers were not sampled. Respondent should further discuss this hypothesis by providing or referring to existing data which can better support this claim.

Response: The text has been revised to include relevant data from existing sources. The sources include the Miller and Vandike 1997 Publication, "*Groundwater Resources of Missouri*", Water Resources Report No. 46; the Miller et al. 1974 publication, "Water Resources: St. Louis Area, Missouri", Water Resources Report No. 30; and the Thomas Thompson 1995 revised publication, "The Stratigraphic Succession in Missouri", Missouri Department of Natural Resources (revised) Volume 40. Additional data was obtained from the Missouri Center for applied Research and Environmental Systems (CARES) Map Room.

The bedrock at the site consists of the Cherokee Group, which is primarily shale beds interlayered with minor carbonate and sandstone beds. The rock layers within the Cherokee Group are described as relatively impermeable with yields ranging from 0 – 10 gallon per minute. The impermeable/low yield nature of the Cherokee Group indicates that the unit acts as a confining layer, limiting or eliminating the vertical transport of groundwater. Underlying the Cherokee Group is the St. Louis Limestone, which is a finely crystalline limestone greater than 100 feet thick in the St. Louis region. Finely crystalline limestone is typically relatively impermeable and acts as an aquitard, further restricting the vertical and horizontal movement of groundwater.

2. Section 2.4.3, Groundwater, Pages 14 and 15: Please insert a sentence or phrase where appropriate in this section to clearly state that groundwater can present an exposure pathway through vapor intrusion.

Response: The text in this section has been revised to state that groundwater can present an exposure pathway through vapor intrusion into the building.

3. Section 2.5.1, Structural Evaluation Procedure, Page 18, Last Paragraph: This paragraph indicates Respondent has doubts about the structural integrity of the buildings. However, Respondent's chosen alternative for the CBI building does not mention any restrictions on the use of the building nor needed repairs to the building to make sure it is structurally sound for future use. Any reuse scenario for these buildings must be supported with data indicating they are structurally sound for reuse. The cost of repairs needed to make the building(s) usable should then be considered in alternative where the building(s) will remain.

Response: Respondent wishes to clarify the statements within Section 2.5.1concerning the structural integrity of the building. Respondent has not identified "doubts" with the structural integrity of the building. Given that the appearance of the CBI and Willco Plastics buildings show evidence of a lack of maintenance, MACTEC felt it prudent to conduct an investigation by a qualified individual to certify that the buildings were safe for the planned activities. The investigation did not identify any structural impediments to the planned investigation activities or with the subsequent use of the building for pre-existing uses.

4. **Section 2.5.2, Current and Future Building Use, Page 18:** The second sentence in the first paragraph once again indicates Respondent has doubts about the structural integrity of the building. However, in the next paragraph the EE/CA does not list "structural repair" in the list of needed items for the future use of the CBI building.

The EPA shares Respondent's concern regarding the integrity of the CBI building, and further states that the building should not be reused for any purpose and should be demolished. The costs of structural repair should be taken into account for this alternative.

Respondent should also mention in this section that a reasonably anticipated future land use of this property is athletic fields for the Herbert Hoover Boys and Girls Club. The Boys and Girls Club has stated repeatedly that they wish to use this property to expand their activities.

Response: As discussed above, there were no structural issues identified within the buildings which will prevent the implementation of the remedial alternatives and subsequent use of the buildings in a manner consistent with prior use of the building.

The text has been revised to include the interest of the Herbert Hoover Boys and Girls Club in acquiring the Site and utilizing it as athletic fields.

5. Section 3.1.3, Summary of Numerical Removal Action Goals, page 21: A paragraph should be inserted to describe the Removal Action Goals for "porous" interior building surfaces for alternatives involving decontamination of the concrete and brick interior surfaces.

Response: The text has been revised to include Removal Action Goals for "porous" interior building surfaces. The Removal Action Goals are consistent with TSCA.

6. **Section 3.2.1, Objectives, Page 21:** Please replace the words "PCB" and "PCBs" with the words 'contaminant' and 'contaminants' respectively to reflect that there are multiple contaminants present at the site, not just PCBs. Also, please insert the following objective: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater." This objective was agreed to in the subject AOC.

Response: The text has been revised as suggested.

7. **Section 4.2, Technology Selection, First Sentence and Title of Section 4.2.1, Page 23:** Please change 'remedial' to 'removal' or 'response' to more clearly distinguish this action as a non-time critical removal.

Response: The text has been revised as suggested.

8. **Section 4.2.3.8, ISTD/VE Combined, Page 33:** EPA has serious doubts about the ability of this technology to safely vaporize PCBs in-situ. EPA recommends this technology not be retained for further evaluation.

Response: After further review of relevant information, the EPA has reconsidered their initial position on the use of ISTD/VE for the destruction of PCBs in-situ. This technology is retained for further evaluation.

9. **Section 4.2.3.9, Selected Die Cast Area Soil Remedial Action Alternatives, Page 34:** See previous comment.

Response: See response to comment 8.

10. **Section 5.1.4.1, Effectiveness, Page 43:** This alternative does not address vapor intrusion issues, TCE contaminated soil issues, or TCE contaminated groundwater issues under the CBI building. In addition, epoxy coatings would not be effective should the CBI building catch fire or somehow collapse. Respondent is keenly aware that unauthorized persons are consistently entering the building. It has been reported by a local television station that these persons are building fires in the building. Respondent's cost of maintenance may significantly increase should a fire occur at this location. In addition, sampling would be required for dibenzo-dioxin and dibenzo-furans which could be formed from the incomplete combustion of PCBs. The presence of dioxins and furans at the site would increase the toxicity of the contaminants, thus the threats posed by the site.

Response: The alternative has been revised to address vapor intrusion issues. The institutional controls proposed for this alternative include a prohibition on excavation at the Site and, coupled with the City of St. Louis prohibition on extraction of groundwater, no exposures to impacted groundwater are expected to occur. The TCE impacted soils under the building, with the exception of one soil sample (SS-MW-FF4-1, 55.7 mg/kg TCE), were below the Remedial Action Goal for Soil at the Site of 52.9 mg/kg. Since the soil is below the slab, no exposure will occur.
With regard to issues related to unauthorized persons entering the building, it is our understanding that the building has been secured in such a manner that this potential has been greatly reduced, if not completely eliminated. Further, fires which may have occurred in the past were not known to have occurred in areas of the building where PCBs were present.

11. Section 5.1.4.2, Implementability, Page 43: This technology has the following implementability issues which Respondent should discuss in this section and then address in the cost section:

- The building must meet local building code requirements prior to reuse;
  Response: Prior to reuse, it will be the owner's responsibility to coordinate with the appropriate agencies to ensure that the building meets code requirements.

- Epoxy coatings on floors cannot be slippery and must be made safe for walking and equipment use;
  Response: On top of the epoxy coating on the existing floor of the first floor of the building, the first floor slab will be covered with an additional four-inch concrete overlay (minimum). The epoxy coatings on the floor surfaces of the upper three floors will include a non-slip additive.

- Replacement of epoxy coatings is highly dependent on use and may require more frequent re-applications in high traffic areas;
  Response: The cost estimates have been revised to include a reapplication of the epoxy in the high traffic areas (estimated at 25% of the floor surface) at a rate of twice every seven years on the upper three floors. The first floor slab will not require re-application of the epoxy as it will be protected by the four-inch concrete overlay.

- The initial rehabilitation of the building should take into account the structural integrity of the building for moderate to heavy equipment use;
  Response: The rehabilitation of the building will take into account the structural integrity and prior uses of the building. The owner is responsible for determining the suitability of the building for the planned use of the building, if the planned use involves expanding the use of the building to include moderate to heavy equipment. Further, it is unclear whether the building has been utilized for moderate to heavy equipment and existing documents do not show any moderate to heavy equipment usage on the upper floors of the building.

- Epoxy coating will more quickly deteriorate when subject to natural elements, thus the continued maintenance and structural repair of the CBI building is necessary;
  Response: This concern has been minimized due to the revised alternative with 4" of concrete on the first floor. Upon completion of the rehabilitation of the building, ACF is willing to conduct periodic inspections of the CBI building and notify the building owner of deficiencies for the owner to correct.

- This alternative does not address vapor intrusion issues, TCE contaminated soil issues, or TCE contaminated groundwater issues under the CBI building;
  Response: The alternative has been revised to address vapor intrusion issues. The institutional controls proposed for this alternative include a prohibition on excavation at the Site and, coupled with the City of St. Louis prohibition on extraction of groundwater, no exposures to impacted groundwater are expected to occur. The TCE impacted soils under the building, with the exception of one soil sample (SS-MW-FF4-1, 55.7 mg/kg TCE), were below the Remedial Action Goal for Soil at the Site of 52.9 mg/kg. Since the soil is below the slab, no exposure will occur.

- Continuous government oversight will be required to assure that these long-term maintenance requirements are being met; and
  Response: Several models exist for the implementation of long-term oversight by either state or federal regulators. ACF will negotiate a financial instrument with either the Missouri Department of Natural Resources (MDNR) or the USEPA to ensure this occurs.

- Eventually, assuming it has not already occurred, the CBI building will reach the end of its useful life and will require demolition and proper disposal of hazardous substances.
  Response: This extremely well-built building has not approached its useful life. Given the construction of the building, if rehabbed and maintained, it has a virtually unlimited useful life. For purposes of the EE/CA we have used a very conservative estimate of 60 years. The estimated cost of demolition and proper disposal of the building as contained in the EE/CA have been added to the Capital and Present Value cost estimate for this alternative.

12. Section 5.1.4.3, Cost, Page 43: This alternative appears to EPA to be grossly undervalued considering all of the implementability issues described above. Respondent must address costs for each implementability issue described in the previous comment. Respondent should include the cost of future cleanup (i.e. partial demolition or demolition) as a present worth capital cost for this alternative.

Response: The costs associated with this alternative have been adjusted as described in the response to Comment 11. The adjusted costs are included in Attachment 2 of the Revised Draft EE/CA.

13. Section 5.2.3.1, Effectiveness, Page 48: Epoxy coatings would not be effective should the Willco building catch fire or somehow collapse. Respondents are keenly aware that unauthorized persons are consistently entering the CBI building, which could lead to access to the Willco building. It has been reported by a local television station that these persons are building fires in the building. Respondent's cost of maintenance may significantly increase should a fire occur at this location. In addition, sampling would be required for dibenzo-dioxin and dibenzo-furans which could be formed from the incomplete combustion on of PCBs. The presence of dioxins and furans at the site would increase the toxicity of the contaminants, thus the threats posed by the site.

Response: With regard to issues related to unauthorized persons entering the building, it is our understanding that the building has been secured in such a manner that this potential has been greatly reduced, if not completely eliminated. Further, fires which may have occurred in the past were not known to have occurred in areas of the building where PCBs were present.

14. Section 5.2.3.2, Implementability, Page 48: This technology has the following implementability issues which Respondent should discuss in this section:

- The building must meet local building code requirements prior to reuse;
  Response: Prior to reuse, it will be the owner's responsibility to coordinate with the appropriate agencies to ensure that the building meets code requirements.

- Epoxy coatings on floors cannot be slippery and must be made safe for walking and equipment use;
  Response: This issue has been partially addressed by the use of 4" of concrete on the first floor. The epoxy coatings on the floor surfaces will include a non-slip additive.

- Replacement of epoxy coatings is highly dependent on use and may require more frequent re-applications in high traffic areas;
  Response: The cost estimates have been revised to include a reapplication of the epoxy in the high traffic areas (estimated at 25% of the floor surface) at a rate of twice every seven years. ADD OTHER LANG FROM EARLIER

- The initial rehabilitation of the building should take into account the structural integrity of the building for moderate to heavy equipment use;
  Response: The rehabilitation of the building will take into account the structural integrity and prior uses of the building. The owner is responsible for determining the suitability of the building for the planned use of the building, if the planned use involves expanding the use of the building to include moderate to heavy equipment. Further, it is unclear whether the building has been utilized for moderate to heavy equipment and existing documents do not show any moderate to heavy equipment usage.

- Epoxy coating will more quickly deteriorate when subject to natural elements, thus the continued maintenance and structural repair of the Willco building is necessary;
  Response: Upon completion of the rehabilitation of the building, ACF is willing to conduct periodic inspections of the CBI building and notify the building owner of deficiencies for the owner to correct.

- Continuous government oversight will be required to assure that these long-term maintenance requirements are being met; and
  Response: Several models exist for the implementation of long-term oversight by either state or federal regulators. ACF will negotiate a financial instrument with either the Missouri Department of Natural Resources (MDNR) or the USEPA to ensure this occurs.

- Eventually, assuming it has not already occurred, the CBI building will reach the end of its useful life and will require demolition and proper disposal of hazardous substances.
  Response: As discussed above, the building has a virtually unlimited useful life, but using a very conservative **estimate** of 60 years, the estimated cost of demolition and proper disposal of the building as contained in the EE/CA, the demolition and disposal costs have been added to the Capital and Present Value cost estimate for this alternative

15. Section 5.2.3.3, Cost, Page 48: This alternative appears to EPA to be grossly undervalued considering all of the implementability issues described above. Respondent must address costs for each implementability issue described in the previous comment. Respondent should include the cost of future cleanup (i.e. partial demolition or demolition) as a present worth capital cost for this alternative.

Response: The costs associated with this alternative have been adjusted as described in the response to Comment 14. The adjusted costs are included in Attachment 2 of the Revised Draft EE/CA.

16. Section 5.3.5.1, Effectiveness, Page 57: Respondent has not adequately demonstrated the effectiveness of this alternative in meeting the objectives stated in the AOC. Respondent should provide data or refer to existing data to ensure the alternative will: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater."

Response: This section has been revised to include data and references to data contained in previous submittals which show that the contaminants of concern in this area have not and are not migrating into surrounding soils, air, surface waters, and groundwater.

17. Section 5.3.5.2, Implementability, Page 57, last Sentence: Respondent must further explain how the addition of a cap over this area "will not significantly hinder the possible future use of the site as either athletic fields or as auxiliary parking areas." It appears that raising this area in elevation will significantly affect these future uses which generally require flat expansive surfaces.

Response: This section has been revised to further explain how the addition of a cap over this area will not significantly hinder the possible future use of the site as either athletic fields or auxiliary parking.

18. Tables 5-2 through 5-5: Please eliminate these tables as the assignment of weighting factors appears subjective and lacks adequate basis.

Response: These tables have been eliminated.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Chris Tedder, P.G.
Principal Scientist

Eugene M. Watson
Senior Project Manager

Copies to:
Mr. Richard Hyink, ACF Industries LLC
Mr. Greg Bach, MDNR Project Manager

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

August 21, 2009

VIA CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Rich Hyink
Director- Safety and Environment
ACF Industries, LLC
100 Clark Street
St. Charles, MO 63301-2088

Re: Carter Carburetor Site Administrative Settlement Agreement and Order on Consent (AOC)
Docket Number CERCLA-07-2005-0372
Notice of Disapproval of the Draft Engineering Evaluation/Cost Analysis

Dear Mr. Hyink:

The U.S. Environmental Protection Agency (EPA) has received and reviewed the May 15, 2009 "**Engineering Evaluation/Cost Analysis (EE/CA)**" submitted by ACF Industries, LLC (Respondent) for the Carter Carburetor Site. Pursuant to the AOC, Section VIII, paragraph 50 (C), EPA disapproves the EE/CA and asks Respondent to revise the EE/CA in accordance with the following comments by EPA. In addition, Respondent shall respond to applicable comments by the Missouri Department of Health and Senior Services (MDHSS), enclosed.

General Comment 1: Respondent's document was well organized and provided much of the information needed to assist EPA in the review. EPA appreciates Respondent's continued attention to this site and willingness to work with EPA on the best cleanup solution for this site.

After review of all the information concerning this site and keeping in mind the risks, EPA has arrived at a different conclusion than Respondent concerning what the preferred alternatives should be at two or three of the four areas at the site evaluated in the EE/CA. Due to a number of factors, EPA believes the cost estimates for the EE/CA recommended alternative of epoxy encapsulation at the CBI and Willco Plastics Buildings are considerably understated.

One such factor is the cost of maintaining and replacing the epoxy coatings in each building. Even though EPA's policies indicate costs should only be determined for 30 years into the future, it is highly likely that re-application of the epoxy will be required for decades. In any agreement with Respondent to perform the EPA selected response action, a provision will be required to ensure that funds would be available to perform maintenance and epoxy replacement as long as the PCBs remain a cause of concern. Such provision will take the form of a trust fund or similar financial mechanism. If fact, it is likely the financial mechanism will also include the funds necessary to ensure the disposal of contaminated wastes once either building reaches the end of its useful life.[1]

After reviewing these comments, it is hopeful Respondent and EPA can meet and discuss the issues and reach agreement on the best alternative response actions for this site that will meet all of the removal action goals described in the AOC.

General Comment 2: Institutional controls (ICs) are mentioned with several of the alternative response actions at each of areas of the site addressed in the EE/CA. However the specific types of ICs that would be necessary for a particular response alternative are not sufficiently identified. The specific institutional controls should be developed in the EE/CA Report to the extent necessary to ensure human health and the environment are protected for the alternatives that will require ICs.

General Comment 3: The estimated time frames for the implementation of the various alternatives that have been evaluated in the EE/CA seem to be missing. Please include time frames for each alternative response action.

Specific Comments

1. Section 2.3, Hydrogeology, Page 12, First Paragraph, First Full Sentence: The EE/CA claims that direct connection to deeper bedrock aquifers is not expected. However, Respondent has provided no factual data to EPA which completely supports this claim. To the best of EPA's knowledge, the deeper bedrock aquifers were not sampled. Respondent should further discuss this hypothesis by providing or referring to existing data which can better support this claim.

2. Section 2.4.3, Groundwater, Pages 14 and 15: Please insert a sentence or phrase where appropriate in this section to clearly state that groundwater can present an exposure pathway through vapor intrusion.

3. Section 2.5.1, Structural Evaluation Procedure, Page 18, Last Paragraph: This paragraph indicates Respondent has doubts about the structural integrity of the buildings. However, Respondent's chosen alternative for the CBI building does not mention any restrictions on the use of the building nor needed repairs to the building to make sure it is structurally sound for future use. Any reuse scenario for these buildings must be supported with data indicating they are structurally sound for reuse. The cost of repairs needed to make the building(s) usable should then be considered in alternatives where the building(s) will remain.

---

[1] The additional maintenance/disposal costs comment also applies to any of the alternatives that leave hazardous substances in place and which must be monitored or maintained beyond 30 years.

4. Section 2.5.2, Current and Future Building Use, Page 18: The second sentence in the first paragraph once again indicates Respondent has doubts about the structural integrity of the building. However, in the next paragraph the EE/CA does not list "structural repair" in the list of needed items for the future use of the CBI building.

The EPA shares Respondent's concern regarding the integrity of the CBI building, and further states that the building should not be reused for any purpose and should be demolished. The costs of structural repair should be taken into account for this alternative.

Respondent should also mention in this section that a reasonably anticipated future land use of this property is athletic fields for the Herbert Hoover Boys and Girls Club. The Boys and Girls Club has stated repeatedly that they wish to use this property to expand their activities.

5. Section 3.1.3, Summary of Numerical Removal Action Goals, Page 21: A paragraph should be inserted to describe the Removal Action Goal for "porous" interior building surfaces for alternatives involving decontamination of the concrete and brick interior surfaces.

6. Section 3.2.1, Objectives, Page 21: Please replace the words "PCB" and "PCBs" with the words 'contaminant' and 'contaminants' respectively to reflect that there are multiple contaminants present at the site, not just PCBs. Also, please insert the following objective: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater". This objective was agreed to in the subject AOC.

7. Section 4.2, Technology Selection, First Sentence and Title of Section 4.2.1, Page 23: Please change 'remedial' to 'removal' or 'response' to more clearly distinguish this action as a non-time critical removal.

8. Section 4.2.3.8, ISTD/VE Combined, Page 33: EPA has serious doubts about the ability of this technology to safely vaporize PCBs in-situ. EPA recommends this technology not be retained for further evaluation.

9. Section 4.2.3.9, Selected Die Cast Area Soil Remedial Action Alternatives, Page 34: See previous comment.

10. Section 5.1.4.1, Effectiveness, Page 43: This alternative does not address vapor intrusion issues, TCE contaminated soil issues, or TCE contaminated groundwater issues under the CBI building. In addition, epoxy coatings would not be effective should the CBI building catch fire or somehow collapse. Respondent is keenly aware that unauthorized persons are consistently entering the building. It has been reported by a local television station that these persons are building fires in the building. Respondent's cost of maintenance may significantly increase should a fire occur at this location. In addition, sampling would be required for dibenzo-dioxin and dibenzo-furans which could be formed from the incomplete combustion of PCBs. The presence of dioxins and furans at the site would increase the toxicity of the contaminants, thus the threats posed by the site.

11. Section 5.1.4.2, Implementability, Page 43: This technology has the following implementability issues which Respondent should discuss in this section and then address in the cost section:

- The building must meet local building code requirements prior to reuse;
- Epoxy coatings on floors cannot be slippery and must be made safe for walking and equipment use;
- Replacement of epoxy coatings is highly dependent on use and may require more frequent re-applications in high traffic areas;
- The initial rehabilitation of the building should take into account the structural integrity of the building for moderate to heavy equipment use;
- Epoxy coating will more quickly deteriorate when subject to natural elements, thus the continued maintenance and structural repair of the CBI building is necessary;
- This alternative does not address vapor intrusion issues, TCE contaminated soil issues, or TCE contaminated groundwater issues under the CBI building;
- Continuous government oversight will be required to assure that these long-term maintenance requirements are being met; and
- Eventually, assuming it has not already occurred, the CBI building will reach the end of its useful life and will require demolition and proper disposal of hazardous substances.

12. Section 5.1.4.3, Cost, Page 43: This alternative appears to EPA to be grossly undervalued considering all of the implementability issues described above. Respondent must address costs for each implementability issue described in the previous comment. Respondent should include the cost of future cleanup (i.e. partial demolition or demolition) as a present worth capital cost for this alternative.

13. Section 5.2.3.1, Effectiveness, Page 48: Epoxy coatings would not be effective should the Willco building catch fire or somehow collapse. Respondents are keenly aware that unauthorized persons are consistently entering the CBI building, which could lead to access to the Willco building. It has been reported by a local television station that these persons are building fires in the building. Respondent's cost of maintenance may significantly increase should a fire occur at this location. In addition, sampling would be required for dibenzo-dioxin and dibenzo-furans which could be formed from the incomplete combustion of PCBs. The presence of dioxins and furans at the site would increase the toxicity of the contaminants, thus the threats posed by the site.

14. Section 5.2.3.2, Implementability, Page 48: This technology has the following implementability issues which Respondent should discuss in this section:

- The building must meet local building code requirements prior to reuse;
- Epoxy coatings on floors cannot be slippery and must be made safe for walking and equipment use;
- Replacement of epoxy coatings is highly dependent on use and may require more frequent re-applications in high traffic areas;
- The initial rehabilitation of the building should take into account the structural integrity of the building for moderate to heavy equipment use;
- Epoxy coating will more quickly deteriorate when subject to natural elements, thus the continued maintenance and structural repair of the Willco building is necessary;
- Continuous government oversight will be required to assure that these long-term maintenance requirements are being met; and
- Eventually, assuming it has not already occurred, the Willco building will reach the end of its useful life and will require demolition and proper disposal of hazardous substances.

15. Section 5.2.3.3, Cost, Page 48: This alternative appears to EPA to be grossly undervalued considering all of the implementability issues described above. Respondent must address costs for each implementability issue described in the previous comment. Respondent should include the cost of future cleanup (i.e. partial demolition or demolition) as a present worth capital cost for this alternative.

16. Section 5.3.5.1, Effectiveness, Page 57: Respondent has not adequately demonstrated the effectiveness of this alternative in meeting the objectives stated in the AOC. Respondent should provide data or refer to existing data to ensure the alternative will: "Halt the further migration of contaminants into surrounding soils, air, surface waters and groundwater".

17. Section 5.3.5.2, Implementability, Page 57, Last Sentence: Respondent must further explain how the addition of a cap over this area "will not significantly hinder the possible future use of the site as either athletic fields or as auxiliary parking areas". It appears that raising this area in elevation will significantly affect these future uses which generally require flat expansive surfaces.

18. Tables 5-2 through tables 5-5: Please eliminate these tables as the assignment of weighting factors appears subjective and lacks adequate basis.

In accordance with the AOC, section VIII, paragraph 52 (A), Respondent is directed to please correct the deficiencies and resubmit the EE/CA within 30 days of receipt of this letter. Thank you for your timely submittal of documents and your continued cooperation in addressing the environmental issues at this site. Please call me at (636) 326-4720, with any questions or comments.

Sincerely:

Jeffrey G. Weatherford, P.E.
Superfund Division

Enclosure: Comments from the Missouri Department of Health and Senior Services

Attachment 2

Capital and Present Value Cost Estimates

CBI Building Alternative 2 - Partial Removal and Replacement Alternative
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, remove and replace PCB impacted building materials, and rehabilitate building so that it can be returned to productive use.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Power Wash Walls/floors, treat water	LS	$810,549	1	$810,549
Debris Removal and Disposal	LS	$176,325	1	$176,325
Building Rehabilitation				
Repair Roof	LS	$811,008	1	$811,008
Repair/Replace Windows/Doors	LS	$836,655	1	$836,655
Rehab Interior Walls/Columns	LS	$785,000	1	$785,000
Rehab Exterior Walls	LS	$426,753	1	$426,753
Remove and Replace Floor Slabs				
First Floor (80%)	sf	$30	112,134	$3,381,961
2nd (1%), 3rd (50%), 4th (10%) Floors	sf	$38	67,475	$2,535,036
Transportation and Disposal				
TSCA Waste	ton	$209	1021	$213,389
Confirmation Sampling				
Confirmation Sampling	ea	$75	555	$41,625
Permitting and Reporting				
Permitting and Reporting	LS	$121,183	1	$121,183
Total Value of Capital Costs				$12,239,484

Notes:

TSCA - Toxic Substance Control Act
PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

CBI Building Alternative 3 - Partial Demolition and Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish CBI structure, leave floor slab in place, install and maintain impermeable cap in compliance with TSCA.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Secure Property	lf	$14.18	2001	$28,368
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$176,325.00	1	$176,325
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
Building Demolition w/o First Floor Slab	ton	$48.00	35,250	$1,692,000
On-site Resize of Material	ton	$9.83	35,250	$346,331
Transport and Dispose - TSCA	ton	$209.00	0	$0
Transport and Dispose - Non-hazardous	ton	$42.01	35,250	$1,480,853
Rehabilitate Willco Plastics Building Common Wall	LS	$220,000.00	1	$220,000
Cover System (Soil Cap)				
Site Preparation	LS	$518,000	1	$518,000
Cover System (Soil Cap)	LS	$1,696,000	1	$1,696,000
Stormwater Controls	LS	$64,000	1	$64,000
Engineering and Design	%	$2,278,000	12%	$273,360
Permitting	%	$2,551,360	5%	$127,568
Confirmation Sampling				
Confirmation Sampling	ea	75	4230	$317,250
Permitting and Reporting				
Permitting and Reporting	LS	$9,354,737	1%	$93,547
Subtotal				$9,448,284
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$32,021	5	$160,105
Cover System - Annual Cost, years 6-30	LS/yr	$13,277	25	$331,925
Cover System - Periodic Costs, once /15 years	LS/event	$63,261	2	$126,522
Stormwater Controls - Annual Costs	LS/yr	$2,343	30	$70,290
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$46,079	2	$92,158
Permitting and Reporting- Annual Cap Costs	LS	$5,000	29	$145,000
Regulatory Oversight	LS/yr	$2,000	29	$58,000
Subtotal				$984,000
Slab Disposal Cost (if required, not included in Total Costs)				
Mob/Demob	LS	$49,682.00	1	$49,682
Site Preparation	LS	$518,000	1	$518,000
Transport and Dispose - TSCA	ton	$209.00	3,680	$769,120
Transport and Dispose - Non-hazardous	ton	$42.01	1,578	$66,292
Subtotal				$2,831,822,694
Total Value of Capital and O&M Costs, Non-Discounted				$10,432,284

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet
% - percent

O&M - operation and maintenance
gal - gallon
cf - cubic feet
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -CBI Building Alternative 3 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 6	Project Mgmt at	Technical Support at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Oversight (1-30)	Concrete Slab Disposal (year 30)	0.05	0.10	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 52,666
2	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 49,221
3	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 46,001
4	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 42,991
5	$ 32,021	$ 2,343	$ -	$ -	$ -	$ 4,500	$ -	$ 1,943	$ 3,886	$ 11,659	$ 56,353	$ 40,179
6	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 19,440
7	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 18,168
8	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 16,980
9	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 15,869
10	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 14,831
11	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 13,860
12	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 12,954
13	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 12,106
14	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 11,314
15	$ -	$ 2,343	$ 13,277	$ 46,079	$ 63,261	$ 4,500	$ -	$ 6,473	$ 12,946	$ 38,838	$ 187,717	$ 68,037
16	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 9,882
17	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 9,236
18	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 8,632
19	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 8,067
20	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 7,539
21	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 7,046
22	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 6,585
23	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 6,154
24	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,752
25	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,375
26	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 5,024
27	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,695
28	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,388
29	$ -	$ 2,343	$ 13,277	$ -	$ -	$ 4,500	$ -	$ 1,006	$ 2,012	$ 6,036	$ 29,174	$ 4,101
30	$ -	$ 2,343	$ 13,277	$ 46,079	$ 63,261	$ 4,500	$ 835,412	$ 48,244	$ 96,487	$ 289,462	$ 1,399,064	$ 183,791
Total	$160,105	$70,290	$331,925	$92,158	$126,522	$135,000	$835,412	$87,571	$175,141	$525,424	**$ 2,540,000** rounded up	**$ 711,000** rounded up

PV Discount F PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT

Reviewed by: EMW

CBI Building Alternative 4 - CBI Building Rehabilitation/Epoxy Encapsulation
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, double epoxy coat PCB impacted building materials. Any rehabilitation of building except for roof repair and window and door repair is responsibility of building owner.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Power Wash Walls/floors, Treat Water	LS	$810,549	1	$810,549
Debris Removal and Disposal	LS	$176,325	1	$176,325
Building Rehabilitation				
Repair Roof	LS	$811,008	1	$811,008
Repair/Replace Windows/Doors	LS	$836,655	1	$836,655
Install Vapor Intrusion Mitigation System	sf	$2.50	77,500	$193,750
Apply Epoxy Coat and Concrete Overlay				
First Floor	sf	$3.20	134,000	$428,800
Double Coat Columns	sf	$3.20	123,800	$396,160
Second, Third, Fourth Floor - Double Epoxy Coat	sf	$3.20	228,908	$732,504
Wall Surfaces, Double Epoxy Coat	sf	$3.20	160,000	$512,000
First Floor Concrete Overlay - 6-10 inches thick	sf	$6.00	134,000	$804,000
Transportation and Disposal				
TSCA Waste	ton	$209	100	$20,900
Confirmation Sampling				
Confirmation Sampling	ea	$75	750	$56,250
Permitting and Reporting				
Permitting and Reporting	LS	$78,789	1	$78,789
Subtotal				$7,957,690
Annual Maintenance, Inspection, Reapplication of Epoxy				
Quarterly Inspection, Annual Costs	LS	$2,500.00	30	$75,000
Annual Maintenance		$6,683	30	$200,490
Regulatory Oversight	LS/year	$2,000	30	$60,000
Repeat Application of Surface Coat after 7.5 years, 4x in 30 years (low traffic areas, 75%of 2nd, 3rd, and 4th floors plus columns and walls)	sf	$1.60	1,182,564	$1,892,102
Repeat Application of Surface Coat after 3.75 years, 8x in 30 years, (high traffic areas, 25% of 2nd, 3rd, and 4th floors)	sf	$1.60	457,816	$732,506
Subtotal				$2,960,098
Building Demolition Costs at End of Useful Life				
Building Demolition Cost	LS	$8,826,627.00	1	$8,826,627
Project Management at 5%		5%	$8,826,627.00	$441,331
Technical Support at 10%		10%	$9,267,958.35	$926,796
Contingency at 30%		30%	$10,194,754.19	$3,058,426
Subtotal				$13,253,180
Total Value of Capital and O&M Costs, Non-Discounted				$24,170,969

Notes:

PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

O&M - operation and maintenance

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -CBI Building Alternative 4 - Building Rehabilitation/Epoxy Encapsulation
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Project Mgmt at	Technical Support at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	Quarterly Inspection and Regulatory Oversight, Annual Cost	Annual Maintenance (VI system, Epoxy, Concrete)	Periodic Re-application in Low Traffic Areas (7.5, 15, 22.5, and 30 yrs.)	Periodic Re-application in High Traffic Areas (every 3.75 years)	0.05	0.10	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 24,238
2	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 22,652
3	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 129,548
4	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 19,785
5	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 18,491
6	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 17,281
7	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 525,967
8	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 15,094
9	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 14,107
10	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 80,676
11	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 12,321
12	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 11,515
13	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 10,762
14	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 10,058
15	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 306,118
16	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 8,785
17	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 8,210
18	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 46,954
19	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 7,171
20	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 6,702
21	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 6,264
22	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 190,635
23	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 5,471
24	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 5,113
25	$ 4,500	$ 13,386	$ -	$ 91,563	$ 5,472	$ 10,945	$ 32,835	$ 158,701	$ 29,241
26	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 4,466
27	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 4,174
28	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 3,901
29	$ 4,500	$ 13,386	$ -	$ -	$ 894	$ 1,789	$ 5,366	$ 25,935	$ 3,645
30	$ 4,500	$ 13,386	$ 473,026	$ 91,563	$ 29,124	$ 58,247	$ 174,742	$ 844,588	$ 110,951
Total	$135,000	$401,580	$1,892,102	$732,506	$158,059	$316,119	$948,356	**$ 4,584,000** rounded up	**$ 1,661,000** rounded up

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

CBI Building Alternative 5 - Demolition
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish CBI structure, including first floor slab.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$2,100,000	1	$2,100,000
Demolish CBI, Including First Floor Slab	cf	$0.39	5601666	$2,160,002
Secure Property	lf	$14.18	2001	$28,368
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$176,325.00	1	$176,325
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
CBI Building Demolition				
On-site Resize of Material	ton	$9.83	62500	$614,063
Transport and Dispose - TSCA (15% of total)	ton	$209.00	9375	$1,959,375
Transport and Dispose - Non-hazardous (85% of total)	ton	$42.01	53125	$2,231,781
Confirmation Sampling				
Confirmation Sampling	ea	75	8,333	$624,975
Permitting and Reporting				
Permitting and Reporting	LS	$10,209,571	1.00%	$102,096
Total Value of Capital Costs				$10,311,667

Notes:

Mob/Demob - mobilization/demobilization

TSCA - Toxic Substance Control Act

LS - lump sum

lf - linear feet

gal - gallon

% - percent

ea - each

cf - cubic feet

updated: 9/22/10

Created by: CLT

Reviewed by: EMW

Willco Plastics Building Alternative 2 - Mechanical Removal (Scabbling/Scarification)
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, mechanically remove PCB impacted concrete floor materials, double epoxy coat impacted building materials (if present). Rehabilitation of building is limited to roof, window and door repair.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors, Treat Water	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Building Rehabilitation				
Repair Roof	LS	$71,288	1	$71,288
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Scabbling/Scarification				
First Floor, average of three passes per impacted area, 1/8" removed per pass	sf	$38.25	26,000	$994,500
Double Coat Columns with Epoxy	sf	$2.10	6,912	$14,503
Second Floor, average of three passes per impacted area, 1/8" removed per pass	sf	$38.25	6,000	$229,500
Transportation and Disposal				
Concrete Waste	ton	$42	934	$39,228
Confirmation Sampling				
Confirmation Sampling	ea	$75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$1,694,499	1.00%	$16,945
Subtotal				$1,711,444
Annual Maintenance, Inspection and Repeat Epoxy Application				
Quarterly Inspection, Annual Costs, Plus Sampling Labor	LS	$8,400	30	$252,000
Annual Maintenance		$670	30	$20,100
Annual Sampling of Scabbled Areas, one sample per 500 sf., x 30 years	ea	$75	1,590	$119,250
Repeat Aapplication of Surface Coat after 7.5 years, 4x in 30 years	sf	$1.03	6,912	$7,144
Regulatory Oversight	LS	$2,000.00	30	$60,000
Subtotal				$458,494
Total Value of Capital and O&M Costs, Non-Discounted				$2,169,937

Notes:

PCB - polychlorinated biphenols
LS - lump sum
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -Willco Plastics Building Alternative 2 - Scabbling/Scarification
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Project Mgmt at	Technical Support at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	Quarterly Inspection, Annual Cost (1-30)	Annual Maintenance and Sampling (1-30)	Annual Reporting (1-30)	Annual Regulatory Oversight (1-30)	0.05	0.10	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 23,776
2	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 22,220
3	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 20,767
4	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 19,408
5	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 18,139
6	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 16,952
7	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 15,843
8	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 14,806
9	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 13,838
10	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 12,933
11	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 12,086
12	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 11,296
13	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 10,557
14	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 9,866
15	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 9,221
16	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 8,617
17	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 8,054
18	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 7,527
19	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 7,034
20	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 6,574
21	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 6,144
22	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,742
23	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,367
24	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 5,015
25	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,687
26	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,381
27	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 4,094
28	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,826
29	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,576
30	$ 8,400	$ 4,645	$ 2,500	$ 2,000	$ 877	$ 1,755	$ 5,264	$ 25,440	$ 3,342
Total	$252,000	$139,350	$75,000	$60,000	$26,318	$52,635	$157,905	**$ 764,000** rounded up	**$ 316,000** rounded up

PV Discount Rat PV Discount Rate (i)	0.07
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 3 -Building Rehabilitation/Epoxy Encapsulation
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, Double epoxy coat PCB impacted building materials. Any rehabilitation of building except for roof repair and window and door repair is left up to building owner.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors, Treat Water	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Building Rehabilitation				
Repair Roof	LS	$71,288	1	$71,288
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Initial Apply Epoxy Coat				
First Floor- Double Epoxy Coat	sf	$3.20	26,000	$83,200
Double Coat Columns	sf	$3.20	6,912	$22,118
Second Floor - Double Epoxy Coat	sf	$3.20	6,000	$19,200
Confirmation Sampling				
Confirmation Sampling	ea	$75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$541,286	1.00%	$5,413
Subtotal				$546,699
Annual Maintenance, Inspection and Reapplication of Epoxy				
Quarterly Inspection, Annual Costs	LS	$2,500.00	30	$75,000
Annual Maintenance		$670.00	30	$20,100
Regulatory Oversight	LS	$2,000.00	30	$60,000
Repeat Application of Surface Coat after 3.75 years, 8x in 30 years (high traffic areas = 25% of floor surface)	sf	$1.60	64,000	$102,400
Repeat Application of Surface Coat after 7.5 years, 4x in 30 years (low traffic areas and columns)	sf	$1.60	123,648	$197,837
Subtotal				$455,337
Building Demolition Costs at End of Useful Life				
Building Demolition Cost	LS	$1,741,531	1	$1,741,531
Project Management at 5%		5%	$1,741,530.86	$87,077
Technical Support at 10%		10%	$1,828,607.40	$182,861
Contingency at 30%		30%	$2,011,468.14	$603,440
Subtotal				$2,614,909
Total Value of Capital and O&M Costs, Non-Discounted				$3,616,945

Notes:

LS - lump sum
sf - square feet
ea - each
O&M - operation and maintenance

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -Willco Plastics Building Alternative 3 - Building Rehabilitation/Epoxy Encapsulation
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Project Mgmt at	Technical Support at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	Quarterly Inspection and Regulatory Oversight Annual Cost	Annual Maintenance	Periodic Re-application in Low Traffic Areas (7.5, 15, 22.5, and 30 yrs.)	Periodic Re-application in High Traffic Areas (every 3.75 years)	0.05	0.10	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 7,006
2	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 6,548
3	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 21,270
4	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 5,719
5	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 5,345
6	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,995
7	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 60,888
8	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,363
9	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 4,078
10	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 13,246
11	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,562
12	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,329
13	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 3,111
14	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,907
15	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 35,437
16	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,539
17	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,373
18	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 7,709
19	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 2,073
20	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,937
21	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,811
22	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 22,069
23	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,581
24	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,478
25	$ 4,500	$ 670	$ -	$ 12,800	$ 899	$ 1,797	$ 5,391	$ 26,057	$ 4,801
26	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,291
27	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,206
28	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,127
29	$ 4,500	$ 670	$ -	$ -	$ 259	$ 517	$ 1,551	$ 7,497	$ 1,054
30	$ 4,500	$ 670	$ 49,459	$ 12,800	$ 3,371	$ 6,743	$ 20,229	$ 97,772	$ 12,844
Total	$135,000	$20,100	$197,837	$102,400	$22,767	$45,534	$136,601	**$ 661,000** rounded up	**$ 248,000** rounded up

PV Discount Ra PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 4 - Partial Removal and Replacement Alternative
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, remove and replace PCB impacted building materials, and rehabilitate building so that it can be returned to productive use.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to R&R				
Asbestos Abatement	LS	$112,350	1	$112,350
Power Wash Walls/Floors	LS	$86,730	1	$86,730
Debris Removal and Disposal	LS	$18,900	1	$18,900
Mob/Demob	LS	$49,682.00	1	$49,682
Water Recovery/Treatment	gal	$2.65	50,000	$132,500
Building Rehabilitation				
Repair Roof	LS	$125,188	1	$125,188
Repair/Replace Windows/Doors	LS	$120,000	1	$120,000
Rehabilitate Willco Plastics/CBI Building Common Wall	LS	$220,000.00	1	$220,000
Remove/Replace Impacted Floor				
First Floor (approx. 10% of floor)	sf	$40	2,510	$100,802
Second Floor (approx. 2% of floor)	sf	$48	507	$24,118
Transportation and Disposal				
TSCA Waste	ton	$209	0	$0
Transport and Dispose - Non-hazardous (75% of total)	ton	$42.01	110	$4,621
Confirmation Sampling				
Confirmation Sampling	ea	$75	35	$2,625
Permitting and Reporting				
Permitting and Reporting	LS	$997,516	1.00%	$9,975
Total Value of Capital Costs				$1,007,491

Notes:

PCB - polychlorinated biphenols
TSCA - Toxic Substance Control Act
LS - lump sum
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 5 - Partial Demolition and Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish Willco Plastics structure, leave floor slab in place, install and maintain soil cap in compliance with TSCA.

	Unit	Unit Price	Quantity	Cost
Clean Building Prior to Demolition				
Asbestos Abatement	LS	$112,350	1	$112,350
Secure Property	lf	$14.18	800	$11,342
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$18,900	1	$18,900
Power Wash Walls/Floors, Treat Water	LS	$86,730	1.00	$86,730
Building Demolition w/o First Floor Slab & Foundations	cf	$0.39	1,040,000	$401,024
On-site Resize of Material	ton	$9.83	7891	$77,529
Transport and Dispose - TSCA (5%)	ton	$209.00	395	$82,555
Transport and Dispose - Non-hazardous (95%)	ton	$42.01	7496	$314,907
Confirmation Sampling				
Confirmation Sampling	ea	$75	280	$21,000
Permitting and Reporting				
Permitting and Reporting	LS	$1,176,019	1.00%	$11,760
Cover System (Soil Cap)				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design	%	$512,000	12%	$61,440
Permitting	%	$573,440	5%	$28,672
Subtotal				$1,789,891
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608
Permitting and Reporting- Annual Cap Costs	LS/yr	$2,500	30	$75,000
Regulatory Oversight	LS/yr	$2,000	30	$60,000
Subtotal O&M				$191,000
Total Value of Capital and O&M Costs, Non-Discounted				$1,980,891

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet

% - percent
O&M - operation and maintenance
cf - cubic feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA - Willco Plastics Building Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site-Willco Plastics Building
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Project Mgmt at	Technical Support at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	0.05	0.10	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 15,817
2	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 14,782
3	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 13,815
4	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,912
5	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,067
6	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,498
7	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,007
8	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,549
9	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,120
10	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,720
11	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,346
12	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,996
13	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,669
14	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,364
15	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 16,071
16	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,811
17	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,562
18	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,329
19	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,111
20	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,908
21	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,718
22	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,540
23	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,374
24	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,218
25	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,073
26	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,938
27	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,811
28	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,692
29	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,582
30	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 5,825
Total	$33,415	$14,670	$69,275	$19,234	$26,406	$135,000	$14,900	$29,800	$89,400	**$ 433,000** rounded up	**$ 180,000** rounded up

PV Discount F PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Willco Plastics Building Alternative 6 - Demolition
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Conduct asbestos abatement, power wash entire building, demolish Willco Plastics structure, including first floor slab.

	Unit	Unit Price	Quantity	Cost
Willco Plastics Building Demolition				
Asbestos Abatement	LS	$112,350	1	$112,350
Demolish Willco	cf	$0.39	1,040,000	$401,024
Secure Property	lf	$14.18	800	$11,342
Mob/Demob	LS	$49,682.00	1	$49,682
Site Setup/Debris Removal		$18,900	1	$18,900
On-site Resize of Material	ton	$9.83	14040	$137,943
Transport and Dispose - TSCA (5% of total)	ton	$209.00	702	$146,718
Transport and Dispose - Non-hazardous (95% of total)	ton	$42.01	13338	$560,329
Water Recovery/Treatment	gal	$2.65	100,000	$265,000
Confirmation Sampling				
Confirmation Sampling	ea	75	280	$21,000
Permitting and Reporting				
Permitting and Reporting	LS	$1,724,288	1.00%	$17,243
Total Value of Capital Costs				$1,741,531

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
lf - linear feet
% - percent
gal - gallon
cf - cubic feet
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 2 - Soil Excavation and Off-Site Disposal
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials, transport for off-site disposal, backfill with suitable fill.

Die Cast Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Stockpile Surface Gravel - (245' x 120' x 2')(2178 cy x 1.4 tons/cy)	tons	3.16	3049.2	$9,635
Impacted Area Excavation and Loading (245' x120' x 23')	cy	6.01	25044	$150,514
Dewater Excavation and Treat/Dispose	gal	2.65	90,000	$238,500
Sheet Pile Installation	lf	2,537	516	$1,308,963
Backfill				
Purchase Backfill	cy	14.00	25,044	$350,616
Place Backfill	cy	7.50	25,044	$187,830
Transportation, Treatment, and Disposal				
TSCA Landfill T&D (25,044 cy x 1.4 tons/cy)	ton	209.00	35062	$7,327,958
Confirmation Sampling				
Confirmation Sampling	ea	75	500	$37,500
Permitting and Reporting				
Permitting and Reporting	LS	$96,019	1	$96,019
Total Value of Capital Costs				$9,707,536

Notes:

TSCA - Toxic Substance Control Act
cy - cubic yard
LS - lump sum
gal - gallon

T&D - transportation and disposal
lf - linear feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 3 - Excavate to 10', Backfill, Install Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials to 10' below ground surface (nominal limits of construction), transport for off-site disposal, backfill with suitable fill, install soil cap.

Die Cast Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Stockpile Surface Gravel - (245' x 120' x 2')(2178 cy x 1.4 tons/cy)	tons	3.16	3049.2	$9,635
Impacted Area Excavation and Loading (245' x120' x 10')	cy	6.01	10,900	$65,509
Dewater Excavation and Treat/Dispose	gal	2.65	90,000	$238,500
Backfill				
Purchase Backfill	cy	14.00	10,900	$152,600
Place Backfill	cy	7.50	10,900	$81,750
Transportation, Treatment, and Disposal				
TSCA Landfill T&D (10,900 cy x 1.4 tons/cy)-soil	ton	209.00	15,260	$3,189,340
TSCA Landfill T&D (545 cy x 2.1 tons/cy)-concrete floor	ton	209.00	1,145	$239,201
TSCA Landfill T&D (272 cy x 2.1 tons/cy)-concrete footings	ton	209.00	571	$119,381
TSCA Landfill T&D (30 cy x 2.1 tons/cy)-concrete knee walls	ton	209.00	63	$13,167
Confirmation Sampling				
Confirmation Sampling	ea	75	315	$23,625
Permitting and Reporting-Excavation and Disposal				
Permitting and Reporting	LS	$4,132,708	1.00%	$41,327
Cap Installation				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design (12%)	%	$61,440	1	$61,440
Permitting (5%)	%	$28,672	1	$28,672
Subtotal				$4,701,002
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$6,683	5	$33,415
Cover System - Annual Cost, years 6-30	LS/yr	$2,771	25	$69,275
Cover System - Periodic Costs, once /15 years	LS/event	$13,203	2	$26,406
Stormwater Controls - Annual Costs	LS/yr	$489	30	$14,670
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$9,617	2	$19,234
Permitting and Reporting				
Permitting and Reporting-Annual	LS/yr	$2,500	30	$75,000
Regulatory Oversight - Annual	LS/yr	$2,000	30	$60,000
Subtotal O&M				$204,585
Total Value of Capital and O&M Costs, Non-Discounted				$4,905,587

Notes:

TSCA - Toxic Substance Control Act
T&D - transportation and disposal
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
% - percent

O&M - operation and maintenance
gal - gallon
cy - cubic yard
sf - square feet
ea - each

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 4 - ISTD/VE
ACF Carter Carburetor Facility
EE/CA Cost Estimate

In-place treatment of impacted subsurface materials.

	Unit	Unit Price	Quantity	Cost
Die Cast Area				
ISTD - (245' X 120' X 26')	cy	275.52	28,311	$7,800,000
Confirmation Sampling				
Confirmation Sampling	ea	75	100	$7,500
Permitting and Reporting				
Permitting and Reporting	LS	$7,807,500	1.00%	$78,075
Total Value of Capital Costs				$7,885,575

Notes:

ISTD/VE - in-situ thermal desorption/vapor extraction
cy - cubic yard
ea - each
LS - lump sum
% - percent

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

Die Cast Area Alternative 5 - Impermeable Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Install and maintain a protective cover system over impacted areas.

	Unit	Unit Price	Quantity	Cost
Die Cast Area				
Site Preparation	LS	$111,000	1	$111,000
Cover System (Soil Cap)	LS	$372,000	1	$372,000
Stormwater Controls	LS	$29,000	1	$29,000
Engineering and Design (12%)	%	$61,440	1	$61,440
Permitting (5%)	%	$28,672	1	$28,672
Subtotal				$602,112
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$6,683	5	$33,415
Cover System - Annual Cost, years 6-30	LS/yr	$2,771	25	$69,275
Cover System - Periodic Costs, once /15 years	LS/event	$13,203	2	$26,406
Stormwater Controls - Annual Costs	LS/yr	$489	30	$14,670
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$9,617	2	$19,234
Permitting and Reporting				
Permitting and Reporting - Annual	LS/yr	$2,500	30	$75,000
Regulatory Oversight - Annal	LS/yr	$2,000	30	$60,000
Subtotal				$298,000
Total Value of Capital and O&M Costs, Non-Discounted				$900,112

Notes:

O&M - operation and maintenance
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
% - percent
O&M - operation and maintenance

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA - Die Cast Area Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Project Mgmt at	Technical Support at	Contingency at		
(t)	Cover System Maintenance (1-5)	Stormwater Controls Maintenance (1-30)	Cover System Maintenance (6-30)	Stormwater Controls Inspection and Maintenance (15, 30)	Cover System Repair (15, 30)	Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	0.05	0.10	0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 15,817
2	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 14,782
3	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 13,815
4	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,912
5	$ 6,683	$ 489	$ -	$ -	$ -	$ 4,500	$ 584	$ 1,167	$ 3,502	$ 16,924	$ 12,067
6	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,498
7	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 7,007
8	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,549
9	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 6,120
10	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,720
11	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 5,346
12	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,996
13	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,669
14	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 4,364
15	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 16,071
16	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,811
17	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,562
18	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,329
19	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 3,111
20	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,908
21	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,718
22	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,540
23	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,374
24	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,218
25	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 2,073
26	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,938
27	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,811
28	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,692
29	$ -	$ 489	$ 2,771	$ -	$ -	$ 4,500	$ 388	$ 776	$ 2,328	$ 11,252	$ 1,582
30	$ -	$ 489	$ 2,771	$ 9,617	$ 13,203	$ 4,500	$ 1,529	$ 3,058	$ 9,174	$ 44,341	$ 5,825
Total	$33,415	$14,670	$69,275	$19,234	$26,406	$135,000	$14,900	$29,800	$89,400	**$ 433,000** rounded up	**$ 180,000** rounded up

PV Discount PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

TCE AST Area Alternative 2 - Soil Excavation and Off-Site Disposal
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials, transport for off-site disposal, backfill with suitable fill.

TCE Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Impacted Area Excavation and Loading (100' x100' x 25')	cy	6.01	9259	$55,647
Dewater Excavation and Treat/Dispose	gal	1.25	50,000	$62,500
Sheet Pile Installation	lf	2,537	100	$253,675
Backfill				
Purchase Backfill	cy	14.00	9,259	$129,626
Place Backfill	cy	7.50	9,259	$69,443
Transportation, Treatment, and Disposal				
On-Site Treatment to Land Ban (9259 cy x 1.4 ton/cy) and T&D	ton	225.00	12,962	$2,916,450
Confirmation Sampling				
Confirmation Sampling	ea	95	186	$17,670
Permitting and Reporting				
Permitting and Reporting	LS	$3,505,010	1.00%	$35,050
Total Value of Capital Costs				$3,540,060

Notes:

T&D - transportation and disposal
cy - cubic yard
gal - gallon

lf - linear feet
ea - each
LS - lump sum

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

TCE Area Alternative 3 - Excavate to 10', Backfill, Install Cap
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Excavate impacted materials to 10' below ground surface (nominal limits of construction), transport for off-site disposal, backfill with suitable fill, install soil cap.

TCE Area	Unit	Unit Price	Quantity	Cost
Excavate Soil				
Impacted Area Excavation and Loading (100' x100' x 10')	cy	6.01	3,704	$22,261
Dewater Excavation and Treat/Dispose	gal	1.25	25,000	$31,250
Backfill				
Purchase Backfill	cy	14.00	3,704	$51,856
Place Backfill	cy	7.50	3,704	$27,780
Transportation, Treatment, and Disposal				
On-Site Treatment to Land Ban (3704 cy x 1.4 ton/cy) and T&D	ton	225.00	5,186	$1,166,760
Confirmation Sampling				
Confirmation Sampling	ea	95	75	$7,125
Permitting and Reporting				
Permitting and Reporting	LS	$1,307,032	1.00%	$13,070
TCE Area - Cover System (Soil Cap)				
Site Preparation	LS	$39,000	1	$39,000
Cover System (Soil Cap)	LS	$125,000	1	$125,000
Stormwater Controls	LS	$22,000	1	$22,000
Engineering and Design (12%)	%	$22,320	1	$22,320
Permitting (5%)	%	$10,416	1	$10,416
Subtotal				$1,538,838
O&M Costs				
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608
Permitting and Reporting				
Permitting and Reporting-Annual	LS/yr	$1,250	30	$37,500
Regulatory Oversight - Annual	LS/yr	$2,000	30	$60,000
Subtotal				$153,500
Total Value of Capital and O&M Costs, Non-Discounted - Excavation and Cap Only				$1,692,338
TCE Area - GWCA System installation and O&M Cost - see table for TCE Alternative 5				

Notes:

T&D - transportation and disposal
cy - cubic yard
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event

gal - gallon
ea - each
O&M - operation and maintenance
% - percent
GWCA - groundwater corrective action

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

TCE AST Area Alternative 4 - ISTD/VE
ACF Carter Carburetor Facility
EE/CA Cost Estimate

In-place treatment of impacted subsurface materials.				
	Unit	**Unit Price**	**Quantity**	**Cost**
TCE Area				
ISTD - (100' X 100' X 25')	cy	215.8	9259	$1,998,092
Confirmation Sampling				
Confirmation Sampling	ea	95	50	$4,750
Permitting and Reporting				
Permitting and Reporting	LS	$2,002,842	1.00%	$20,028
Total Value of Capital Costs				$2,022,871

Notes:

ISTD/VE - in-situ thermal desorption/vapor extraction
cy - cubic yard
ea - each
LS - lump sum
% - percent

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

TCE AST Area Alternative 5 - Impermeable Cap and GWCA System
ACF Carter Carburetor Facility
EE/CA Cost Estimate

Install and maintain a protective cover system over impacted areas. TCE impacted area includes groundwater corrective action system (active or passive) to minimize off-site migration of impacted groundwater.

	Unit	Unit Price	Quantity	Cost	
TCE Area - Cover System (Soil Cap)					
Site Preparation	LS	$39,000	1	$39,000	
Cover System (Soil Cap)	LS	$125,000	1	$125,000	
Stormwater Controls	LS	$22,000	1	$22,000	
Engineering and Design (12%)	%	$22,320	1	$22,320	
Permitting (5%)	%	$10,416	1	$10,416	
Subtotal - Capital Costs				$218,736	
O&M Costs					
Cover System - Annual Cost, years 1-5	LS/yr	$2,296	5	$11,480	
Cover System - Annual Cost, years 6-30	LS/yr	$952	25	$23,800	
Cover System - Periodic Costs, once /15 years	LS/event	$4,536	2	$9,072	
Stormwater Controls - Annual Costs	LS/yr	$168	30	$5,040	
Stormwater Controls - Periodic Costs, once/15 years	LS/event	$3,304	2	$6,608	
Permitting and Reporting					
Permitting and Reporting-Annual	LS/yr	$1,250	30	$37,500	
Regulatory Oversight	LS/yr	$2,000	30	$60,000	
Subtotal - O&M Costs				$153,500	
Install and Maintain Impermeable Cap				$372,236	
	Unit	**Unit Price**	**Quantity**	**Cost**	**Cost**
TCE Area - GWCA System				**Pump and Treat**	**Passive Barrier**
Monitoring Well Installation	LS	$4,000	5	$20,000	
Extraction Well Installation	LS	$12,500	3	$37,500	
Pumps, Motors, Piping, Vaults	LS	$16,250	3	$48,750	
Control Shed	LS	$15,000	1	$15,000	
Air Stripper	LS	$30,000	1	$30,000	
Installation Labor	hr	$90	320	$28,800	
Engineering and Design (12%)	%	$21,606	1	$21,606	
Permitting (5%)	%	$9,003	1	$9,003	
Project Management (10%)				$21,066	
Subtotal - Capital Costs				$231,724	$450,000
Operation, Maintenance, and Monitoring Costs					
GWCA-Sampling Labor	LS/yr	$6,000	1	$6,000	$6,000
Analytical Costs	LS/yr	$7,200	1	$7,200	$7,200
GWCA Maintenance Costs	LS/yr	$28,800	1	$28,800	
Equipment Costs	LS/yr	$5,250	1	$5,250	$5,250
Permitting and Reporting-Annual	LS/yr	$10,920	1	$10,920	$10,920
Project Management (10%)	LS/yr	$5,817	1	$5,817	$5,817
Regulatory Oversight	LS/yr	$2,000	1	$2,000	$2,000
Subtotal-Annual				$65,987	$35,187
Subtotal - O&M Costs		$65,987	30	$1,979,610	$1,055,610
Passive Barrier Re-Injection Costs (5 yr. intervals)	LS/event	$120,000	6		$720,000
Install and Operate GWCA System (Active/Passive)				$2,211,334	$2,225,610

Notes:

TSCA - Toxic Substance Control Act
LS - lump sum
LS/year -lump sum per year
LS/event - lump sum per event
lf - linear feet
% - percent
GWCA - groundwater corrective action

TCE - trichloroethylene
O&M - operation and maintenance
gal - gallon
cf - cubic feet
sf - square feet
ea - each
hr - hour

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -TCE AST Area Alternative 5 - Impermeable Cap - Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year (t)	Item 1 Cover System Maintenance (1-5)	Item 2 Stormwater Controls Maintenance (1-30)	Item 3 Cover System Maintenance (6-30)	Item 4 Stormwater Controls Inspection and Maintenance (15, 30)	Item 5 Cover System Repair (15, 30)	Item 6 Annual Inspection, Permitting, Reporting, and Regulatory Oversight (1-30)	Project Mgmt at 0.05	Technical Support at 0.10	Contingency at 0.30	Total Non-Discounted Cost	Total Present Value
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 9,437
2	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 8,820
3	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 8,243
4	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 7,704
5	$ 2,296	$ 168	$ -	$ -	$ -	$ 4,500	$ 348	$ 696	$ 2,089	$ 10,098	$ 7,200
6	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 5,430
7	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 5,075
8	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,743
9	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,433
10	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 4,143
11	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,872
12	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,618
13	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,382
14	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 3,160
15	$ -	$ 168	$ 952	$ 3,304	$ 4,536	$ 4,500	$ 673	$ 1,346	$ 4,038	$ 19,517	$ 7,074
16	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,760
17	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,580
18	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,411
19	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,253
20	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 2,106
21	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,968
22	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,839
23	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,719
24	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,607
25	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,501
26	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,403
27	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,311
28	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,226
29	$ -	$ 168	$ 952	$ -	$ -	$ 4,500	$ 281	$ 562	$ 1,686	$ 8,149	$ 1,145
30	$ -	$ 168	$ 952	$ 3,304	$ 4,536	$ 4,500	$ 673	$ 1,346	$ 4,038	$ 19,517	$ 2,564
Total	$11,480	$5,040	$23,800	$6,608	$9,072	$135,000	$9,550	$19,100	$57,300	**$ 277,000** rounded up	**$ 115,000** rounded up

PV Discount PV Discount Rate (i)	0.07
PV = non-discounted cost x 1/((1+i)^t)	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA - TCE AST Area Alternative 5 - GWCA System Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 1	Item 2	Item 3	Item 4	Item 5	Project Mgmt at	Contingency at	Total Non-Discounted Cost	Total Present Value
(t)	GWCA-Sampling Labor	Annual Analytical Costs	GWCA Maintenance Costs	Equipment Costs	Annual Permitting, Reporting, and Regulatory	0.1	0.30		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 78,727
2	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 73,577
3	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 68,763
4	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 64,265
5	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 60,061
6	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 56,131
7	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 52,459
8	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 49,027
9	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 45,820
10	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 42,822
11	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 40,021
12	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 37,403
13	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 34,956
14	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 32,669
15	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 30,532
16	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 28,534
17	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 26,668
18	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 24,923
19	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 23,293
20	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 21,769
21	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 20,345
22	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 19,014
23	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 17,770
24	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 16,607
25	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 15,521
26	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 14,505
27	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 13,556
28	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 12,670
29	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 11,841
30	$ 6,000	$ 7,200	$ 28,800	$ 5,250	$ 12,920	$ 6,017	$ 18,051	$ 84,238	$ 11,066
Total	$180,000	$216,000	$864,000	$157,500	$387,600	$180,510	$541,530	**$ 2,528,000** rounded up	**$ 1,046,000** rounded up

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

Note:

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -TCE AST Area - Alternative 5 - ISCO Barrier 5 yr Reinjection Interval
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year	Item 7	Item 8	Item 9	Project Mgmt at	Technical Support at	Total Non-Discounted Cost	Total Present Value
(t)	Quarterly GW Sampling, Annual Cost	Periodic Re-Injection	Regulatory Oversight	0.05	0.10		
0	$ -	$ -	$ -	$ -	$ -	$ -	$ -
1	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 30,514
2	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 28,518
3	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 26,652
4	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 24,908
5	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 121,868
6	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 21,756
7	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 20,333
8	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 19,002
9	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 17,759
10	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 86,890
11	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 15,512
12	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 14,497
13	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 13,549
14	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 12,662
15	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 61,951
16	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 11,060
17	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 10,336
18	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 9,660
19	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 9,028
20	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 44,170
21	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 7,885
22	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 7,369
23	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 6,887
24	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 6,437
25	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 31,493
26	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 5,622
27	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 5,254
28	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 4,911
29	$ 26,652		$ 2,000	$ 1,333	$ 2,665	$ 32,650	$ 4,589
30	$ 26,652	$ 120,240	$ 2,000	$ 7,345	$ 14,689	$ 170,926	$ 22,454
Total	$799,560	$721,440	$60,000	$ 76,050	$ 152,100	**$ 1,810,000** rounded up	**$ 704,000** rounded up

Note:

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW

EE/CA -TCE AST Area - Alternative 5 - ISCO Barrier 3 yr Reinjection Interval
Post-Closure Long-Term Maintenance and Monitoring
Calculation of Present Worth Value of Future Costs
Former Carter Carburetor Site
St. Louis, Missouri

Year (t)	Item 7 Quarterly GW Sampling, Annual Cost	Item 8 Periodic Re-Injection	Project Mgmt at 0.05	Technical Support at 0.10	Total Non-Discounted Cost	Total Present Value
0			$ -	$ -	$ -	$ -
1	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 28,645
2	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 26,771
3	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 137,894
4	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 23,383
5	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 21,853
6	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 112,562
7	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 19,087
8	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 17,838
9	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 91,884
10	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 15,581
11	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 14,561
12	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 75,005
13	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 12,719
14	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 11,887
15	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 61,226
16	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 10,382
17	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 9,703
18	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 49,979
19	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 8,475
20	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 7,920
21	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 40,798
22	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 6,918
23	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 6,465
24	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 33,303
25	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 5,647
26	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 5,278
27	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 27,185
28	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 4,610
29	$ 26,652		$ 1,333	$ 2,665	$ 30,650	$ 4,308
30	$ 26,652	$ 120,240	$ 7,345	$ 14,689	$ 168,926	$ 22,191
Total	$799,560	$1,082,160	$ 94,086	$ 188,172	**$ 2,303,000** rounded up	**$ 915,000** rounded up

Note:

PV Discount Rate (i)	**0.07**
PV = non-discounted cost x $1/((1+i)^t)$	

(t) - time

1. Discount rate of 7% is based on Environmental Protection Agency (EPA) guidance.
2. "Project Management" and "Technical Support" costs are oversight, management, administrative, and technical costs associated with the yearly inspection and maintenance requirements.

updated: 9/22/10

Created by: CLT
Reviewed by: EMW