URS

March 17, 2008

Ms. Vanessa Steigerwald Dick, Ph.D.
Ohio Environmental Protection Agency
Northeast District Office
2110 East Aurora Road
Twinsburg, Ohio 44087

Re: Draft Risk Assessment Report
Akron Airdock, Akron, Ohio
Voluntary Action Program
Technical Assistance # 06GR054

Dear Ms. Steigerwald Dick:

On behalf of Lockheed Martin Corporation and Summit County Port Authority, URS is submitting the enclosed Ohio Voluntary Action Program (VAP) Property-Specific Risk Assessment draft report ("Draft Risk Assessment") of the Akron Airdock property for review under the technical assistance account referenced above. URS is providing overall project management and VAP certified professional services for the project, and is collaborating with Mr. Eric Morton of Tetra Tech EM Inc., the primary risk assessor and author of the enclosed Draft Risk Assessment.

Through this submittal we are also responding to a letter from Ohio EPA dated October 23, 2007 in which review comments were provided on Lockheed Martin's "*Application for 40 CFR §761.61(c) Risk-Based Cleanup of Soil, Akron Airdock, August 2007*", which was submitted to Region 5 of the United States Environmental Protection Agency (Region 5) under the Toxic Substances Control Act (TSCA). As we discussed with you on a follow-up telephone call, many of the comments in the October 23, 2007 letter are relevant to the Voluntary Action Program (VAP) rather than to TSCA, and therefore, we are addressing most of the comments in the enclosed Draft Risk Assessment.

Ohio EPA Comments on *Application for 40 CFR 761.61 (c) Risk-Based Cleanup of Soil, Akron Airdock, Akron, Ohio, August 2007* (Soil Cleanup Application) are presented below in bold, italicized type. Each of the Ohio EPA comments from the October 23, 2007 letter is followed with a clarification, explanation, or a reference to the location of the cited information in the Draft Risk Assessment or the Soil Cleanup Application, as appropriate.

1. ***<u>Executive Summary and 1. Introduction</u>: The second bullet under the first paragraph discusses the "Removal and off-site disposal of soil containing PCBs greater than 25 parts per million (ppm) and backfilling with clean (<1 ppm total PCB) fill. It should be***

clarified here that by removing soil with concentrations greater than 25 ppm, the remaining concentration of PCBs in soil will be 15 ppm or less. The VAP commercial and industrial land use generic direct contact soil standard for PCBs is 16 ppm.

URS Response to Comment 1:

The clarification statement made by Ohio EPA is correct; the complete statement is in the existing Soil Cleanup Application (Section 2.3, paragraph 4 and Section 5.1, paragraph 1). Following the presumptive soil removal activity from two on-parcel areas and based on the existing soil sampling and analysis characterization data, the remaining concentration of PCBs in on-parcel soil are anticipated to be 15 ppm or less.

Ohio EPA's statement regarding the VAP generic direct contact soil standard for PCBs under commercial and industrial land use of 16 ppm is accurate however, in the case of the Akron Airdock, applicable standards are being derived under property-specific risk assessment rules (Ohio Administrative Code [OAC] Chapter 3745-300-09) rather than under the generic standards of OAC Chapter 3745-300-08.

2. *Section 2.3 Soil Removal Areas:* ***It is stated that "soils containing PCBs greater than 25 ppm in individual soil core samples will be excavated." It should be clarified that this removal goal will result in the remaining concentration of PCBs in soil to be 15 ppm or less.***

URS Response to Comment 2:

Again, the clarification statement made by Ohio EPA is correct. Following the presumptive soil removal activity from two on-parcel areas and based on the existing soil sampling and analysis characterization data, the remaining concentration of PCBs in on-parcel soil is anticipated to be 15 ppm or less.

3. *Section 2.3 Soil On-Parcel, and Section 3.1.1 Southeast Area:* ***It is stated that "The average PCB concentration of all soil samples collected in the on-parcel area (156 samples) is 1.5 ppm and the 95 percent upper confidence level (UCL) is 1.8 ppm." Based on the sampling data, the concentrations of PCBs in soil are elevated in the southeast area of the property, as shown in Figure 4 and discussed in Section 3.1.1. As a result, excavation has been proposed in this area. In accordance with OAC 3745-300-07, the southeast area should be considered a separate identified area and its concentration determined separately from the remaining areas for all risk assessment purposes.***

URS Response to Comment 3:

We are treating the Southeast Area as a separate VAP identified area in the Draft Risk Assessment (see Section 1.2.1 and Figure 3 of the enclosed Draft Risk Assessment). A presumptive soil removal action will be initiated at the Southeast Area as described in the Soil Cleanup Application (Section 4). Accordingly, the Draft Risk Assessment relied upon sampling data collected below and adjacent to the excavation area to calculate the risk and hazard associated with potential exposure to residual PCBs in the Southeast Area. Based on those existing sampling data, the 95 percent confidence interval (UCL) of PCBs in soil at the Southeast Area is 4.9 ppm (Section 3.3.1, Surface Soil EPCs and Table 5). As detailed in Section 5.2.1.1, the total risk for industrial workers exposed to the Southeast Area is 6E-06 and is entirely the result of potential exposure to PCBs. The calculated risk is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

4. ***Section 2.3 Soil Off-Parcel and Section 3.2.1 South Area Off-Parcel*: It is discussed that 38 samples were collected, with only one location exceeding 1 ppm PCBs. Samples were collected at seven locations in the south areas, with sampling location LM-SO122 containing a level of 1.7 ppm PCBs. The extent of PCB contamination around this area should be verified. The South Area Off-Parcel Area does not currently meet the VAP applicable standard of 1.1 for total PCBs. The South Area is not contiguous with the North off-parcel Area and, therefore, should be assessed separately. Additional remediation and verification sampling appears to be warranted in the South Area.**

URS Response to Comment 4:

We are also treating the South Off-Parcel Area as a separate VAP identified area in the Draft Risk Assessment (see Section 1.2.1 and Figure 3 of the enclosed Draft Risk Assessment). Eight soil samples were collected from seven discrete locations in the South Off-Parcel Area and analyzed by a non-VAP Certified Laboratory. The maximum PCB soil sample from the South Off-Property Area is reported at 1.7 ppm and the 95 UCL of PCBs in all eight soil samples is 0.91 ppm (Section 3.3.1, Surface Soil EPCs and Table 5). As detailed in Sections 5.2.1.1, 5.2.1.2, and 5.2.3, the total risk values for off-property receptors (industrial workers, construction workers, and potential residents) are less than the applicable standards required under OAC Rule 3745-300-09 (C) (1) (b) (i). Therefore, no remediation is warranted in the South Area. Three verification soil samples will be collected from the South Off-Parcel Area for analysis of PCBs by a VAP Certified Laboratory to demonstrate compliance with applicable standards in the South Off-Parcel Area before the VAP No Further Letter is submitted.

5. ***Section 3 Sampling Locations, Figure 3*: Figure 3 shows the soil sample locations. Figure 3 should be modified to also show the PCB concentrations in soil at each location.**

URS Response to Comment 5:

There are different figures for the Soil Cleanup Application and the Draft Risk Assessment. Soil sampling locations are shown on Figure 9 of the Draft Risk Assessment. PCB concentrations for each sampling location are presented in Figure 11 (Southeast Area Soil Sampling Data and Proposed Excavation), Figure 12 (On-Property [Non-IA-Specific] Sampling Map), Figure 13 (Off-Property [North] Sampling Map) and Figure 14 (Off-Property [West] and Off-Property [South] Sampling Map).

6. ***Section 4.4 Verification Sampling*****:** ***In addition to the proposed sampling of the base of each excavation sub-area, the horizontal extent of the contamination needs to be verified or confirmed in accordance with OAC 3745-300-07. For example, in the southeast area, additional verification samples need to be taken horizontally, to the south, southwest, and west of LM-SO009 and LM-SO045, and to the north, northeast, and east of LM-SO051. Please make sure adequate verification sampling has been conducted to demonstrate that VAP applicable standards have been met around the proposed excavation areas. The maximum or 95% UCL for each VAP identified area must meet the applicable standard in accordance with OAC 3745-300-07, 08, and 09.***

URS Response to Comment 6:

It is our position that based upon the type of release, the physical conditions of the site, and the step-wise sampling approach used to delineate the extent of impact, adequate soil characterization sampling has been completed on the Airdock property and adjoining off-property parcels to meet the requirements of OAC 3745-300-07. As described in Section 3 of the Soil Cleanup Application, several rounds of soil sampling occurred over a four-year assessment program to delineate the vertical and lateral extent of PCB contamination. The exterior sampling program was biased toward areas expected to be directly impacted by the exfoliated siding material, which would be close to the Airdock itself, and the areas to which the siding pieces could have migrated via runoff or wind dispersion.

Additional confirmation samples will be collected during or prior to the soil removal activities to collect the necessary samples to verify the results of previous non-CL data from the Southeast Area, the Off-Property South Area and the Off-Property North Area to meet the requirements of rule OAC 3745-300-07(D)(1)(a)(iv)(c)(*ii*), which requires a minimum of 10 percent of the sampling population or 3 samples, whichever is greater, from each earlier, non-CL data set. Consequently, we are planning to collect four (4) samples from the Southeast Area, three (3) samples from the Off-Property North Area, and three (3) samples from the Off-Property South Area.

7. ***Section 5.1 Risk and Hazard Summary*****:** ***As discussed in the previous comments, the Southeast Area should be considered a separate identified area due to its relatively elevated concentrations and special distribution of PCBs. Similarly, the South Area off-parcel should be assessed separately from the North Area off-parcel. The Akron Airdock property is over 19 acres, with off-parcel areas that are discontiguous and far***

As noted in our response to Comments 3 and 4, the Draft Risk Assessment analyzes the Southeast Area and the Off-Property (South) Areas separately. Additionally, the Draft Risk Assessment analyzes the Off-Property (North), the Off-Property (West), and the On-Property Non-IA Specific Areas separately (see Figure 3 of the Draft Risk Assessment).

8. ***General VAP Risk Assessment Comment, Cumulative Risk:* Prior to initiation of excavation activities, the property specific risk assessment should be completed for the property and all identified areas, to assure that the VAP cumulative risk goals have been met for multiple chemicals of concern and complete exposure pathways (e.g., direct contact, vapor intrusion, etc.) in accordance with OAC 3745-300-09(C).**

URS Response to Comment 8:

The enclosed Draft Risk Assessment is being submitted with a request for a technical assistance review to provide Ohio EPA with additional details on the exposure pathway analysis and risk and hazard characterization for the property prior to the excavation activities and submission of the NFA Letter. The enclosed report reflects input provided by Ohio EPA from teleconferences held in 2006 under earlier technical review. Lockheed Martin is planning to conduct the soil removal activity in spring 2008.

9. ***General VAP Risk Assessment Comment, Impacts to Surface Water:* It is understood that after the cleanup of the pavement and soils has been completed, the storm drainage system will be addressed followed by Haley's Ditch. An assessment should be conducted to determine whether PCBs remaining in the soils on the property could result in ongoing and future PCB contamination entering the storm drainage system and emanating from the property. This potentially complete PCB migration pathway needs to be assessed to demonstrate that applicable standards have been met.**

URS Response to Comment 9:

URS completed an evaluation of the sediment to surface water exposure pathway in the enclosed Draft Risk Assessment. The evaluation, presented as Appendix E, is a hypothetical sediment loading and water quality analysis that compares modeling results to applicable standards at the off-property point of discharge (Haley's Ditch). The evaluation uses a mass balance model based on soil loss and certain conservative assumptions to estimate 1) the worst-case, upper bound water quality impact to Haley's Ditch from residual PCB-impacted soils from the Airdock property following remediation, and 2) the maximum concentration of PCBs in sediment at the discharge point from the watershed. The modeling results indicate that the upper-bound concentration of PCBs in stormwater is less than the most stringent Great Lakes water quality standard at the discharge point and that the corresponding PCB concentration in sediment is less than the VAP direct contact standard of 1.1 ppm. These results provide weight-of evidence to support the conclusion that the soil remedy on the Airdock property will meet applicable standards.

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Please contact me if you have any questions or comments during your review of the Draft Risk Assessment, or if further information is needed.

Sincerely,

URS Corporation

Jennifer J. Krueger

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Project Manager

Enclosure

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OHIO VOLUNTARY ACTION PROGRAM
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

DRAFT

MARCH 12, 2008

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SIGNATURE PAGE

PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
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CONTENTS

CONTENTS (Continued)

CONTENTS (Continued)

APPENDICES

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

µg/L = Micrograms per liter
ABS = Dermal Absorption factor
ABSC = Aircraft Braking Systems Corporation
ADD = Average daily dose
AF = Adherence factor
ASHRAE = American Society of Heating, Refrigeration, and Air-Conditioning Engineers
AT = Averaging time
ATSDR = Agency for Toxic Substances and Disease Registry
B = Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis
BBL = Blasland, Bouck & Lee, Inc.
BUSTR = Bureau of Underground Storage Tank Regulations
BW = Body weight
CAFO = Consent Agreement and Final Order
CFR = Code of Federal Regulations
cm^2 = Square centimeter
cm^3/g = Cubic centimeters per gram
COPC = Chemical of potential concern
CORF = Clean Ohio Revitalization Fund
CSM = Conceptual site model
DA$_{event}$ = Absorbed dose per event
Di = Air diffusivity
Dw = Water diffusivity
ED = Exposure duration
EF = Exposure frequency
ELCR = Excess lifetime cancer risk
EPA = U.S. Environmental Protection Agency
EPC = Exposure point concentration
ER = Air exchange rate
ET = Exposure time
EV = Event frequency
FR = Fraction absorbed water
GAC = Goodyear Aerospace Corporation
GI = Gastrointestinal
Goodyear = Goodyear Tire and Rubber Corporation
GNS = Generic numerical standard
H’ = Dimensionless Henry’s Law constant
HEAST = Health Effects Assessment Summary Tables
HI = Hazard index
HQ = Hazard quotient
IA = Identified area
InR = Inhalation rate
IR = Ingestion rate
IRIS = Integrated risk information system
J&E = Johnson and Ettinger
Kd = Soil-water partition coefficient
kg = Kilogram
kg/mg = Kilogram per milligram
Kp = Dermal permeability coefficient in water
LADD = Lifetime average daily dose
LATA = Los Alamos Technical Associates, Inc.

LMC = Lockheed Martin Corporation
LNAPL = Light, non-aqueous phase liquid
LOAEL = Lowest observed adverse effect level
m^3/hour = Cubic meters per hour
m^3/kg = Cubic meters per kilogram
MCL = Maximum contaminant level
mg/µg = Milligrams per microgram
mg/cm^2-event = Milligrams per square centimeter per event
mg/kg = Milligrams per kilogram
mg/kg-day = Milligrams per kilogram per day
msl = Mean sea level datum
MTBE = Methyl tertiary butyl ether
NA = Not applicable
NCEA = National Center for Environmental Assessment
NOAEL = No observed adverse effect level
OAC = Ohio Administrative Code
ODC = Ohio Department of Commerce
ODOD = Ohio Department of Development
OERR = Office of Emergency and Remedial Response
Ohio EPA = Ohio Environmental Protection Agency
OSWER = Office of Solid Waste and Emergency Response
PAH = Polynuclear aromatic hydrocarbon
PCB = Polychlorinated biphenyls
PEF = Particulate emission factor
RAGS = Risk Assessment Guidance for Superfund
RAP = Remedial action plan
RfD = Reference dose
RME = Reasonable maximum exposure
RPM = Robertson Protected Metal
SA = Surface area
SCPA = Summit County Port Authority
SE = Southeast
sf = Square foot
SF = Slope factor
STD = Standard
T* = Time to reach steady-state
Tevent = Lag time per event
Tetra Tech = Tetra Tech Inc.
TSCA = Toxic Substances Control Act
95 UCL = 95 percent upper confidence limit
USD = Urban Setting Designation
URS = URS Corporation
UST = Underground storage tank
VAP = Voluntary Action Program
VDEQ = Virginia Department of Environmental Quality
VF = Volatilization factor
VOC = Volatile organic chemical
Weston = Weston Solutions, Inc.
ZVI = Zero valent iron

EXECUTIVE SUMMARY

Introduction

The Akron Airdock facility, located in Akron, Ohio, is undergoing remediation under the Ohio Voluntary Action Program (VAP) for Lockheed Martin Corporation (LMC)'s aerospace manufacturing redevelopment project. Summit County Port Authority (SCPA), the current property owner, is Grantee of a Round 3 Clean Ohio Revitalization Fund (CORF) grant along with development partner LMC to support redevelopment of the Airdock parcel. On behalf of LMC, Tetra Tech EM Inc. (Tetra Tech) completed a property-specific risk assessment in accordance with the procedures specified in Ohio Administrative Code (OAC) 3745-300-09, to evaluate the potential human health risks and hazards posed by environmental impacts associated with surface and subsurface media in selected identified areas at the Airdock. The purposes of the property-specific risk assessment presented in this document are to (1) assess and characterize potential human health exposures and risks, respectively, (2) determine whether identified risks exceed target levels, and (3) for target levels that are exceeded, assess the need for and extent of remedial actions, including determination of chemical- and medium-specific remedial objectives.

Background

The Airdock property is located in the southern portion of the Akron metropolitan area in Summit County, Akron, Ohio. The property consists of an approximately 19-acre parcel located within an industrial complex situated north of Waterloo Road (U.S. Route 224) and south of City of Akron's Fulton International Airport.

In 2003, LMC discovered and reported to EPA Region 5 that the Airdock was constructed with corrugated roofing and siding material composed of Robertson Protected Metal (RPM), a material that contains non-liquid PCBs. Subsequent to the discovery, LMC voluntarily initiated a broad-based sampling program to characterize the presence and extent of polychlorinated biphenyls (PCB) contamination inside and surrounding the Airdock.

The Goodyear Tire & Rubber Company (Goodyear), a former property owner/operator, is responsible for ongoing remediation of groundwater and conducts long-term groundwater extraction, treatment and monitoring at the facility. In 2005, Goodyear initiated source control measures at VAP Identified Area (IA) 9, the Former Plate Shop/Vapor Degreaser using zero valent iron (ZVI) treatment. Goodyear is also working cooperatively with LMC to address certain VAP response requirements with respect to groundwater under OAC 3745-300-10.

Remedial activities pursuant to Toxic Substances Control Act (TSCA) and Federal PCB regulations have been underway at the Airdock since 2003. Prior remedial efforts focused on repairing RPM siding and roofing material, preventing movement of siding material released in the past, and determining the extent of PCB-containing materials in the areas adjacent to the Airdock and the stormwater drainage pathway. These activities consisted primarily of the following:

- Removing visible siding debris from the ground surface surrounding the Airdock
- Replacing the Airdock's vertical siding panels and RPM walls of the door motor buildings and electrical substation building
- Covering the Airdock roof and doors with a rubber membrane
- Replacing all gutters and downspouts
- Cleaning all accessible storm drain catch basins and visually inspecting the storm drain pipes
- Installing and maintaining filter fabric on all storm drain catch basins
- Collecting pavement, siding, and soil samples for laboratory analysis

The remaining remedial efforts for the exterior of the Airdock consist of encapsulating siding materials containing PCBs on the two small pinhouse structures on the Airdock roof, final cleanup of the ground surrounding the Airdock including removal and disposal of some soils containing PCBs, followed by final cleaning of the storm drainage system. These actions will eliminate exterior sources of PCBs and prevent future releases of PCBs from the 19-acre parcel.

As presented in previous VAP Phase I and II property assessment reports, 13 identified areas (IA) have been recognized within the parcel as follows:

IA No.	IA Description
1	Former Underground Storage Tanks (UST) – Northeast corner of Plant A (LMC Location 4)
2	Former UST – Motor Run-In Building (LMC Location 8)
3	Former Resource Conservation and Recovery Act (RCRA) Drummed Waste Storage Area
4	Former RCRA Waste Oil Storage/ Former Bondolite Process Area
5	Former RCRA Drummed Cyanide Waste Storage Area
6	Former RCRA Acid/Alkali waste storage tanks (Building 113)
7	Former RCRA Flammable Liquid Storage (Building 116)
8	Airdock ABSC Operations: Coolant Sump in northwest corner
9	Airdock ABSC Operations: Former Plate Shop and Degreaser
10	Airdock ABSC Operations: Press Shop (Area 1)
11	Airdock ABSC Operations: Open Area at North End of Airdock
12	Plant A Photocopy Lab/X-ray Area
13	Airdock Roofing and Siding, and PCB Impacted Areas

Risk Assessment Scope and Approach

The scope of the risk assessment is limited to evaluating potential human exposures to contaminants present in soil and groundwater at these IAs. At this time, IA 13 only includes PCB-impacted areas on the Airdock property. Sediment samples collected at Haley's Ditch outside of the Airdock property appear to contain PCBs that emanated from the Airdock in the past. Additional assessments are being conducted to delineate the extent of impact of historical releases and to determine the course of action necessary to respond to the off-property impact of these historical releases. For purposes of VAP, this report focuses on Haley's Ditch only to the extent relevant to demonstrate that, post-remediation, the Airdock property will not in the future contribute PCBs to Haley's Ditch at concentrations above applicable regulatory levels. Finally, this property-specific risk assessment is being conducted during implementation of voluntary remedial actions at the property. The conclusions of the property-specific risk assessment will be used to focus remediation of the remaining IAs and, to the extent necessary, design appropriate work restrictions. Once confirmatory samples are collected following remediation, the property-specific risk assessment will be re-visited to demonstrate compliance with applicable standards in support of the No Further Action Letter.

Risk assessment is typically conducted in four basic steps: (1) data evaluation and identification of chemicals of potential concern (COPC), (2) exposure assessment, (3) toxicity assessment, and (4) risk and hazard characterization. These four steps, as well as a risk assessment summary and recommendations for future remediation, are presented herein.

The property-specific risk assessment was completed in a manner consistent with the procedures specified in OAC 3745-300-09. In the future the Airdock will be used for aerospace manufacturing. Consistent with a future industrial land use, the risk assessment evaluated potential exposures to two groups of receptor: industrial workers and construction/excavation workers. The risk assessment included evaluation of potential location-specific exposures, risks, and hazards at IA 1, IA 4 (IAs 3, 4, and 5 were considered together and are referred to collectively as "Combined IA 4"), IA 9 (also represents a conservative surrogate for IA 10), IA 11, and IA 13 (specifically the Southeast Area, the On-Property [non-IA-specific] area, and Off-Property [North], Off-Property [South], and Off-Property [West] areas). The property-specific risk assessment evaluated the potential indoor air pathway in portions of the Airdock that overlie the chlorinated volatile organic chemical (VOC) plume, a pathway for which there are no generic standards (OAC 3745-300-09(2)(a)). The mandatory requirement to conduct a property-specific risk assessment when important ecological resources or sediments are impacted by hazardous substances (OAC 3745-300-09(2) (d)) was addressed by an evaluation of the maximum estimated concentration of PCBs in Haley's Ditch surface water resulting from off-property migration via run-off of low-level PCB-impacted soil from unpaved areas adjacent to the Airdock.

Results

Medium-specific concentrations detected in soil and groundwater at the selected IAs were evaluated to identify COPCs. Chemicals detected at a maximum concentration exceeding a value of one-tenth its medium-specific Ohio EPA VAP Generic Numerical Standard value for industrial and commercial land use categories were identified as COPCs. The COPCs identified and carried through the risk assessment are as follows (Note: these chemicals are considered COPCs for both soil and groundwater unless otherwise noted):

- Benzene
- 1,1-Dichloroethene
- *cis*-1,2-Dichloroethene
- *trans*-1,2-Dichloroethene
- Ethyl benzene
- Toluene
- Trichloroethene
- Vinyl chloride
- Benzo(a)anthracene (soil only)
- Benzo(b)fluoranthene (soil only)
- Benzo(a)pyrene (soil only)
- Dibenzo(a,h)anthracene (soil only)
- PCBs (soil only)
- Arsenic
- Beryllium
- Cadmium (soil only)
- Lead
- Mercury
- Nickel

Risks and hazards were evaluated separately for industrial and construction/excavation workers. These results are summarized below.

- Risks and hazards associated with the Combined IA 4, IA 11, Southeast Area, on-property (non-IA-specific), Off-Property (North), Off-Property (South), and Off-Property (West) locations are less than receptor-specific target cumulative risks and hazards. Therefore, remediation at these IAs is not required.

- Risks and hazards at IA 1 exceed the target cumulative risk and hazard for construction/excavation workers. These risks and hazards are driven by potential exposure to benzene in construction trench air (Note: the benzene groundwater concentration, 210 µg/L, used in the calculations is associated with monitoring well NW-4; the concentration of benzene in other monitoring wells at IA 1 is significantly lower). Implementation of work restrictions may be warranted at IA 1, particularly near monitoring well NW-4.

- Hazards at IA 9 exceed the target cumulative hazard for construction/excavation workers. The hazard for construction/excavation workers is driven by incidental ingestion of and dermal contact with cadmium in subsurface soil. Implementation of work restrictions may be warranted with regard to potential exposure to cadmium in subsurface soil.

The conclusions drawn from this risk assessment are also summarized in the following tables:

Risk Assessment Outcome for Industrial Worker Scenario

Area	Risk	Hazard	Recommended Action
Combined IA 4	Pass	Pass	No Action Required
IA 9	Pass	Pass	No Action Required
IA 11	Pass	Pass	No Action Required
Southeast Area*	Pass	Pass	No Action Required
On-Property (non-IA-specific)*	Pass	Pass	No Action Required
Off-Property (North)	Pass	Pass	No Action Required
Off-Property (South)	Pass	Pass	No Action Required
Off-Property (West)	Pass	Pass	No Action Required

* Assumes soil removal is implemented as described in Section 2.1.2.

Risk Assessment Outcome for Construction Worker Scenario

Area	Risk	Hazard	Recommended Action
IA 1	Fail	Fail	Institute Risk Mitigation Plan
Combined IA 4	Pass	Pass	No Action Required
IA 9	Pass	Fail	Institute Risk Mitigation Plan
IA 11	Pass	Pass	No Action Required
Southeast Area*	Pass	Pass	No Action Required
On-Property (non-IA-specific)*	Pass	Pass	No Action Required
Off-Property (North)	Pass	Pass	No Action Required
Off-Property (South)	Pass	Pass	No Action Required
Off-Property (West)	Pass	Pass	No Action Required

*Assumes soil removal is implemented as described in Section 2.1.2.

Finally, based on a conservative modeling exercise, the maximum concentration of PCBs in the waters of Haley's Ditch at the discharge point that could be attributable to the Airdock property in the future was estimated to be 0.018 nanograms per liter (ng/L). This estimated value is less than the lowest of the Lake Erie drainage basin water quality criteria for protection of human health Outside Mixing Zone Average water quality criteria of 0.026 ng/L (OAC 3745-1-33, Table 33-2). The corresponding PCB concentration in sediment that may in the future be discharged from the Airdock property is estimated to be 0.04 milligram per kilogram (mg/kg). This concentration is less than the VAP Standard for Residential Direct Contact of 1.1 mg/kg (OAC 3745-300-8 Generic Numerical Standards, Table II: Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Residential Land Use Category).

Based on the summary and conclusions and consistent with VAP response requirements specified in OAC 3745-300-09 for industrial properties, additional voluntary actions are recommended at specific areas of the Airdock property to meet and maintain applicable standards. The areas at which additional remedial actions are recommended are IA 1 and IA 9. For both of these areas, the potential risks and hazards posed to construction workers are recommended to be managed through the development of risk mitigation measures.

This property-specific risk assessment was conducted concurrently with implementation of voluntary, presumptive remedial actions at the property. Following full implementation of the remedial action plan, and upon completion of final confirmatory samples, the property-specific risk assessment will be re-visited and updated to demonstrate compliance with applicable standards in support of the VAP No Further Action Letter.

1.0 INTRODUCTION

On behalf of Lockheed Martin Corporation (LMC), Tetra Tech Inc. (Tetra Tech) completed Phase I and II Property Assessment reports following the Ohio Environmental Protection Agency's (Ohio EPA) Voluntary Action Program (VAP) standards for the Akron Airdock facility in Akron, Ohio (see Figure 1) (Tetra Tech 2005a, b). The Airdock property is approximately 19 acres in area and is located in the northwestern portion of a large industrial complex (see Figure 2). In 2006, Tetra Tech prepared a Supplemental Phase II Property Assessment (Supplemental Phase II) for the Airdock parcel to address data gaps associated with the earlier Phase I and II reports and to augment new information from ongoing assessments at the Airdock parcel (Tetra Tech 2006b). Summit County Port Authority (SCPA), the current owner of the Airdock property, is the Grantee of a Round 3 Clean Ohio Revitalization Fund (CORF) grant (Ohio Department of Development [ODOD] 2006) to support remediation of the property for LMC's Airdock redevelopment project.

The Phase I, Phase II, and Supplemental Phase II reports identified potential adverse environmental impacts associated with surface and subsurface media in selected identified areas at the Airdock (Tetra Tech 2005a, 2005b, 2006b). The purposes of the property-specific risk assessment (risk assessment) presented in this document are to (1) assess and characterize potential human health exposures and risks, respectively, (2) determine whether identified risks exceed target levels, and (3) for target levels that are exceeded, assess the need for and extent of remedial actions, including determination of chemical- and medium-specific remedial objectives (RO). The property-specific risk assessment was conducted in accordance with the procedures specified in Ohio Administrative Code (OAC) 3745-300-09.

The remainder of this section summarizes the site history (Section 1.1), presents the risk assessment scope and technical approach (Section 1.2), and discusses the risk assessment report organization (Section 1.3).

1.1 SITE HISTORY

This section describes the property location and layout (Section 1.1.1), summarizes property operations (Section 1.1.2), and summarizes major remedial actions (Section 1.1.3). The information is condensed from the Phase I and Phase II reports (Tetra Tech 2005a, b, and 2006b), along with updated information provided by LMC.

1.1.1 Property Location and Description

The Airdock property is located in the southern portion of the Akron metropolitan area in Summit County, Akron, Ohio. The property consists of an approximately 19-acre parcel located within an industrial complex situated north of Waterloo Road (U.S. Route 224) and south of City of Akron's Fulton International Airport (see Figures 1 and 2). The property and surrounding land are nearly level, with a surface elevation of 1,043 feet mean sea level datum (msl). No surface water features are on the property, which is located immediately north of an east-west trending hydrologic divide. Runoff from the Airdock property is collected in two 30-inch-diameter stormwater sewers that run parallel to the western and eastern lengths of the Airdock, before converging on airport property to the north. The storm sewer eventually discharges to LMC-owned property north of Triplett Boulevard approximately 0.75 mile north of the Airdock (see Figure 1), before discharging to Haley's Ditch.

Primary structures at the Airdock property include the following buildings (with historical numbers and building names) (see Figure 3):

- Plant A (Airdock)
- Building 102, Helium Compressor/Fire Suppression
- Building 103, Electrical Substation/Transformer House
- Building 105, Outer Press Room
- Building 108, Motor Run-In
- Building 113, Former Acid/Alkali Waste Storage Facility
- Building 112/116, Former Flame Cutting and Storage.

The parcel is dominated by the Airdock with its 364,000-square-foot (sf) footprint. Paved parking areas and roadways surround the Airdock except for limited grass and unpaved areas along the southeastern side of the structure, and north of the pavement surrounding the northern end of the Airdock (see Figure 3). A chain-link fence completely surrounds the property. Access to the parcel is from a security gate at Emmitt Road, south of the Airdock. Adjoining properties and respective orientations are former Aircraft Braking Systems Corporation (ABSC, now Meggitt) to the east, LMA Commerce LLC to the south and west, and the Akron-Fulton International Airport to the north.

1.1.2 Property Operations and Ownership

Originally constructed in 1929 by Goodyear Zepplin as an airship factory, the Airdock is 1,175 feet long, 325 feet wide, and 211 feet high, with 13 alloy arch supports built on 80-foot centers, resulting in enormous uninterrupted floor space under a single roof. Semi-spherical clam-shell door systems at both ends of the structure were used to allow airship entry and exit, with launching conducted from the adjoining airfield. In the 1940s and 50s, interior shop and office buildings were constructed along the eastern and western sides, in addition to a connected exterior press shop (Building 105 located on the east side), creating a total Airdock surface area of 433,085 sf.

Goodyear Aerospace Corporation (GAC) operated the Airdock facility until the property was sold to Loral Defense Systems in 1987. Goodyear manufacturing operations involved metal coating and cadmium-cyanide plating, hazardous waste storage, X-ray laboratory, photographic laboratory, assembly, and metal press and die operations. Loral Defense Systems, a predecessor-in-interest to LMC, entered into an occupancy agreement with ABSC in 1991 covering approximately 12 acres of the property, including the entire Airdock. ABSC used the Airdock for parts and equipment storage, press shop operations, repair of aircraft braking systems, and metal salvage operations. LMC continued to lease most of the Airdock parcel to ABSC through the 1990s and up to late 2005, except for a 2,000-sf X-ray laboratory used by LMC, and limited use of the southern high bay area for infrequent lift testing of military aerostats. Meggitt, formerly ABSC, currently owns and operates the adjoining parcel, located directly east of the Airdock parcel. The property owned by Meggitt includes Plant B and Plant F, both of which were originally part of the larger industrial complex when it was under ownership and operation of the Goodyear Tire and Rubber Corporation (Goodyear) and GAC.

The Akron Airdock was transferred to SCPA on December 31, 2005. SCPA and development partner LMC were awarded a Round 3 CORF grant in 2006 to subsidize remediation of the Airdock for redevelopment. LMC leases the Airdock property from SCPA through an occupancy and construction agreement dated January 1, 2006.

1.1.3 Remedial Actions

This section discusses remedial actions regarding groundwater (Section 1.1.3.1) and non-liquid polychlorinated biphenyls (PCB) (Section 1.1.3.2). It also discusses the current remedial action plan for the property (Section 1.1.3.3).

1.1.3.1 Groundwater

Goodyear, a former property owner/operator, is responsible for ongoing remediation of groundwater and conducts long-term groundwater treatment and monitoring at the site. The responsibility for remediating groundwater was established in an Environmental Agreement between Goodyear and Loral dated March 13, 1987. Goodyear conducted most of the groundwater assessments in the 1980s and 1990s as part of a voluntary, facility-wide corrective action program to address impacts associated with several waste management units. Remedial efforts to address the elevated chlorinated solvent concentrations in groundwater beneath and emanating from the Airdock property began in 1993 with the installation of a groundwater pump-and-treat remediation system. The facility-wide remediation system functions by recovering and treating impacted groundwater from 11 extraction wells, 4 of which are located at or close to the Airdock (RW-1A, RW-2A, RW-3A, and RW-4A (see Figure 4). The northern portion of the extraction system was temporarily shut-down in 2006 as electrical service to the Airdock was modified during construction activities. The current groundwater plume emanating from the Airdock is characterized by trichloroethene and the associated breakdown products cis-1,2-dichloroethene and vinyl chloride.

In 2005, Goodyear voluntarily initiated source control measures at VAP Identified Area (IA) 9, the Former Plate Shop/Vapor Degreaser (see Figure 5), using zero valent iron (ZVI) injections to accelerate the removal and breakdown of concentrated solvent mass in the subsurface (Sharp and Associates, Inc. [Sharp] 2005a).

Goodyear is working cooperatively with LMC to address certain VAP response requirements with respect to groundwater under rule OAC 3745-300-10, including protection of groundwater meeting unrestricted potable use standards. Goodyear and its consultant, Floyd Browne Group, in conjunction with City of Akron, requested an Urban Setting Designation (USD) for a portion of the airport property and northern two-thirds of the Airdock parcel (Floyd Browne Group 2006). Specifically, this USD is referred to as the Akron East USD Extension (see Figure 6). Ohio EPA is expected to approve the USD by the end of first quarter 2008 (URS 2008).

1.1.3.2 Non-Liquid PCBs

In December 2003, LMC notified EPA Region 5 of a discovery that the Airdock was constructed with corrugated roofing and siding material composed of Robertson Protected Metal (RPM), a building material that contains non-liquid PCBs. According to a technical description prepared by LMC (LMC 2005a), the RPM material consists of five components: steel sheet metal, asphalt, asbestos felt (impregnated with a fire-retardant, Aroclor 1268), bitumen, and aluminum paint. The combination of asphalt and steel and their mismatched coefficients of thermal expansion, degree of asphalt oxidation, and dryness due to over 75 years of aging and the seasonal temperature fluctuation, apparently resulted in the exfoliation of the RPM coating over time (LMC 2005b). The PCB that was found in the RPM, Aroclor 1268, is solid at room temperature and almost insoluble in water. Its mobility in the exterior environment therefore is extremely limited, and it is present only as a constituent of variously sized small, solid particles. As a result, it was necessary to assess the Airdock property for PCBs, specifically in the interior and exterior areas potentially affected by the exfoliated RPM material.

Upon discovery of the PCB-containing RPM, LMC voluntarily initiated a broad-based sampling program to characterize the extent of PCB contamination inside the Airdock. In addition, LMC developed a risk-based sampling and cleaning protocol for equipment and other items that were stored and used in the Airdock. This protocol was eventually amended and approved by EPA in June 2004 under the Toxic Substances Control Act (TSCA) and Federal PCB regulations under 40 *Code of Federal Regulations* (CFR), Section 761.61 (c). The implementation of a risk-based sampling and cleaning protocol (“Sampling and Release Protocol”) resulted in the collection and analysis of hundreds of PCB bulk and wipe samples (EPA 2004c).

The target areas for exterior assessment were those expected to be directly impacted by the exfoliated RPM, which would be close to the Airdock itself, and the areas to which the RPM could have migrated via runoff or wind dispersion. A route of potential environmental exposure included the site stormwater piping system, which receives runoff with sediment and debris that collects along the exterior of the building. A phased sample collection effort was conducted in September 2003, June 2004, and June 2005. Samples were collected of various media, including debris around the exterior of the building, outdoor pavement borings, sediment in catch basins, soil, and sediment from Haley’s Ditch.

A Consent Agreement between EPA Region 5 and LMC, and a related Final Order (CAFO) were entered on May 5, 2005, outlining conditional use of the Airdock because of the non-liquid PCB content of materials used to construct the Airdock (TSCA-05-2005-0016) (EPA 2005). The CAFO states that use of the Airdock must be limited to the following activities for no more than 24 months from the date of the CAFO: (1) assembly and testing of no more than four Aerostats, (2) ABSC operations, and (3) emergency testing of an Aerostat for the United States Army.

1.1.3.3 Current Remedial Action Plan and Status

The Airdock is undergoing remediation as part of redevelopment to return the facility to its original purpose to support manufacturing and testing for the aerospace and defense sectors. SCPA and development partner LMC applied for an ODOD Brownfields grant in August 2005 to provide partial funding for the costly PCB remediation program. A condition of the grant, known as a CORF grant, is to clean up the property in accordance with Ohio EPA's VAP, as set forth in OAC Chapter 3745-300-1-15.

Remedial activities pursuant to TSCA and Federal PCB regulations have been underway at the Airdock since 2003. Prior remedial efforts focused on repairing PRM roofing and siding material, preventing movement of RPM roofing and siding material released in the past, and determining the extent of PCB-containing materials in the areas adjacent to the Airdock and the stormwater drainage pathway. These activities consisted primarily of the following:

- Removing visible siding debris from the ground surface surrounding the Airdock
- Replacing the Airdock's vertical siding panels and RPM walls of the door motor buildings and electrical substation building
- Covering the Airdock roof and doors with a rubber membrane
- Replacing all gutters and downspouts
- Cleaning all accessible storm drain catch basins and visually inspecting the storm drain pipes
- Installing and maintaining filter fabric on all storm drain catch basins
- Collecting pavement, siding, and soil samples for laboratory analysis.

The remaining remedial efforts for the exterior of the Airdock consist of encapsulating siding materials containing PCBs on the two small pinhouse structures on the Airdock roof, final cleanup of the ground surrounding the Airdock including removal and disposal of some soils containing PCBs, followed by final cleaning of the storm drainage system. These actions will eliminate exterior sources of PCB releases and prevent future releases of PCBs from the 19-acre parcel.

The current remedial action plan (RAP) includes a combination of elements under the self-implementing provisions and the risk-based disposal provisions of 40 CFR § 761.61, (a) and (c), respectively, to complete remediation of the property.

Airdock Interior

Decontamination of the Airdock interior involved three primary activities to clean and coat the affected surfaces:

1. Repairing and sealing the interior surface of the RPM siding material covering the entire Airdock to prevent further dust generation. A primer and final paint coating system was used to seal the RPM.
2. Removing dust and debris from the structural steel and interior building surfaces by cleaning methods including vacuuming and wiping using solvent liquid solutions.
3. Sealing the floor with a double-coated sealant.

The cleaning and coating project was conducted between March and October 2007. Decontamination standards for the interior surfaces are based on TSCA standards approved by EPA. By prior agreement between Ohio EPA and EPA (Ohio EPA 2005), the PCB decontamination activity will not be included in the VAP risk assessment. Otherwise, the Airdock Parcel will be remediated to meet applicable standards in accordance with the VAP.

In preparation for the interior cleaning and coating project, a former tenant of the property, ABSC, vacated the property in early 2006. Also, certain structural components at the Airdock were demolished including the removal of the Danly Press Building and the dismantling of the Repair and Overhaul Building in the Airdock interior.

Airdock Exterior

Approximately 25 percent of the original RPM panels were replaced in 1976 with non-PCB-containing materials. A Urethane foam/silicon cover was applied to the doors and east side of the Airdock from arches 9 to 13 between 1985 and 1987. Remaining roof and siding areas were covered with rubber sheeting starting in 1992, with 90 percent of the Airdock exterior encapsulated by 2003 (LMC 2003). The remediation strategy for the exterior of the Airdock and the surrounding areas is to fully encapsulate the exterior roof and siding, or remove and replace remaining siding materials that may contain PCBs. Once source control is accomplished, final cleanup of the ground surrounding the Airdock will be performed, followed by final cleaning of the storm drainage system. These actions will eliminate exterior sources of exfoliated siding and prevent future releases. The original exterior remediation plan was submitted to EPA in June 2005 (LMC 2005c) and updated in June 2007 (LMC 2007c). A risk-based application for soil removal actions was submitted to EPA in August 2007 (LMC 2007d).

Ongoing PCB remediation and demolition activities are being coordinated by LMC and its general environmental contractor, Arcadis - Blasland, Bouck & Lee, Inc. (Arcadis-BBL). To date, the RPM bottom paneling on the Airdock has been removed and replaced with new painted aluminum corrugated siding along with replacement roof and siding on all four motor buildings. Other improvements have included applying new rubber membranes over the north door and the door lips, installing new gutters and downspouts, and implementing a stormwater runoff control program. Assessment activities to delineate the extent of historic PCB impact at Haley's Ditch continue as part of a separate voluntary action initiated by LMC.

Groundwater response requirements are being coordinated with Goodyear and will be reported in a stand-alone report after additional Phase II property assessments are completed.

1.2 RISK ASSESSMENT SCOPE AND TECHNICAL APPROACH

This section summarizes the scope (Section 1.2.1) and technical approach (Section 1.2.2) of the risk assessment.

1.2.1 Risk Assessment Scope

As presented in the Phase I and II reports and the Supplemental Phase II report, releases of hazardous substances and petroleum have occurred on, underlying, and in the case of groundwater, are emanating from the property (Tetra Tech 2005a, 2005b, 2006b; Brownfield Restoration Group, LLC, 2007). In the Phase I, 13 IAs were recognized within the parcel, as follows (see Figure 5):

IA No.	IA Description
1	Former Underground Storage Tanks (UST) – Northeast corner of Plant A (LMC Location 4)
2	Former UST – Motor Run-In Building (LMC Location 8)
3	Former Resource Conservation and Recovery Act (RCRA) Drummed Waste Storage Area
4	Former RCRA Waste Oil Storage/ Former Bondolite Process Area
5	Former RCRA Drummed Cyanide Waste Storage Area
6	Former RCRA Acid/Alkali waste storage tanks (Building 113)
7	Former RCRA Flammable Liquid Storage (Building 116)
8	Airdock ABSC Operations: Coolant Sump in northwest corner
9	Airdock ABSC Operations: Former Plate Shop and Degreaser
10	Airdock ABSC Operations: Press Shop (Area 1)
11	Airdock ABSC Operations: Open Area at North End of Airdock
12	Plant A Photocopy Lab/X-ray Area
13	Airdock Roofing and Siding, and PCB Impacted Areas

The scope of the risk assessment is limited to evaluating potential human exposures to contaminants present in soil and groundwater at these IAs and in soil outside the Airdock property, but directly adjoining the parcel within the surrounding airport or industrial property. For the purposes of the risk assessment, soil within the Airdock property, but not associated with IAs 1 through 12 is divided into two areas – the Southeast Area and the On-Property [non-IA-specific] area. Likewise, soil outside the Airdock property, but within the surrounding airport or industrial property is divided into three areas referred to as – Off-Property (North), Off-Property (South), and Off-Property (West).   Sediment samples collected at Haley's Ditch appear to contain PCBs that came from past releases from the Airdock. Additional assessments of Haley's Ditch are being conducted to delineate the extent of the historic contamination and to determine the appropriate response to this off-property impact.   However, this report does not address historic offsite contamination. Consistent with VAP, this report evaluates the potential for future off-property impacts caused by the Airdock property post-remediation.   An assessment of compliance with applicable standards in the storm water drainage pathway based on the target cleanup level for PCBs in soil is addressed in Section 3.4.

Finally, this property-specific risk assessment is being conducted concurrently with implementation of voluntary remedial actions at the property, most of which were already initiated as presumptive remedies. The conclusions of the property-specific risk assessment will be used to focus remediation of the remaining IAs, and in the specific case of IA 9 and the limited exterior areas with PCBs in soil, to develop risk-based cleanup targets. Once confirmatory samples are collected following remediation, the property-specific risk assessment will be re-visited to demonstrate compliance with applicable standards in support of the VAP No Further Action Letter (NFA) and Covenant Not to Sue (CNS).

Figure 7 summarizes the exposure scenarios (human receptors, exposure routes, and exposure point combinations) considered in the risk assessment (these exposure scenarios are discussed in greater detail in Section 3.0). In order to focus the risk assessment, the maximum concentration of each chemical detected at each IA was compared to VAP generic numerical standards (OAC 3745-300-08). The proposed end use of the parcel is continued industrial manufacturing in the aerospace/defense sectors. Therefore, for preliminary screening purposes, the appropriate generic numerical standards (GNS) are those associated with a commercial or industrial land use (soil) and unrestricted potable use standards for groundwater. The chemical-specific GNS values considered in the risk assessment are presented in Tables 1 and 2.

These comparisons were originally completed as part of the Phase 2 report (Tetra Tech 2005b). As noted in the Supplemental Phase 2 report, "The March 2006 sampling data from all of the Identified Areas are generally consistent with previous sampling data collected during prior investigations" (Tetra Tech 2006b). Consistent with this statement the results of comparing maximum detected chemical concentrations to appropriate GNS values were not impacted by inclusion of the supplemental data.

The following seven IAs were identified as having one or more chemicals in either or both soil (less than or equal to 10 feet below ground surface [bgs]) and groundwater at concentrations above medium-specific GNS values: IA 1, IA 4, IA 5, IA 9, IA 10, IA 11, and IA 13.

For the purposes of the risk assessment, the definition of IA 1 was expanded from its original definition as presented in the Phase I report (Tetra Tech 2005a). Specifically, IA 1 was described as "former underground storage tanks (UST) – Northeast corner of Plant A (LMC Location 4)." While conducting fire hydrant repair activities at HYD 105, petroleum-impacted soils were encountered about 2 to 3 feet bgs (BBL 2006b). Associated analytical results identified the presence of several PAHs and total petroleum hydrocarbon, as diesel (LMC 2007b). Therefore, for the purposes of the property-specific risk assessment, IA 1 was expanded to the south to include HYD 105 (see Figure 8). It should be noted that as redefined, IA 1 groundwater is now characterized by well A-3 in addition to the previously included well A-1.

Also, IAs 3, 4, and 5 were considered together (they are located adjacent to each other) and are collectively referred to as "Combined IA 4." Also, IA 10 was not directly evaluated for the following reasons. First, the maximum concentration of arsenic measured in soil at IA 10 (19.7 milligrams per kilogram [mg/kg]) only marginally exceeds the Ohio EPA VAP GNS for industrial workers (19.0 mg/kg) and is less than the GNS for construction workers, 210 mg/kg (see Tables III and IV, OAC 3745-300-08). Also, the maximum concentration of vinyl chloride detected in groundwater beneath IA 10, 4.2 micrograms per liter [µg/L], exceeds the generic unrestricted potable use standard of 2 µg/L, but is significantly less than the generic direct contact standard of 25 µg/L. Vinyl chloride has been detected at much higher concentrations beneath IA 9 (located south of IA 10). Also, the work space at IA 9 has a smaller interior air space than IA 10. Therefore, IA 9 is considered a conservative surrogate for IA 10 – that is, estimated indoor air concentrations based on the same groundwater concentration will be higher at IA 9 than at IA 10. Remediation being conducted at IA 9 has significantly reduced the concentration of vinyl chloride (see Section 3.3.1) and is expected to reduce the concentration of vinyl chloride at IA 10 as well. Therefore, the risk assessment includes evaluation of potential location-specific exposures, risks, and hazards at IA 1, IA 4, IA 9, and IA 11 (see Figure 5). The risk assessment does not include location-specific evaluations for the following IAs at which no chemicals were detected above medium-specific GNS values -- IA 2, IA 3, IA 6, IA 7, IA 8, and IA 12. However, IA 13 includes common areas located outside the Airdock. Therefore, the risk assessment assumes that all future industrial workers at the Airdock may be exposed to releases associated with IA 13. As discussed in Section 3.0, IA 13 is divided into various on- and off-property areas.

1.2.2 Risk Assessment Technical Approach

The risk assessment was completed in accordance with Ohio EPA VAP property-specific risk assessment procedures (OAC 3745-300-09). Because PCBs are present at the Airdock property, TSCA and the regulations adopted thereunder are applicable to portions of the property (OAC 3745-300-09(4)).
A property-specific risk assessment is also required at the Airdock to evaluate the indoor air pathway in portions of the Airdock that overlie the chlorinated volatile organic chemical (VOC) plume (see Figure 4), a pathway for which there are no generic standards (OAC 3745-300-09(2)(a)).

The risk assessment also addresses the requirement to evaluate the cumulative cancer risk to off-property receptors under an industrial site remedy (OAC 3745-300-9(C) (1) (b) (i)).

The mandatory requirement to conduct a property-specific risk assessment when important ecological resources or sediments are impacted by hazardous substances (OAC 3745-300-09(2) (d)) is addressed in this document although there are no surface water or sediment-containing features on the Airdock property. LMC’s off-property area north of Triplett Boulevard and Haley’s Ditch is subject to an ongoing non-VAP assessment aimed at characterizing historic contamination. The exterior Airdock remedy is abating future releases to stormwater runoff directly through source mitigation measures. It is further understood that the predominant source of PCB-containing material in past releases originated directly from primary source material -- RPM roofing and siding materials, and loose debris on paved areas that entered the storm drains -- as opposed to erosion and transport of secondary source material, such as contaminated soils, that entered the storm drains from the limited unpaved portion of the property. For purposes of the VAP, the derivation of on-property soil cleanup levels for PCBs includes an evaluation of the maximum estimated concentration of PCBs in the waters and sediment of Haley's Ditch that may result from future off-property migration of low-level PCB-impacted soil from areas adjacent to the Airdock (see Section 3.4).

1.3 RISK ASSESSMENT ORGANIZATION

A risk assessment is typically conducted in four basic steps: (1) data evaluation and identification of chemicals of potential concern (COPC), (2) exposure assessment, (3) toxicity assessment, and (4) risk and hazard characterization. These four steps as well as development of property-specific numerical standards and a risk assessment summary step are summarized below and are discussed in detail in Sections 2.0 through 7.0.

- **Section 2.0, Data Evaluation and Identification of Chemicals of Potential Concern (COPC)**, summarizes data collection and evaluation activities and identifies COPCs.
- **Section 3.0, Exposure Assessment**, identifies potential human exposure pathways, estimates environmental concentrations of COPCs at potential exposure points (exposure point concentrations [EPC]), and estimates potential human intakes or doses.
- **Section 4.0, Toxicity Assessment**, identifies and summarizes the basis for COPC-specific toxicity criteria used in the risk assessment.
- **Section 5.0, Risk and Hazard Characterization**, presents estimates of carcinogenic risks and noncarcinogenic hazards, general conclusions regarding potential risks and hazards associated with exposures to COPCs, and major uncertainties associated with the risk and hazard estimates.
- **Section 6.0, Uncertainty Analysis**, summarizes potentially significant sources of uncertainty associated with the risk assessment.
- **Section 7.0, Summary and Conclusions**, summarizes the risk assessment process, major assumptions, significant conclusions, and uncertainties related to the risk assessment.
- **Section 8.0, Recommendations,** makes recommendations relative to the ongoing remediation and identifies and documents chemical- and medium-specific COPC remediation or target performance standards.

References cited in this report are listed after Section 8.0. Tables and figures for this report are provided after the list of references. Shorter tables are embedded in text. In addition, the report also includes four appendices. Appendix A documents the calculation of medium-specific EPCs used in the risk assessment. Appendix B presents trench air calculations. Appendix C presents the results of indoor air modeling. Appendix D presents receptor-specific exposure, risk, and hazard calculations. Appendix E presents a modeling evaluation of Haley's Ditch sediment loading and water quality under post-remediation conditions.

2.0 DATA EVALUATION AND IDENTIFICATION OF COPCS

The primary purpose of this section is to identify and discuss analytical results considered in the risk assessment and to discuss the basis for identifying site-specific COPCs. COPCs are chemicals carried through the entire risk assessment process for which carcinogenic risks and noncarcinogenic hazards are estimated. Section 2.1 discusses data collection and evaluation, and Section 2.2 summarizes the COPC identification process.

2.1 DATA COLLECTION AND EVALUATION

As discussed in Section 1.2.1, the risk assessment focuses on potential exposure to contaminants in soil and groundwater based on analytical data sets for samples collected inside and outside (but in the immediate vicinity) of the Airdock. Section 2.1.1 discusses the sources of medium-specific analytical data considered in the risk assessment. Section 2.1.2 evaluates the analytical data in terms of its use in the risk assessment.

2.1.1 Data Collection

Analytical data considered for use in the risk assessment were reported in the following reports.

- Tier I Evaluation Report (Tetra Tech 2004)
- Phase II Property Assessment Report (Tetra Tech 2005b)
- Phase II Exterior Soil Sampling & Analysis (Weston 2004)
- Additional Exterior Soil Sampling & Analysis (BBL 2005 and LMC 2007a)
- Supplemental Phase II Property Assessment (Tetra Tech 2006b)
- Laboratory Analytical Results for Goodyear’s Voluntary Corrective Action Groundwater Monitoring Network (Goodyear 2007 and Brownfield Restoration Group 2007)
- Summary of Soil Analytical Results – 3rd Quarter – 2006 (Goodyear 2006b)
- HYD-105 Excavation Plan and associated analytical data (BBL 2006a and LMC 2007b)
- Subsurface Soil Characterization (BBL 2006b)
- Pavement Sampling Report (Tetra Tech 2007b).

Each of these data sources is summarized below.

Tier I Evaluation Report (Tetra Tech 2004)

As part of the Phase II Property Assessment, one soil boring (NB-31) was installed on the southeast side of IA 1 in June 2004. Gauging conducted at NB-31 revealed 0.05 foot of a light nonaqueous-phase liquid (LNAPL). A suspected release was reported to the Bureau of Underground Storage Tank Regulations (BUSTR) (Release No. 77001231-N00002). A grab sample of groundwater was collected from this direct push soil boring. Analysis was performed on two phases of the grab groundwater sample: a dissolved groundwater phase and LNAPL. The dissolved groundwater phase analysis revealed elevated concentrations (concentrations exceeding a BUSTR action level or VAP GNS) of benzene, ethylbenzene, toluene, total xylenes, n-hexane, and methyl tertiary butyl ether (MTBE).

In response to the suspected release, four permanent wells (NW-1 through NW-4) were installed around IA 1; NW-4 was installed directly over the original location of boring NB-31. As reported in the Tier I Evaluation Report (Tetra Tech 2004), the groundwater results from monitoring well NW-4, installed to replace NB-31, are significantly lower in concentration than the elevated levels in the grab groundwater sample from NB-31. The lower concentrations in NW-4 suggest that the free phase conditions encountered at NB-31 are limited in extent and not representative of groundwater quality in the local area of the former underground storage tank (UST) at IA 1. The four permanent wells were monitored for 3 months, with no free product detected subsequently. The absence of free product in monitoring well NW-4 and the surrounding perimeter wells (NW-1 through NW-3) further supports the conclusion that residual impact from the former UST system is relatively isolated.

BUSTR issued a No Further Action letter on March 16, 2005 (ODC 2005). Based on the conclusion that the free-phase conditions encountered at soil boring NB-31 are not representative of groundwater quality at IA 1, the risk assessment did not consider the analytical results associated with the free-phase groundwater sample from soil boring NB-31.

Phase II Property Assessment Report (Tetra Tech 2005b)

As part of the Phase II Property Assessment, 24 shallow borings were completed at IAs 1 through 12 on the Airdock parcel. A minimum of one soil sample was collected at each of the 24 boring locations, and groundwater samples were collected at 13 of the 24 boring locations (see Figure 8) (Tetra Tech 2005b).

The risk assessment considered the analytical data for all soil and groundwater samples collected as part of the Phase II property assessment (with the exception of free-phase groundwater data associated with soil boring NB-31, as discussed above).

The Phase II Property Assessment Report also summarized the results of LMC's voluntarily initiated broad-based sampling program to characterize the extent of PCB impact inside and immediately outside the Airdock. LMC collected the following samples from media located outside the Airdock; all samples were analyzed for PCBs using EPA Method 8082:

- A total of 26 soil samples were collected from grassy areas adjacent to the Airdock (20 samples) and the north perimeter fence line (6 samples)
- 14 concrete core samples were collected from the apron surrounding the Airdock
- 26 samples were collected from cracks in concrete and other locations where a soil matrix sample and other debris could be collected
- 13 sediment samples were taken from catch basins
- 7 sediment samples were collected from roof gutters associated with the Airdock.

In addition to samples collected outside the Airdock, LMC also collected hundreds of PCB bulk and wipe samples inside the Airdock of the following media:

- Dust – samples of dust were collected from the Airdock floor, superstructure, catwalks, and equipment
- Concrete floor – wipe and core samples were collected systematically from throughout the Airdock floor
- Asphalt
- Interior dividers and block walls
- Airdock siding
- Indoor air.

The results of all the medium-specific sampling conducted outside and inside the Airdock were considered in the risk assessment for the specific purpose of identifying COPCs (all of these samples were analyzed only for PCBs, a known component of RPM). However, as discussed in greater detail in Section 3.0, based on past, on-going, and future cleaning and remedial efforts, potential exposure to PCBs will be insignificant or nonexistent in areas associated with sediment (in rain gutters and the catch basins), concrete (outdoor apron and indoor floor), soil and other debris from cracks in the outdoor concrete apron, interior and external structural surfaces, panels, building and plant surfaces (including equipment), and indoor air. Therefore, the risk assessment only considered analytical results associated with soil samples collected from grassy areas adjacent to the Airdock and the north perimeter fence line. The locations of these soil samples are shown on Figure 9.

Phase II Exterior Soil Sampling & Analysis (Weston 2004)

In June 2004, Weston conducted a Phase II assessment to further investigate the native soil surrounding the Airdock (Weston 2004). Soil samples were collected from 17 locations. Eleven of these locations are in the grassy area southeast of the Airdock (Southeast Area), and the remaining six locations are along the north perimeter fence line (see Figure 9). The soil samples were analyzed only for PCBs by EPA Method 8082; Aroclor 1268 was included as a target analyte. The risk assessment considered all of the analytical results associated with these soil samples.

Additional Exterior Soil Sampling & Analysis (BBL 2005 and LMC 2007a)

Additional exterior soil sampling was conducted in May and August 2005. The purpose of the sampling was to more completely characterize the concentration of PCBs in soil in the grassy area beyond the north fence line, within and beyond the northwestern fence line, and beyond the south fence line. Specifically, additional soil samples were collected at the following locations:

- 38 locations in the grassy area extending beyond the north fence line (May 2005)
- 16 locations in the grassy area within and beyond (primarily) the northwestern fence line (May 2005)
- 12 locations at 5-foot intervals out to a distance of 15 feet in four directions from sampling location LM-S0117 (August 2005)
- 7 locations in the grassy area south of the Airdock (May 2005).

The locations of these soil samples are shown on Figure 9.

For the purposes of the risk assessment, the additional exterior soil samples were organized into on- and off-property areas as described below and shown in Figure 9.

On-Property

On-property soil samples are defined as those collected at locations inside the Airdock property line. LMC plans to extend the limit of the chain-link fence on the north and northwest side of the Airdock to the property boundary. The new fence line will enclose the previous sampling locations north and northwest of the current fence line. The risk assessment organized the analytical results associated with all additional soil samples collected within the property line into two areas:

- Southeast Area – 16 locations (LM-S0004, LM-S0006, LM-S0008, LM-S0010, SM-S0011, SM-S0043, LM-S-44, LM-S0046 through LM-S0053, and LM-SC16)
- On-Property (Non-IA-Specific) – 73 locations (LM-S0054 through LM-S0059, LM-S0072 through LM-S0083, LM-S0073A, LM-S0078A, LM-S0079A, LM-S0081A, LM-S0083A, LM-S0088 through LM-S0099, LM-S0091A, LM-S0107 through LM-S0109, LM-S011 through LM-S0113, LM-S0115 through LM-S0121, LM-S0205, LM-S0208 through LM-S0216, LM-SC1 through LM-SC7, and LM-SC9 through LM-SC15)

Off-Property

Off-property samples are defined as those on airport property, but outside the Airdock property line on the north, south, and west sides of the Airdock. The risk assessment organized the analytical results associated with all additional soil samples collected off-property into three areas:

- Off-Property (North) – 27 locations (LM-S0060 through LM-S0071, LM-S0069A, LM-S0070A, LMS0084 through LM-S0087, LM-S0100 through LM-S0106, LM-S0110, and LM-S0104)
- Off-Property (South) – 7 locations (LM-S0122 through LM-S0128)
- Off-Property (West) – 4 locations – (LMC-CC-105-003 through LMC-CC-108-003).

Supplemental Phase II Property Assessment (Tetra Tech 2006b)

The supplemental Phase II Property assessment was conducted at certain identified areas at the property to address data gaps and augment new information from ongoing assessments. The data gaps involved the minimum number and depth of samples generally required by Ohio's VAP rule for Phase II property assessments, specified in OAC 3745-300-07.

As part of the supplemental Phase II Property assessment, 26 soil samples were collected from 1 to 4 feet bgs at 13 soil boring locations (see Figure 8). These soil samples were collected to fill data gaps associated with nine IAs: 1, 2, 3, 4, 5, 6, 7, 8, and 10. No groundwater samples were collected as part of the supplemental Phase II Property assessment. The risk assessment considered all of the analytical results associated with these supplemental soil samples.

Laboratory Analytical Results for Goodyear's Voluntary Corrective Action Groundwater Monitoring Network (Goodyear 2007 and Brownfield Restoration Group 2007)

Quarterly groundwater monitoring data was obtained from Goodyear and its consultant, Brownfield Restoration Group LLC (BRG) through September 2007, the most recent sampling date. Goodyear's monitoring is conducted on select wells at the Airdock and surrounding properties throughout the year as part of its ongoing voluntary corrective action program (see Section 1.1.3.1).

In March 2005, an *in situ* treatment remedy, ZVI injection was initiated at IA 9 to reduce the concentrations of chlorinated hydrocarbons in groundwater beneath the Airdock (Sharp 2005a, b). The ZVI treatment technology was implemented by Goodyear as a presumptive remedy to address the indoor air pathway at the source area, and is expected to continue until the potential human health risk to industrial workers can be demonstrated to meet applicable standards. The injection targeted the strata containing the highest detected concentrations of chlorinated VOCs. These targeted areas included the vadose zone and the fully saturated upper aquifer (LATA 2005).

In order to monitor the impacts of the ZVI treatment remedy (specifically, to monitor the changing concentrations of individual hydrocarbons in the groundwater beneath IA 9), Goodyear installed monitoring well A-8 outside the Plate Shop/Degreaser (IA 9) (see Figure 4). Monitoring well A-8 is the only permanent well within the Airdock building. Because the concentrations of individual hydrocarbons are changing in response to the ZVI treatment, and because groundwater samples collected from permanent wells are preferred to groundwater samples collected from soil borings, the risk assessment assumed that groundwater beneath IA 9 was most accurately estimated by the most recently available groundwater results from monitoring well A-8.

Therefore, in terms of characterizing potential exposure to chemicals in groundwater, the risk assessment preferentially considered analytical results from Goodyear's groundwater samples collected most recently in 2007 (Goodyear 2007).

Summary of Soil Analytical Results – 3rd Quarter 2006 (Goodyear 2006)

Goodyear conducted a limited Phase II assessment of shallow soil conditions along a transect extending north from the northern end of the Airdock in September 2006. The purpose of the assessment was to characterize soil chemistry in the area of a proposed rail system. The scope of the assessment involved advancing six borings (GP-1 through GP-6) to the water table using direct push methods. Sample locations are shown on Figure 10. Samples were collected at the surface, from a depth of 0 to 2 feet bgs, and deeper based on field screening results. (Note – the deepest samples were collected from 8 to 10 feet bgs at GP-2).

HYD-105 Excavation Plan and Associated Analytical Data (BBL 2006a and LMC 2007b)

LMC initiated repair and maintenance activities for fire hydrant HYD-105 in spring of 2006. In order to make the necessary repairs, excavation was required to expose the hydrant's valve. Petroleum-impacted soils were encountered approximately 2 to 3 feet bgs; a soil sample was collected and indicated the presence of PAHs and total petroleum hydrocarbon, as diesel. Based on this initial result, BBL excavated the area around HYD-105 to a depth of about 8 feet bgs (see Figure 8). Soil samples were collected from the sidewalls of the excavation to further characterize subsurface soils (BBL 2006a). The analytical results associated with the sidewall samples confirmed the presence of PAHs and other petroleum hydrocarbons, particularly gasoline range organics (GRO) (C6 to C12), as well as the presence of limited VOC contamination (LMC 2007b). Based on these results, the boundary of IA 1 was extended south to include HYD-105. The risk assessment considered all of the analytical results associated with the HYD-105 soil samples.

Subsurface Soil Characterization (BBL 2006b)

In July 2006, BBL completed a subsurface soil investigation at the Airdock. The objective of this investigation was "to characterize subsurface soil located beneath concrete and asphalt pavement surrounding the Airdock facility" (BBL 2006b). A total of 16 soil borings (LM-SC1 through LM-SC16) were completed (see Figure 9). Soil samples were collected from three intervals: 0 to 0.25 foot bgs; 1 to 2 feet bgs; and 2 to 4 feet bgs. The soil samples from the first two intervals were submitted to the analytical laboratory for total PCB analysis. Soil samples from the third interval were sent to the laboratory for extraction only. If PCBs were detected in the samples from the 1 to 2 feet bgs interval, the 2 to 4 feet bgs samples from that same location were analyzed. The risk assessment considered all of the analytical results associated with the subsurface soil samples with the exception of LM-SC8, which will be subject to a limited removal action as part of LMC's soil cleanup plan (LMC 2007d).

Pavement Sampling Report (Tetra Tech 2007b)

In May 2007, Tetra Tech performed pavement and sub-pavement sampling at the Airdock and surrounding areas. The purpose of the sampling was to characterize the impact from prior releases of non-liquid PCBs (Aroclor 1268) from RPM used as roofing and siding material at the Airdock within the storm water drainage divide. Pavement samples were collected at 15 locations near the Airdock; six samples were collected within the Airdock boundary (4 on south side and 2 on southeast side) and nine samples were collected outside the Airdock boundary (5 on west side and 4 on the south side) (see Figure 9). At four of these locations (LMC-CC-105, LMC-CC-106, LMC-CC-107, and LMC-CC-108), soil samples were collected from beneath the pavement at a depth interval of 0 to 3 inches bgs (subpavement samples could not be collected at the other 11 locations due to the thickness of the pavement).

PCBs were not detected in any of the pavement and subpavement soil samples. The risk assessment considered all of the analytical results associated with the subpavement soil samples.

2.1.2 Data Evaluation

Medium-specific samples were collected using similar methodologies and were analyzed using the same or similar analytical methods. EPA Method 8082 was used for analysis of all medium-specific samples for which PCB was an analyte. Therefore, it is appropriate to combine the samples collected as part of different investigations into a single data set in accordance with EPA's "Guidance for Data Usability in Risk Assessment (Part A) Final" (EPA 1992).

The risk assessment considered the analytical results associated with all medium-specific samples collected as part of the investigations described in Section 2.1.1 with four primary exceptions. The first two exceptions were discussed already in Section 2.1.1 and are summarized below.

- Analytical results associated with the grab free-phase groundwater sample collected from soil boring NB-31 were not considered in the risk assessment. As discussed in Section 2.1.1, the analytical results from this free-phase groundwater sample are not considered representative of the groundwater at IA 1. Instead, the risk assessment considered the analytical results from the groundwater sample collected from permanent well NW-4 installed at the same location as NB-31.

- For the purpose of characterizing the concentrations of VOCs present in groundwater beneath IA 9, the risk assessment considered the analytical results associated with the groundwater samples collected over four quarters in 2007 from monitoring well A-8, rather than the concentrations of VOCs measured in groundwater samples collected from soil borings in 2004, prior to the initiation of the ZVI treatment remedy.

The third exception regards the exclusion of samples from an area immediately southeast of the Airdock where the soil will be excavated and removed. One proposed area of soil removal is approximately 250 feet long by 25 feet wide and 6 inches deep. Another area approximately 60 feet long by about 25 feet wide and 2 feet deep around sampling location S0045 within the Southeast Area will also be removed (BBL 2005; LMC 2007c, 2007d) (see Figure 11). The excavation area includes sampling locations where PCBs were measured at concentrations greater than a preliminary target cleanup level of 16 mg/kg, the VAP GNS for PCBs, commercial/industrial work exposure. Therefore, the risk assessment did not consider at least one depth-specific set of analytical results associated with the following seven sampling locations LM-S0005, LM-S0007; LM-S0009; LM-S0012, LM-S0045, LM-S0048, LM-S0049; and LM-S0051 (see Figure 9), since these sampling points fall within the soil areas that will be removed.

The final exception regards the proposed excavation and removal of soil at sampling location LM-SC8 along the northwest side of the Airdock (LMC 2007d) (see Figure 11). Therefore, the risk assessment did not consider analytical results from soil samples collected at this location.

2.2 COPC IDENTIFICATION

Consistent with Ohio EPA and EPA guidance, the first step in the COPC identification process was to identify all chemicals that were positively detected in at least one sample, including chemicals with no data qualifiers and chemicals with data qualifiers indicating known identities but unknown concentrations (for example, J-qualified data) (OAC 3745-300-09; EPA 1989). According to EPA’s “Risk Assessment Guidance for Superfund” (RAGS), this initial list of chemicals may be reduced based on the following factors:

- Comparison with appropriate background concentrations
- Evaluation of detection frequency
- Evaluation of essential nutrients
- Use of a concentration-toxicity screen

Because site-specific background samples have not been collected for the Airdock, the risk assessment did not consider the first of these factors. Similarly, in order to be health protective, the risk assessment did not consider the second of these factors. Finally, medium-specific samples were not analyzed for essential human nutrients (for example, sodium); therefore, the risk assessment did not consider the third of these factors.

In practice, the fourth factor typically takes the form of a comparison to medium-specific screening levels. These screening levels represent medium-specific concentrations back-calculated from target risk and hazard levels. The Ohio EPA VAP GNS values are back-calculated from a target risk level of 1E-05 (1×10^{-5}) and a target noncarcinogenic hazard of 1 (Ohio EPA 2002). In order to be protective of health and consistent with an adjustment for multiple chemicals as required by Ohio EPA (OAC 3745-300-08(D)), chemical-specific Ohio EPA VAP GNS values were divided by a factor of 10 for the purposes of identifying COPCs. (Note: Groundwater GNS values that are based on maximum contaminant levels [MCL] were not divided by a factor of 10). For the purpose of the risk assessment, medium-specific Ohio EPA VAP GNS values were identified as summarized below and described in the Phase II report (Tetra Tech 2005b).

- **Soil** – Generic direct contact standard for a single chemical (OAC 3745-300-8 Generic Numerical Standards, Table III: Generic Direct Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Commercial and Industrial Land Use Categories).
- **Groundwater** – Generic unrestricted potable use standard (OAC 3745-300-8 Generic Numerical Standards, Table VI: Generic Unrestricted Potable Use Standards Based on MCLs or Other Regulatory Established Criteria, and Table VII: Risk-Derived Generic Unrestricted Potable Use Standards)

Tables 1 and 2 present a comparison of the maximum chemical-specific concentrations detected in soil and groundwater and the adjusted Ohio EPA VAP GNS values for these chemicals. Chemicals detected at concentrations exceeding their respective medium-specific Ohio EPA VAP GNS values were considered preliminary COPCs. As shown in Tables 1 and 2, respectively, the preliminary soil and groundwater COPCs were identified as follows:

- **Soil** – benzo(a)anthracene, benzo(b)fluroanthene, benzo(a)pyrene, dibenzo(a,h)anthracene, PCBs, arsenic, and cadmium
- **Groundwater** – benzene, 1,1-dichloroethene, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, ethylbenzene, toluene, trichloroethene, vinyl chloride, naphthalene, arsenic, beryllium, lead, and nickel

In order to account for potential movement of chemicals between soil and groundwater and the potential for receptor-specific exposure to chemicals in both soil and groundwater, chemicals identified as a preliminary COPC in soil, groundwater, or both media are, for the purposes of the risk assessment, considered COPCs in both media. The only exceptions are chemicals detected in only one medium and, based upon the physical and chemical characteristics of the chemical, these chemicals are considered COPCs only in the medium in which they were detected. This exception applies in only two instances at this property. PCBs and cadmium were identified as preliminary COPCs in soil, but in the case of cadmium, was not detected in groundwater samples and in the case of PCBs, since the form of PCBs is non-liquid, largely insoluble, and limited to the surface (based on vertical profile sampling), was not tested for nor expected to leach to groundwater. Therefore, PCBs and cadmium are not considered as COPCs in groundwater.

Polynuclear aromatic hydrocarbons (PAH) were detected in only a limited number of samples at concentrations greater than their respective adjusted GNS values as summarized below.

- Benzo(a)anthracene, benzo(b)fluroanthene, and dibenzo(a,h)anthracene were detected in only a single sample location (HYD 105W1, 2 feet bgs) from IA 1 at concentrations (8.7, 13, and 1.6 mg/kg, respectively) greater than their respective adjusted GNS values (6.3, 6.3, and 0.67 mg/kg, respectively.
- Benzo(a)pyrene was detected in only one sample (HYD 105W1, 2 feet bgs) from IA 1 (10 mg/kg) and two samples from IA 10 (AA-11 [1 to 2 feet bgs] and PLTA-9) (1.6 and 3.9 mg/kg, respectively) greater than or equal to its adjusted GNS value of 0.63 mg/kg.

PAHs including the four compounds discussed above have not been identified as chemicals potentially requiring remediation at the Airdock; discussions between LMC, its consultant Tetra Tech, and Ohio EPA have focused on (1) PCBs based on their presence in the RPM used to coat Airdock surfaces and (2) VOCs in groundwater. Also, as discussed further in Section 3.0, the existing 6-inch concrete slab present throughout the Airdock is assumed to prevent potential exposure of industrial workers to surface and subsurface soil underneath the Airdock. Therefore, only construction and excavation workers may potentially be exposed to benzo(a)pyrene in soil beneath IA 10. The maximum concentration of benzo(a)pyrene detected at IA 10 (3.9 mg/kg) is well below the generic direct contact standard for a single chemical for the construction and excavation activities category (81 mg/kg); in fact, the maximum detected concentration of benzo(a)pyrene is less than the adjusted GNS value of 8.1 mg/kg for the construction and excavation activities category. Based on these results, industrial workers will not be exposed to the maximum detected concentration of benzo(a)pyrene at IA 10, and the risks and hazards associated with potential exposure of construction and excavation workers to benzo(a)pyrene in soil at IA 10 are not considered significant (that is, they are less than 1E-05).

With regard to the exceedances of PAHs above their respective adjusted GNS values at IA 1, these exceedances occurred at a single location (HYD 105W1, 2 feet bgs). Therefore, potential worker exposure to residual PAHs is expected to be limited.

Despite these considerations regarding the limited potential for exposure to PAHs at significant levels, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene were retained as COPCs for the purposes of this risk assessment.

Table 3 presents the medium-specific COPCs considered in the risk assessment.

3.0 EXPOSURE ASSESSMENT

This section discusses the assumptions and methods used to estimate the types and magnitude of potential human exposure to COPCs in soil and groundwater from beneath and near the Airdock. Exposure is defined as human contact with a chemical or physical agent (EPA 1989). The exposure assessment consists of three fundamental steps: (1) exposure setting characterization, (2) exposure pathway identification through a conceptual site model (CSM), and (3) exposure quantification. These steps are discussed below in Sections 3.1, 3.2, and 3.3, respectively. Finally, for the purposes of the property-specific risk assessment, the potential for low-level PCB-impacted soil adjacent to the Airdock to migrate off-property and into Haley's Ditch was evaluated through a modeling exercise in Section 3.4.

3.1 EXPOSURE SETTING CHARACTERIZATION

The exposure settings at and surrounding the Airdock, as well as historical and intended future operations, are described in Section 1.1. In addition, this section presents some of the important assumptions regarding the exposure setting that directly influence the site-specific exposure assessment. These assumptions were previously submitted to, discussed with, and approved in principle by Ohio EPA (Tetra Tech 2005d, 2006a, 2007a).

- The Airdock roofing and siding, which are comprised of RPM containing non-liquid PCBs, specifically Aroclor 1268, has been remediated to prevent further exfoliation. Specifically, (1) the inside structural features were cleaned, (2) interior RPM panels were coated and exterior RPM panels covered with a rubber membrane, (3) the bottom 24 feet of wall panels were replaced, and (4) interior building surfaces were cleaned (see the next bullet).

- PCB dust was removed from the interior surfaces of the Airdock to EPA approved levels of 100 μg/100 cm^2 on the superstructure steel and to 10 μg/100 cm^2 for accessible areas such as the catwalks and building surfaces. These levels will ensure that potential exposures to interior plant surfaces (including any inhalation of fugitive emissions) are insignificant.

- The floor slab in the Airdock was prepared, and double-coated with a sealer using contrasting colors. This slab prevents potential exposure to surface and subsurface soil underneath the Airdock by industrial workers.

- Institutional controls will be put in place to limit the property to industrial use with specific access and activity restrictions to be determined, but expected to include a deed notice to provide disclosure of site conditions, and an operations and maintenance agreement, if required under TSCA. Furthermore, a risk mitigation plan is anticipated for portions of the Airdock property where construction workers may come in contact with residual contaminated media.

- Institutional controls will be put in place to prohibit potable groundwater use at the Airdock until such time as contaminant concentrations in groundwater are at acceptable levels.

- Groundwater downgradient of the Airdock is within an USD, specifically the Akron East USD Extension. There is no potable use of groundwater within the USD or within a 0.5 mile of the USD perimeter. Municipal water is supplied to the entire USD area for potable use.

3.2 CONCEPTUAL SITE MODEL

The CSM links potential or actual contaminant releases to potential human exposures. As discussed in Section 1.1.2, the Airdock is undergoing redevelopment to return use of the facility to its original purpose of to manufacturing and housing large airships. Future land use is expected to be industrial. In addition to potential exposures by industrial workers, the risk assessment also considers potential exposures by workers involved in construction and excavation activities, both inside and outside the Airdock. Finally, as discussed below, potential exposures to site-related COPCs by residents living in the area are expected to be potentially complete, but insignificant. Therefore, the risk assessment assesses potential residential exposures only semiquantitatively.

Figure 7 shows the CSM, illustrating potential exposure pathways for future industrial and construction/excavation workers and hypothetical residents on adjoining parcels. Specifically, Figure 7 identifies (1) potential contaminant sources, (2) potential receptors and exposure pathways, and (3) exposure scenarios. These three elements are discussed below in Sections 3.2.1 through 3.2.3.

3.2.1 Potential Contaminant Sources and Release Mechanisms

The primary historic mechanism of release of Aroclor 1268 from the Airdock into the environment was the exfoliation of RPM from exterior (and interior) surfaces (IA 13). Also, spills and leaks of various chemicals other than Aroclor 1268 (some documented) have occurred at other IAs. These primary contaminant release and transport mechanisms resulted in the contamination of internal plant surfaces, exterior concrete surfaces, and surface and subsurface soil. Through mechanisms including the generation of fugitive dust, leaching by percolation, and runoff, certain contaminants have migrated from the primary affected media into indoor and outdoor air, the underground stormwater system (and ultimately Haley’s Ditch), and groundwater. Tertiary release and transport mechanisms including deposition and subsurface vapor transport have or may have resulted in contamination or recontamination of internal plant surfaces, surface soil, and indoor and outdoor air.

In addition to the exposure characterization assumptions described in Section 3.1, the risk assessment also assumes that potential human exposures to exterior concrete surfaces are insignificant for three primary reasons: (1) all exterior building surfaces were removed or encapsulated to prevent further exfoliation, (2) all pavement debris will be cleaned up and removed, and (3) PCB concentrations in pavement are all less than 1 mg/kg. Also, the underground stormwater system drains ultimately to Haley's Ditch. This surface water feature is located about 0.75 mile north-northwest of the Airdock facility and is not part of the VAP/CORF property (see Figure 1). Investigation of historic impacts in Haley's Ditch is being conducted under TSCA; see also Sections 3.4 and 5.4.

3.2.2 Potential Receptors and Exposure Pathways

Identification and evaluation of potential future receptors at the Airdock is based primarily on its intended future industrial use. Potential receptors and exposure pathways identified with this assumed future land use are discussed below.

Potential Receptors

Human exposures in and near the Airdock are expected to occur almost exclusively as a result of work-related activities. Receptors are expected to include industrial workers employed at industrial operations located in the Airdock and construction/excavation workers hired as needed to perform construction/excavation activities such as utility installation and repair.

As noted in Section 3.2.1, residents living off site in the area could be exposed to COPCs originating at the Airdock through inhalation of ambient air and non-potable domestic use of groundwater in addition to potential exposure to COPCs in sediment and surface water in Haley's Ditch (see above). However, potential residential exposures through inhalation of ambient air are expected to be insignificant. Further, potential exposures through domestic use of groundwater are expected to be eliminated through implementation of institutional controls (prevention of potable use of groundwater until COPC concentrations in groundwater reach acceptable levels.) Finally, it should be noted that the emanation and migration of PCBs from the Airdock property to off-property locations (for example, Haley's Ditch) was the result of historic weathering of the RPM used at the Airdock. As described in Section 1.1.3.3, a significant amount of remedial actions have taken place and are planned for the future to eliminate the off-site migration of weathered RPM material. PCBs in site soil (for example the Southeast Area) are present in a solid form that is unlikely to migrate off site to any significant level. However, Section 3.4 presents a modeling exercise intended to estimate the maximum concentration of PCBs in the waters of

Haley's Ditch resulting from potential off-property migration via run-off of low-level PCB-impacted soil from areas adjacent to the Airdock.

Exposure Pathways

Receptors are expected to be exposed to COPCs in soil and groundwater beneath and near the Airdock through a variety of exposure pathways as shown in the CSM (see Figure 7). The potentially complete exposure pathways evaluated in the risk assessment include the following:

- Incidental ingestion of, direct contact with, and inhalation of fugitive dusts from surface soil (Note: industrial workers are expected to be exposed to surface soil only outside the Airdock; residential receptors are expected to be exposed to surface soil only at off-property locations)
- Incidental ingestion of and direct contact with subsurface soil (construction/excavation workers only)
- Direct contact with and inhalation of VOCs from groundwater in a construction trench (construction/excavation workers only)
- Inhalation of indoor air (industrial workers only)
- Incidental ingestion of and dermal contact with surface water and sediment in Haley's Ditch (residential receptors only).

Medium-specific analytical results form the basis for soil and groundwater exposures. COPC concentrations in indoor and construction trench air were estimated using fate and transport modeling (see Section 3.3).

3.2.3 Exposure Scenarios

Exposure pathways and scenarios are considered complete when a point of contact exists or potentially exists between an affected medium and a receptor. For the Airdock, potentially complete exposure scenarios are identified in the CSM (see Figure 7) and are associated with the following receptors:

- Adult industrial workers
- Adult construction/excavation workers
- Adult and child residential receptors.

Exposure scenarios for these receptors are discussed below.

Adult Industrial Workers

Adult industrial workers are expected to be employed either helping to build or providing support services related to manufacturing. Adult industrial workers are expected to be potentially exposed through the inhalation of VOCs originating from groundwater and/or soil beneath the Airdock, or through incidental ingestion of, direct contact with, and inhalation of fugitive dusts from surface soil outside, but adjacent to the Airdock. For the purposes of this property-specific risk assessment, these areas are referred to as on-property (non-IA-specific) areas (see Figure 3).

Adult Construction/Excavation Workers

Adult construction/excavation workers are expected to be hired on an as-needed basis to perform limited construction and excavation work (for example, the installation and repair of utility lines). Adult construction/excavation workers are expected to be potentially exposed through the inhalation of VOCs originating from groundwater present in a construction trench, or through incidental ingestion of, direct contact with, and inhalation of fugitive dusts from surface and subsurface soil (Note: the inhalation of fugitive dust is expected to occur only outside of the Airdock).

Adult and Child Residents

Adult and child residents are assumed to be potentially exposed through incidental ingestion of and dermal contact with surface soil, as well as through inhalation of fugitive dusts at locations off of airport property. Therefore, for the purposes of the risk assessment, it was conservatively assumed that residential receptors may be exposed to contaminants at off-property locations (defined for the purposes of the risk assessment as outside of the Airdock property line, but on airport property).

3.3 EXPOSURE QUANTIFICATION

Exposure is defined as the contact of an organism with a chemical or physical agent. Potential chemical exposure depends on the amount of a chemical available at human exchange boundaries (skin, lungs, and gut) during a specified time. The magnitude of exposure was quantitatively assessed for the human receptors discussed in Section 3.2.3.

Exposure dose equations that consider contact rate, receptor body weight, and frequency and duration of exposure were used to estimate the intake or dose of each COPC for each receptor. Exposure doses were calculated for the reasonable maximum exposure (RME) case, which represents the highest exposure reasonably expected to occur.

An exposure can occur over a period of time. The total exposure can be divided by the time period to calculate an average exposure per unit of time. An average exposure can be expressed in terms of body weight. All exposures quantified in the risk assessment were normalized for time and body weight, are presented in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day), and are termed "intakes." Equation 1 is a generic equation for calculating chemical intake (EPA 1989).

$$D = (C \times CR \times EF \times ED)/(BW \times AT) \qquad (1)$$

where

D = Dose: the amount of chemical at the exchange boundary (mg/kg-day); to evaluate exposure to noncarcinogenic chemicals, the intake is referred to as the average daily dose (ADD); to evaluate exposure to carcinogenic chemicals, the intake is refereed to as the lifetime average daily dose (LADD)

C = Chemical concentration: the average concentration (referred to as the EPC) contacted over the exposure period (for example, milligrams per kilogram [mg/kg] for soil)

CR = Contact rate: the amount of contaminated medium contaminated per unit of time of event (for example, milligram per day [mg/day] for soil)

EF = Exposure frequency: how often the exposure occurs (days/year)

ED = Exposure duration: how long the exposure occurs (years)

BW = Body weight: the average body weight of the receptor over the exposure period (kilograms [kg])

AT = Averaging time: the period over which exposure is averaged (days); for carcinogens, the averaging time is 25,550 days based on a lifetime exposure of 70 years; for noncarcinogens, the averaging time is calculated as ED (years) x 365 days/year

Variations of Equation 1 were used to calculate pathway-specific worker exposure to COPCs. The equations and parameter values used for each exposure pathway are presented on Figure 10 and in Table 4, respectively. The EPC calculations are discussed in Section 3.3.1. Pathway-specific intake equations and exposure parameters used in the risk assessment are discussed in Section 3.3.2. Fate and transport modeling used to estimate receptor-specific exposures to potential VOCs in indoor air is discussed in Section 3.3.3. Finally, as discussed in Section 3.2, receptors are assumed to be exposed to PCBs through various medium-specific exposure pathways (see Figure 7). Section 3.3.4 summarizes the medium-specific exposure scenarios that were summed in order to calculate total exposures for adult industrial and construction/excavation workers at each exposure point.

3.3.1 EPC Calculations

The EPC is defined as the concentration of a COPC that a human receptor is exposed to at an exposure point. This section summarizes how EPCs were derived for surface soil, subsurface soil, groundwater, and indoor air. Medium-specific EPCs are discussed below.

Surface Soil EPCs

Surface soil samples were analyzed only for PCBs. Separate surface soil EPCs were calculated for two on-property exposure areas (the Southeast Area and the On-Property [non-IA-specific] area) and three off-property exposure areas (the Off-Property [North], Off-Property [South], and Off-Property [West] areas) as identified in Section 2.1.1 and shown in Figure 3. Consistent with EPA guidance, the surface soil EPC for industrial workers and residential receptors was defined as the lesser of the maximum detected concentration and the 95 percent upper confidence limit (95 UCL) of the sample concentration mean. Location-specific 95 UCL values were calculated using EPA's ProUCL Version 3.0 software package (EPA 2004b). A value equal to one-half the reporting limit was used for censored measurements.

The 95 UCL values calculated for surface soil within the Southeast and On-Property (non-IA-specific) areas are presented in Tables A-1 and A-2, respectively in Appendix A. The 95 UCL values calculated for surface soil within the Off-Property (North) and Off-Property (South) areas are presented in Tables A-3 and A-4, respectively in Appendix A. The surface soil analytical results used to calculate the 95 UCLs for on- and off-property areas are presented in Tables A-5 and A-6, respectively in Appendix A and shown in Figures 11 (Southeast Area), 12 (On-Property [non-IA-specific]), 13 (Off-Property [North]), and 14 (Off-Property [West] and [South]). The on- and off-property surface soil EPCs were set equal to the 95 UCLs as follows: Southeast Area (4.9 mg/kg), On-Property (non-IA-specific) (1.5 mg/kg), Off-Property (North) (0.3 mg/kg), and Off-Property (South) (0.9 mg/kg). An EPC was not calculated for surface soil within the Off-Property (West) area because PCBs were not detected in the four samples collected in this area.

In contrast to industrial workers who are assumed to move freely throughout an exposure area (in this case, on- and off-property, construction workers are assumed to be exposed in discrete locations in each exposure area (for example, in a construction trench). Therefore, consistent with EPA and Ohio EPA guidance, the on- and off-property surface soil EPCs for construction workers were set equal to the maximum concentrations of PCBs detected in these two exposure areas: on-property (15 mg/kg) and off-property (1.7 mg/kg). It should be noted that PCBs were detected at 30 mg/kg at soil sample LM-SC8. However, this location will be excavated as discussed in Section 2.1.2.

Subsurface Soil EPCs

Industrial workers are assumed to not be directly exposed to contaminants in subsurface soil. Specifically, it was assumed that the 6-inch concrete slab present throughout the interior of the Airdock will prevent direct exposure to subsurface soil beneath the Airdock by industrial workers. Also, industrial workers are assumed to not engage in any work activities that require direct exposure to subsurface soil.

Construction/excavation workers may be exposed to subsurface soil as a result of their normal work activities (for example, installing or repairing utility lines). As described above for surface soil, construction/excavation workers are assumed to be exposed in discrete locations in each exposure area (for example, in a construction trench). Therefore, consistent with EPA and Ohio EPA guidance, the subsurface soil EPCs for construction/excavation workers at the different IAs, as well as non-IA-specific on-property and off-property locations evaluated in the risk assessment were set equal to the maximum concentration of each COPC detected at these locations. The location-specific subsurface soil EPCs for construction/excavation workers are presented in Table 5.

Groundwater EPCs

Industrial workers are assumed to not be directly exposed to contaminants in groundwater. Specifically, as discussed in Section 3.1, it was assumed that institutional controls will be put in place to prohibit potable groundwater use at the Airdock until such time as contaminant concentrations in groundwater are at acceptable levels. However, industrial workers may be exposed to VOCs that potentially migrate from groundwater to soil gas and then to indoor air into Airdock work spaces. EPA’s Johnson and Ettinger model was used to estimate the concentration of volatile COPCs in indoor air. As input to EPA's GW-ADV-Feb04.xls spreadsheet, the groundwater concentration was set equal to the maximum concentration of each volatile COPC detected in groundwater beneath each IA, with the exception of IA 9. Groundwater beneath IA 9 is being treated by ZVI injection. This treatment has already significantly reduced the concentration of vinyl chloride in the groundwater beneath IA 9. In order to better characterize the on-going impact of the ZVI injection treatment, groundwater EPCs for IA 9 were calculated as the average 2007 concentration (based on four quarters of results). IA-specific groundwater concentrations used as input to EPA's Johnson and Ettinger model are presented in Table 5. The assumptions and input parameter values used to model potential indoor air concentrations are discussed below under "Indoor Air EPCs."

In addition, construction/excavation workers may be exposed through dermal contact with groundwater as a result of their normal work activities (for example, installing or repairing utility lines). As described above for surface soil, construction/excavation workers are assumed to be exposed in discrete locations in each exposure area (for example, in a construction trench). Groundwater is assumed to enter and collect in a construction trench to a depth of about 6 inches. Consistent with EPA and Ohio EPA guidance, groundwater EPCs for construction/excavation workers at the different IAs evaluated in the risk assessment were set equal to the maximum concentration of each COPC detected in groundwater beneath each IA. The IA-specific groundwater EPCs for construction/excavation workers are presented in Table 5.

Finally, for the purpose of evaluating potential future off-property residential exposure, groundwater EPCs were set equal to the maximum concentration of each COPC as measured in the most recent groundwater samples collected from off-property, in-plume alluvial wells. These wells are A-5, A-6, P-1, P-2, and P-3 (see Figure 4). The most recent groundwater samples were collected in June 2007 for all wells except P-2 for which the most recent groundwater sample was collected in January 2007.

Indoor Air EPCs

Indoor air EPCs were estimated using EPA's Johnson and Ettinger model (EPA 2004a). Specifically, indoor air concentrations were calculated for IAs 4, 9, and 11 using EPA's GW-ADV-Feb04.xls spreadsheet. The model-specific results were used to represent the potential indoor air exposure scenario for each IA.

To the maximum extent possible, input parameter values required by the spreadsheet were based on site-specific conditions. Table C-1 in Appendix C presents the Johnson and Ettinger input parameters used in EPA's GW-ADV-Feb04.xls spreadsheet. These input parameter values were discussed with Ohio EPA prior to their use in the risk assessment (Tetra Tech 2006a).

Construction Trench Air EPCs

Chemical-specific volatilization factors (VF) were used to estimate construction trench air EPCs. The chemical-specific VFs relate concentrations of volatile chemicals in groundwater accumulated in a construction trench to airborne concentrations that may be inhaled by construction workers. COPC-specific VFs and construction trench air EPCs were calculated for this scenario based on Virginia Department of Environmental Quality (VDEQ) guidance, which provides a combination of a vadose zone model to estimate volatilization of gaseous COPCs from groundwater into a trench and a box model to estimate dispersion of the COPCs from the air inside the trench into aboveground air (VDEQ 2005). Appendix B further describes the modeling and presents the COPC-specific construction trench air EPCs calculated using the VDEQ model. IA-specific construction trench air EPCs are presented in Table 5.

3.3.2 Pathway-Specific Intake Equations and Exposure Parameters

Figure 10 and Table 4, respectively, present the pathway-specific intake equations and exposure parameter values used to estimate receptor-specific exposure under RME conditions for each exposure pathway. Chemical-specific parameters referred to in Table 4 regarding the calculation of the term "DAevent" are presented in Table 6. The intake equations and exposure parameter values used in the risk assessment were taken primarily from Ohio EPA's "Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures" (Ohio EPA 2002) and EPA's RAGS Part E (EPA 2004d).

Consistent with the intended future land use at the Airdock – aerospace manufacturing – exposures were calculated for two receptor groups: adult industrial workers and adult construction/excavation workers. Table 4 summarizes the basis for each receptor-specific exposure parameter value for the potential exposure routes evaluated. Receptor-specific doses under RME conditions are presented in Tables D-1 through D-8 in Appendix D.

3.3.3 Calculation of Total Exposures

As discussed in Section 3.3, human receptors are expected to be exposed to COPCs through various medium-specific exposure pathways. Exposures were evaluated for a series of six exposure points. These exposure points represent different IAs identified at the Airdock and are listed below:

- IA 1
- Combined IA 4
- IA 9
- IA 11
- Southeast Area
- On-Property (non-IA-specific)
- Off-Property (North)
- Off-Property (South)
- Off-Property (West).

Industrial workers are assumed to be exposed through potential inhalation of VOCs in indoor air at IAs located inside the Airdock (IAs 4, 9, and 11). Industrial workers may also be exposed via incidental ingestion, dermal contact, and inhalation of fugitive dusts from surface soil both on- and off-property. (Note: industrial workers were assumed not to be exposed at IA 1 because contamination has not been detected in surface soil at this location). The medium-specific exposure pathways that were summed to calculate exposure point-specific total exposures for industrial workers are summarized below.

- **Combined IA 4** – inhalation of indoor air at IA 4 and incidental ingestion, dermal contact, and inhalation of fugitive dust at on- and off-property locations.
- **IA 9** – inhalation of indoor air at IA 9 and incidental ingestion, dermal contact, and inhalation of fugitive dust at on- and off-property locations.
- **IA 11** – inhalation of indoor air at IA 11 and incidental ingestion, dermal contact, and inhalation of fugitive dust at on- and off-property locations.

Note: in order to simplify the combined calculations and focus on the greatest potential combined exposures, the Southeast Area was used to represent on- and off-property locations, respectively. This area has the highest calculated PCB EPC and therefore represents the location of greatest potential exposure outside the Airdock.

In contrast, construction/excavation workers are assumed to be exposed to a variety of media at particular locations; therefore, it was assumed that these workers will not be exposed at multiple locations. Summarized below are the medium-specific exposure pathways that were summed to calculate exposure point-specific total exposures for construction/excavation workers.

- **IA 1** – incidental ingestion, dermal contact, and inhalation of fugitive dusts from soil (surface and subsurface combined) and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at IA 1

- **Combined IA 4** – incidental ingestion of and dermal contact with subsurface soil and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at IA 4

- **IA 9** – incidental ingestion of and dermal contact with subsurface soil and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at IA 9

- **IA 11** – incidental ingestion of and dermal contact with subsurface soil and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at IA 11

- **Southeast Area** – incidental ingestion, dermal contact, and inhalation of fugitive dusts from surface soil (potential subsurface exposure was not evaluated because PCB contamination is limited to surface and near-surface soil). Potential groundwater exposures were not evaluated because the Southeast Area is outside the identified groundwater plume (see Figure 4).

- **On-Property (non-IA-specific)** – incidental ingestion, dermal contact, and inhalation of fugitive dusts from surface soil at non-IA-specific on-property locations (potential subsurface exposure was not evaluated on-property because PCB contamination is limited to surface and near-surface soil) and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at on-property (non-IA-specific) locations (outside the Southeast Area)

- **Off-Property (North) –** incidental ingestion, dermal contact, and inhalation of fugitive dusts from surface soil (potential subsurface exposure was not evaluated off-property because PCB soil contamination is limited to surface and near-surface soil) and dermal contact with groundwater and inhalation of VOCs from groundwater in construction trench air at Off-Property (North) locations

- **Off-Property (South)** – incidental ingestion, dermal contact, and inhalation of fugitive dusts from surface soil (potential subsurface exposure was not evaluated off-property because PCB soil contamination is limited to surface and near-surface soil). Potential groundwater exposures were not evaluated because the Off-Property (South) area is outside the identified groundwater plume (see Figure 4).

- **Off-Property (West)** – Potential exposure via incidental ingestion of and dermal contact with surface soil was not evaluated because PCBs were not detected in this area. Potential groundwater exposures were not evaluated because the Off-Property (West) area is outside the identified groundwater plume (see Figure 4).

3.4 WATER QUALITY AND SEDIMENT LOADING EVALUATION UNDER POST-REMEDIATION CONDITIONS

Modeling was used to evaluate the potential water quality and sediment loading to Haley's Ditch for post-remediation areas of the Property. The evaluation considered the potential impacts of stormwater emanating from unpaved areas of the Property following remediation of the Airdock, specifically the Southeast Area and the unpaved areas of the On-Property (non-IA-Specific) Area (see Figure E-1 in Appendix E). The objectives of the evaluation were to estimate the potential maximum water quality and sediment impact from erosion of residual soils impacted by PCBs in stormwater runoff from the Airdock Property following completion of remedial activities.

The general methodology consisted of estimating the amount of soil loss from the unpaved areas of the Property containing low-level PCBs. The EPCs from these areas, 1.5 mg/kg for the On-Property (Non-IA-specific) Area and 4.9 mg/kg for the portion of the Southeast Area not subject to remediation, were used to derive the annualized mass of PCBs that could enter the storm sewer system and ultimately discharge to Outfall 001, which forms the headwater of Haley's Ditch. The estimated mass of PCBs was used to derive two values.

- **Estimating the Maximum Water Quality Load** –The analysis modeled the PCB mass within the annualized flow at Outfall 001 assuming the PCBs remained in suspension and several other conservative assumptions. The maximum anticipated water quality load, 0.018 ng/L, was compared to applicable water quality standards for PCBs in the Lake Erie drainage basin outside mixing zone average of 0.026 ng/L (protection of human health) and 0.120 ng/L (protection of wildlife) (OAC 3745-1-33, Table 33-2).

- **Estimating the Maximum Sediment Load** –The analysis compared the PCB mass contribution (assuming the PCB mass was deposited and not suspended) to the modeled sediment loss for the Outfall 001 drainage area. The estimated sediment PCB concentration, 0.04 mg/kg, was compared to the VAP Standard for Residential Direct Contact (OEPA, OAC 3745-300-08 (B)(3)(b)) for PCBs of 1.1 mg/kg.

Collectively, the conservative assumptions used in the model result in an overestimation of the PCB concentrations in post-remedial stormwater migrating from the 19-acre Property. Additional details on the model and the assumptions of the analysis appear in Appendix E, Uncertainties in the modeling exercise are discussed in Section 6 and summarized in Table 10.

4.0 TOXICITY ASSESSMENT

This section identifies the toxicity values used to quantify potential adverse effects on human health associated with potential exposures to COPCs in soil, groundwater, and air inside and outside (but adjacent to) the Airdock. These toxicity factors include slope factors (SF) for carcinogenic COPCs and reference doses (RfD) for noncarcinogenic COPCs. Sections 4.1 and 4.2 discuss the toxicity factors used to assess the carcinogenic and noncarcinogenic effects of COPCs, respectively. Section 4.3 discusses the estimation of toxicity values for dermal exposure.

4.1 TOXICITY FACTORS FOR CARCINOGENIC COPCS

The potential for exposure to a given chemical to result in carcinogenic effects is evaluated differently than for noncarcinogenic effects. The upper-bound excess lifetime cancer risk (ELCR) associated with a given dose is calculated by multiplying the dose from a given route of exposure (LADD) by an SF. An SF is an upper-bound estimate of the probability of a carcinogenic response per unit dose of a chemical over a lifetime. SFs are derived through use of mathematical models based on a high-to-low dose extrapolation and under the assumption that no threshold exists for initiation of cancer. Because of the use of the nonthreshold assumption and the 95 UCL of the slope of the dose-response curve, SFs provide a conservative, upper-bound estimate of potential cancer risks. The actual response to a given dose of a chemical is therefore probably less than the predicted response (EPA 1989).

EPA assigns weight-of-evidence designations to indicate the likelihood that a chemical agent is a carcinogen in humans. These designations are defined below (EPA 1989).

- "A" indicates that a chemical is considered a proven human carcinogen
- "B" indicates that a chemical is considered a probable human carcinogen. "B1" indicates that suggestive but inconclusive evidence of human carcinogenicity is associated with the chemical, and "B2" indicates that conclusive evidence of a chemical's human carcinogenicity is documented in repeated animal studies but the evidence of carcinogenicity in humans in inconclusive.
- "C" indicates that a chemical is a possible human carcinogen either because a single high-quality animal study demonstrates carcinogenicity or because several low-quality animal studies indicate carcinogenicity.
- "D" indicates that evidence of a chemical's carcinogenicity in animals or humans is inconclusive.
- "E" indicates that no evidence of a chemical's carcinogenicity is available from adequate human or animal studies.

SFs are specific to a chemical and a route of exposure and are generally available for both the oral (ingestion or gavage) and inhalation routes. Chemical-specific SFs were selected from Table II of Ohio EPA's "Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures" (Ohio EPA 2002). Ohio EPA selected these SFs from the following sources of toxicity information (presented in order of decreasing preference):

- EPA's Integrated Risk Information System (IRIS) (EPA 2006)
- EPA National Center for Environmental Assessment (NCEA) Provisional Values
- EPA's "Health Effects Assessment Summary Tables" (HEAST) (EPA 1997)
- Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles (ATSDR 2006)
- EPA criteria documents including, but not limited to, drinking water criteria documents, drinking water health advisory summaries, ambient water quality criteria documents, and air quality criteria documents.

Table 7 presents COPC-specific oral and inhalation SF values used in the risk assessment. It should be noted that the inhalation SF for trichloroethene presented in Table II of Ohio EPA (2002) differs from the inhalation SF included in EPA's Johnson and Ettinger models (EPA 2004a). As directed by Ohio EPA, Tetra Tech used the inhalation SF for TCE as presented in Table II of Ohio EPA (2002) for all Johnson and Ettinger model calculations (see Appendix C) (Tetra Tech 2006a).

4.2 TOXICITY FACTORS FOR NONCARCINOGENIC COPCS

Standard risk assessment models are based on the assumption that noncarcinogenic effects, unlike carcinogenic effects, exhibit a threshold (that is, a level of exposure exists below which no adverse effects are observed). The potential for noncarcinogenic health effects resulting from exposure to a COPC was assessed by comparing an exposure estimate for intake (ADD) to an RfD. The RfD represents an estimated daily intake rate for a noncarcinogenic COPC that is believed to pose no appreciable risk of adverse effects on human health, including the health of sensitive populations, during a lifetime. RfDs also apply to the noncarcinogenic effects of potential carcinogens.

An RfD is specific to a chemical and a route of exposure, such as ingestion or inhalation. Chronic and subchronic RfDs are developed for different periods of exposure. Chronic RfDs are used to evaluate exposures occurring over periods of more than 7 years, and subchronic RfDs are used to evaluate exposures occurring over periods of less than 7 years. Therefore, chronic RfDs were used to characterize hazards associated with industrial worker exposures and subchronic RfDs were used to characterize hazards associated with construction/excavation worker exposures. These RfDs were identified for Table II of Ohio EPA's "Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures" (Ohio EPA 2002) as discussed in Section 4.1.

To derive an RfD, EPA workgroups review all human and animal studies relevant to a chemical and select the study or studies pertinent to the derivation of the RfD. RfDs are often derived from a measured no-observed-adverse-effect-level (NOAEL). The NOAEL corresponds to the dose (in mg/kg-day) administered during the toxicity study without inducing observable adverse effects. If a NOAEL cannot be determined, the lowest observed adverse effect level (LOAEL) is used. The LOAEL corresponds to the lowest daily dose administered in the toxicity study that induces an observable adverse effect. The toxic effect characterized by the LOAEL is referred to as the "critical effect."

To derive an RfD, the NOAEL or LOAEL is divided by uncertainty factors to ensure that the RfD will be protective of human health. Uncertainty factors usually occur in multiples of 10, and each factor represents a specific area of uncertainty inherent in extrapolation from available data. Uncertainty factors account for (1) variations in the general population to protect sensitive human populations such as child and elderly receptors, (2) extrapolation of data from animals to humans (interspecies extrapolation), (3) derivation of a chronic RfD based on a subchronic rather than a chronic study, and (4) derivation of an RfD based on a LOAEL instead of a NOAEL. Modifying factors may be applied to data in order to reflect additional uncertainties associated with the data. Modifying factors range from 0 to 10.

Table 7 presents COPC-specific oral and inhalation chronic and subchronic RfD values used in the risk assessment.

4.3 ESTIMATION OF TOXICITY VALUES FOR DERMAL EXPOSURE

SFs and RfDs are not available for the dermal exposure pathway; however, in many cases, carcinogenic risks and noncarcinogenic hazards associated with the dermal exposure pathway can be evaluated using oral SFs and RfDs. Most oral SFs and RfDs are expressed as the amount of substance administered per unit time and unit body weight, or the administered dose; however, exposure estimates developed for dermal exposure to COPCs in soil or water are expressed as the amount of substance absorbed, or the absorbed dose. Adjustments are sometimes required to ensure that the exposure estimate and the toxicity value are both expressed as absorbed doses or both expressed as administered doses (Ohio EPA 2002, EPA 1989).

To ensure that the exposure estimate and toxicity value are comparable, the toxicity value (SF or RfD), which is generally based on an administered dose, is adjusted to reflect an absorbed dose. Specifically, the oral SF or RfD for a COPC is adjusted using the gastrointestinal (GI) absorption efficiency for that COPC. For a carcinogen, the absorbed dose SF is the quotient of the oral administered dose SF and the GI absorption efficiency. For a noncarcinogen, the absorbed dose RfD is the product of the oral administered dose RfD and the GI absorption efficiency (EPA 1989).

As noted by Ohio EPA, most organic chemicals are well absorbed (GI > 50 percent). Inorganics sometimes have a wider range of absorption values; the GI values for in inorganic COPCs considered in the risk assessment also are greater than 50 percent. As recommended by EPA, oral administered toxicity values for chemicals with a GI absorption efficiency greater than 50 percent are generally not adjusted for use in characterizing risks and hazards associated with dermal exposures (EPA 2004d). Therefore, for the purpose of this risk assessment, the oral administered SFs and RfDs for COPCs were used directly and were not adjusted to characterize risks and hazards associated with dermal exposure.

5.0 RISK AND HAZARD CHARACTERIZATION

This section characterizes the carcinogenic risks and noncarcinogenic hazards associated with the exposure pathways identified in Section 3.0. Risks and hazards are characterized for individual COPCs and for exposures attributable to multiple exposure pathways, as appropriate. Carcinogenic risk estimates were derived based on LADDs, and noncarcinogenic hazard estimates were derived based on ADDs.

Section 5.1 discusses the methodologies used to characterize carcinogenic risks and hazards. Section 5.2 discusses the receptor-specific risks and hazards estimated from these methodologies. Section 5.3 discusses the calculation of segregated hazards. Finally, Section 5.4 presents the results of the Haley's Ditch sediment and water quality evaluation (see Section 3.4 and Appendix E).

5.1 RISK AND HAZARD CHARACTERIZATION METHODOLOGIES

The methodologies used to quantify carcinogenic risks and noncarcinogenic hazards are discussed in Sections 5.1.1 and 5.1.2, respectively. Section 5.1.3 presents the methodology by which theoretical residential exposures at off-property locations were evaluated semiquantitatively.

5.1.1 Carcinogenic Risks

For carcinogenic COPCs, risk estimates represent the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to the COPC (EPA 1989). These ELCRs are calculated as shown in Equation 2 below:

$$\text{Upper-Bound ELCR (Risk)} \quad = \quad \text{LADD x SF} \qquad (2)$$

where

LADD = Lifetime average daily dose (mg/kg-day)

SF = Slope factor $(\text{mg/kg-day})^{-1}$

Risk is expressed as a probability. For example, a risk of 1E-06 indicates one additional case of cancer in an exposed population of 1 million. The SF in almost all cases represents a 95 UCL of the probability of a carcinogenic response based on experimental data used in a multistage model. The resulting risk estimate therefore represents an upper-bound estimate of the carcinogenic risk. The actual risk probably does not exceed the estimate and is likely to be less.

Future land use at the Airdock will be industrial (aerospace). Therefore, a cumulative carcinogenic target risk level of 1E-04 is applicable, per OAC 3745-300-09 (C) (1) (b) (i). The additional requirement that the cumulative cancer risk to off-property property receptors, attributable to COPCs, is less than 1E-05 (OAC 3745-300-09 (C) (1) (b) (i)) is demonstrated in Section 5.1.3.

Within a given exposure pathway, receptors may be exposed to more than one chemical. The total upper-bound risk associated with exposure to multiple chemicals through a single pathway is estimated as shown in Equation 3.

$$\text{Risk}_{(EP)} = \text{Risk}_1 + \text{Risk}_2 + \ldots + \text{Risk}_i \quad (3)$$

where

$\text{Risk}_{(EP)}$ = Total risk for a given exposure pathway

Risk_i = Risk estimate for the ith COPC

At particular exposure points, receptors may be exposed through a number of exposure pathways (see the CSM in Figure 7). At each exposure point, the total exposure for a receptor equals the sum of the exposures through the various exposure pathways to which the receptor is exposed. Under each exposure scenario, exposure pathway combinations were developed for each receptor (see Section 3.3.3). The total risk posed to a receptor through a combination of pathways is calculated as shown in Equation 4.

$$\text{Total Risk} = \text{Risk}\ (EP_1) + \text{Risk}\ (EP_2) + \ldots + \text{Risk}\ (EP_i) \quad (4)$$

where

Total Risk = Risk resulting from multiple exposure pathways

$\text{Risk}\ (EP_j)$ = Risk resulting from the jth exposure pathway

The approach described above is consistent with the widely held belief that the total carcinogenic risk associated with exposure to multiple carcinogenic COPCs can be estimated as the sum of the carcinogenic risks posed by individual COPCs (EPA 1986).

5.1.2 Noncarcinogenic Hazards

The potential for receptors to develop noncancerous health effects is characterized by comparing an intake for a specific exposure period (the ADD) to an RfD developed for a similar exposure period.

When performed for a single chemical, this comparison yields a ratio known as the hazard quotient (HQ), which is calculated in Equation 5.

$$HQ \quad = \quad ADD/RfD \qquad (5)$$

where

ADD = Average daily dose (mg/kg-day)

RfD = Reference dose (mg/kg-day)

Generally, an HQ of less than or equal to 1 is considered to be health-protective. An HQ exceeding 1 indicates a potential for adverse noncarcinogenic health effects (EPA 1989). Also, based on the intended future use of the Airdock (airship construction and housing), a cumulative target hazard of 1 is applicable per OAC 3745-300-09 (C) (2). For the purposes of this risk assessment, chronic and subchronic RfDs were used to characterize noncarcinogenic hazards for industrial and construction/excavation worker, respectively.

As with carcinogenic COPCs within a given exposure pathway, a receptor may be exposed to multiple substances with associated noncarcinogenic health effects. To estimate the total noncarcinogenic hazards for each exposure pathway, the risk assessment used the procedures outlined in "Guidelines for the Health Risk Assessment of Chemical Mixtures" and RAGS (EPA 1986, 1989). The total noncarcinogenic hazard attributable to exposure to multiple COPCs through a single pathway was calculated as shown in Equation 6.

$$HI_{(EP)} \quad = \quad HQ_1 + HW_2 + \ldots + HQ_i \qquad (6)$$

where

$HI_{(EP)}$ = Total hazard index (HI) for a given exposure pathway

HQ_i = Hazard quotient for the ith COPC

This summation methodology is based on the assumption that the effects of the various COPCs to which a receptor is exposed are additive.

As discussed in Section 5.1.1 for carcinogenic COPCs, exposure pathway combinations were developed for each receptor. The total noncarcinogenic hazard posed to a receptor through a combination of exposure pathways is calculated as shown in Equation 7.

Total HI = HI (EP1) + HI (EP2) + . . . + HI (EPj) (7)

where

HI (EPj) = Hazard index resulting from the jth exposure pathway

Consistent with EPA guidance, all total HIs exceeding 1 were further evaluated (EPA 1989). The total HI for an exposure pathway can exceed 1 as a result of either (1) a single COPC with an HQ exceeding 1 or (2) several COPCs whose HQs sum (HI) exceeds 1, but whose individual HQs do not exceed 1. In the second case, a detailed analysis is required to determine whether the potential for noncarcinogenic health effects is accurately represented by the total HI because the toxicological effects associated with exposure to multiple COPCs may not be additive; therefore, the total HI may overestimate the potential for noncarcinogenic health effects. To address this possibility, the primary contributors to the total HI are grouped according to target organ or effect, and the total segregated HI for each group is derived. This process is referred to as segregation of the HI. Section 5.3 provides further discussion of the impact of segregating HIs.

5.1.3 Semiquantitative Characterization of Residential Risks and Hazards

As introduced in Section 3.2.2, risks and hazards associated with theoretical residential exposure to COPCs in surface soil at off-property locations were characterized in a semiquantitative manner. Specifically, risks and hazards associated with potential direct contact exposure to COPCs in surface soil were characterized by comparing off-property soil EPCs to COPC-specific residential GNS values for a single chemical (OAC 3745-300-8 Generic Numerical Standards, Table II: Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Residential Land Use Category). Potential exposure to COPCs in groundwater is limited to indirect exposure via inhalation of VOCs resulting from the subsurface vapor transport of VOCs from groundwater into indoor air, even though currently there are no buildings on the adjoining airport property located over the plume. Specifically, off-property groundwater EPCs were compared to generic groundwater screening levels recommended by EPA (see Table 2c, EPA 2002).

5.2 RISKS AND HAZARDS

This section discusses receptor-specific risks and hazards estimated using the methods described in Sections 5.1.1 and 5.1.2, respectively. Results are presented separately for industrial workers (Section 5.2.1), construction/excavation workers (Section 5.2.2), and residents (Section 5.2.3). Each section summarizes the exposure scenarios and receptors evaluated. For each receptor, risks are discussed first, followed by hazards. Risks and hazards specific to each IA are referred to as “IA-specific” results and are presented first in Sections 5.2.1.1 (risks) and 5.2.1.2 (hazards). However, industrial workers may be exposed both at their work stations inside the Airdock (Combined IA 4, IA 9, and IA 11) and outside the Airdock at non-IA-specific on-property and off-property locations. The PCB EPC for the Southeast Area is greater than the EPCs for the On-Property (non-IA-specific) and off-property area PCB EPCs as are the associated risks and hazards from potential exposure to PCBs in surface soil. Therefore, for purposes of the property-specific risk assessment, overall total risks and hazards for the Combined IA 4, IA 9, and IA 11 were calculated as the sum of IA-specific risks and hazards plus the risks and hazards at the Southeast Area. For industrial workers (Section 5.2.1), overall total risks and hazards are presented after the IA-specific results are presented.

For both IA-specific and overall total results, the risk assessment identified COPCs contributing significantly to potentially significant risks and hazards. Risks equal to or greater than 1E-06 are identified as contributing significantly to total risks. This approach is consistent with EPA policy that identifies a risk level of 1E-06 as the low end of EPA’s “acceptable” risk range (EPA 1990). Risks less than 1E-06 are considered to be insignificant. Total risks are compared to the cumulative target risk of 1E-04 based on the intended future industrial use of the Airdock (OAC 3745-300-09 (C) (1) (b) (i)). Similarly, HIs equal to or greater than 1 are identified as significant consistent with a cumulative target hazard of 1 based on the intended future industrial use of the Airdock (OAC 3745-300-09 (C) (2).

Tables 8 and 9 show the risk summary and hazard summary, respectively, for the individual areas and for the two worker exposure scenarios.

5.2.1 Industrial Workers

This section discusses risks and hazards calculated for industrial workers for each of the IAs evaluated in the risk assessment: the Combined IA 4, IA 9, IA 11, on-property, and off-property. Overall total risks and hazards (calculated as described above) are also discussed for the exposure scenario combinations identified in Section 3.3.3 for the Combined IA 4, IA 9, and IA 11. Risks are discussed in Section 5.2.1.1, and hazards are discussed in Section 5.2.1.2. Tabulated summaries are presented in Tables 8 and 9.

5.2.1.1 Risks

This section discusses risks calculated for industrial workers for the Combined IA 4, IA 9, and IA 11, as well as on- and off-property locations. It should be noted that risks specific to the Combined IA 4, IA 9, and IA 11 are based entirely on potential exposure through inhalation of indoor air (see Appendix C). Risks specific to on- and off-property locations are based on potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dusts associated with surface soil (see Tables D-5 through D-8 in Appendix D). Overall total risks for each of the exposure scenario combinations identified in Section 3.3.3 are also discussed.

Combined IA 4

The IA-specific total risk for industrial workers at the Combined IA 4 is 3E-07 and is driven by potential exposure to vinyl chloride (90 percent). This result is less than 1E-06 and is therefore considered insignificant.

IA 9

The IA-specific total risk for industrial workers at IA 9 is 3E-05. This result is entirely the result of potential exposure to vinyl chloride. This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)). It should be noted that groundwater beneath IA 9 is being treated by ZVI injection. This treatment has already significantly reduced the concentration of vinyl chloride in the groundwater beneath IA 9.

IA 11

The IA-specific total risk for industrial workers at IA 11 is 4E-09 and is entirely the result of potential exposure to vinyl chloride. This result is less than 1E-06 and is therefore considered insignificant.

Southeast Area

The total risk for industrial workers at the Southeast Area is 6E-06 and is entirely the result of potential exposure to PCBs. Specifically, the risk is driven by potential exposure to PCBs via dermal contact (4.7E-06) and incidental ingestion (1.7E-06). This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

On-Property (non-IA-specific)

The total risk for industrial workers at non-IA-specific locations is 2E-06. This risk is entirely the result of potential exposure to PCBs in surface soil. Specifically, the risk is driven by potential exposure to PCBs via dermal contact (1.5E-06) and incidental ingestion of soil (5.2E-07). This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

Off-Property (North)

The total risk for industrial workers at Off-Property (North) locations is 4E-07. This risk is entirely the result of potential exposure to PCBs in surface soil. This result is less than 1E-05 and is therefore considered insignificant.

Off-Property (South)

The total risk for industrial workers at Off-Property (South) locations is 1E-06. This risk is entirely the result of potential exposure to PCBs in surface soil. Specifically, the risk is driven by potential exposure to PCBs via dermal contact (8.8E-07) and incidental ingestion (3.2 E-07). This result is less than 1E-05 and is therefore considered insignificant.

Off-Property (West)

PCBs were not detected in surface soil in this area. Therefore, no risks were calculated for industrial workers at Off-Property (West) locations.

Overall Total Risks

Overall total risks were calculated for each IA located inside the Airdock (the Combined IA 4, IA 9, and IA 11). As discussed in Section 5.2, total risks were estimated by summing the risks associated with IA-specific exposures through inhalation of indoor air and the risks associated with potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dust from surface soil at the Southeast Area. Overall total risks for the Combined IA 4, IA 9, and IA 11 are presented below.

Combined IA 4

The overall total risk for industrial workers at the Combined IA 4 is 7E-06. This result is driven (95 percent) by potential exposure to PCBs in soil at the Southeast Area. This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

IA 9

The overall total risk for industrial workers at IA 9 is 3E-05. This result is driven (80 percent) by potential exposure to vinyl chloride through inhalation of indoor air. This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)). As discussed above, the groundwater beneath IA 9 is being treated by ZVI injection. This treatment has already significantly reduced the concentration of vinyl chloride in the groundwater beneath IA 9 and will continue until the concentrations of COPCs (primarily vinyl chloride) in the groundwater beneath IA 9 are reduced to equal or less than site-specific remediation objectives.

IA 11

The overall total risk for industrial workers at IA 11 is 6E-06. This result is driven (>99 percent) by potential exposure to PCBs in soil at the Southeast Area. This result is less than the cumulative target risk of 1E-04 identified for industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

5.2.1.2 Hazards

This section discusses hazards calculated for industrial workers for the Combined IA 4, IA 9, and IA 11, as well as at non-IA-specific on-property locations. It should be noted that hazards specific to the Combined IA 4, IA 9, and IA 11 are based entirely on potential exposure through inhalation of indoor air. Hazards specific to on- and off-property locations are based on potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dusts associated with surface soil. Overall total hazards for each of the exposure scenario combinations identified in Section 3.3.3 are also discussed.

Combined IA 4

The IA-specific total HI for industrial workers at the Combined IA 4 is 4.4E-03. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is therefore considered insignificant.

IA 9

The IA-specific total HI for industrial workers at IA 9 is 9.2E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2))and is therefore considered insignificant.

IA 11

The IA-specific total HI for industrial workers at IA 11 is 1.2E-05. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is therefore considered insignificant.

Southeast Area

The total HI for industrial workers at the Southeast Area is 4.5E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is therefore considered insignificant.

On-Property (non-IA-specific)

The total HI for industrial workers at on-property non-IA-specific locations is 1.4E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is therefore considered insignificant.

Off-Property (North)

The total HI for industrial workers at Off-Property (North) locations is 2.9E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and therefore is considered insignificant.

Off-Property (South)

The total HI for industrial workers at Off-Property (South) locations is 8.4E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and therefore is considered insignificant.

Off-Property (West)

PCBs were not detected in surface soil in this area. Therefore, no hazards were calculated for industrial workers at Off-Property (West) locations.

Overall Total Hazards

Overall total hazards were calculated for each of the IAs located inside the Airdock (the Combined IA 4, IA 9, and IA 11). As discussed in Section 5.2, total hazards were estimated by summing the HIs associated with IA-specific exposures through inhalation of indoor air and the HIs associated with potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dust from surface soil at the Southeast Area. Overall total hazards for the Combined IA 4, IA 9, and IA 11 are presented below.

Combined IA 4

The overall total HI for industrial workers at IA 4 is 5E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and therefore is considered insignificant.

IA 9

The overall total HI for industrial workers at IA 9 is 5E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and therefore is considered insignificant.

IA 11

The overall total HI for industrial workers at IA 4 is 5E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and therefore is considered insignificant.

5.2.2 Construction/Excavation Workers

This section discusses risks and hazards calculated for construction/excavation workers for each of the IAs evaluated in the risk assessment: IA 1, the Combined IA 4, IA 9, IA 11, on-property and off-property locations. Total risks and hazards are discussed for the exposure scenario combinations identified in Section 3.3.3. Risks are discussed in Section 5.2.2.1, and hazards are discussed in Section 5.2.2.2. Tabulated summaries are presented in Tables 8 and 9.

5.2.2.1 Risks

This section discusses risks calculated for construction/excavation workers for IA 1, the Combined IA 4, IA 9, and IA 11, as well as on- and off-property locations. Risks are based on potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dust from soil, as well as dermal contact with groundwater and inhalation of air in a construction trench. (Note: inhalation of fugitive dust was evaluated only for IA 1, as well as non-IA-specific on-property and off-property locations – the other IAs are located inside the Airdock). Total risks for each of the exposure scenario combinations identified in Section 3.3.3 are also discussed.

IA 1

The total risk for construction/excavation workers at IA 1 is 3E-05. This result is driven by potential exposure through inhalation of air in a construction trench (85 percent); the contribution from inhalation of construction trench air is from potential exposure to benzene (1.2E-05), 1,1-dichloroethene (4.5E-06), vinyl chloride (2.8E-06), and trichloroethene (2.7E-06) and dermal contact with and incidental ingestion of PAHs in soil (14 percent). This result exceeds the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b)(i)).

Combined IA 4

The total risk for construction/utility workers at Combined IA 4 is 1E-06. This result is driven by potential exposure to 1,1-dichloroethene (3.0E-07) and vinyl chloride (1.5E-07) in construction trench air and incidental ingestion of and dermal contact with arsenic (3.4E-07 and 1.2E-07, respectively) in subsurface soil. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b)(i)).

IA 9

The total risk for construction/excavation workers at IA 9 is 9E-06. This result is driven by potential exposure to vinyl chloride in construction trench air (97 percent). This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b)(i)). As discussed above, the groundwater beneath IA 9 is being treated by ZVI injection. This treatment has already significantly reduced the concentration of vinyl chloride in the groundwater beneath IA 9 and will continue until the concentrations of COPCs (primarily vinyl chloride) in the groundwater beneath IA 9 are reduced to levels equal to or less than site-specific remediation objectives.

IA 11

The total risk for construction/excavation workers at IA 11 is 7E-07. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

Southeast Area

The total risk for construction/excavation workers at the Southeast Area is 1E-06. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

On-Property (non-IA-specific)

The total risk for construction/excavation workers at On-Property, non-IA-specific locations is 9E-06. This result is (1) driven by potential exposure to vinyl chloride (3.7E-06) and 1,1-dichloroethene (3.5E-06) and (2) less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

Off-Property (North)

The total risk for construction/excavation workers at Off-Property (North) locations is 7E-06. This result is (1) driven by potential exposure to trichloroethene (3.7E-06), 1,1-dichloroethene (2.0E-06), and vinyl chloride (1.4E-06) in construction trench air and (2) less than the cumulative target cancer risk of 1E-05 identified for construction /excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

Off-Property (South)

The total risk for construction/excavation workers at Off-Property (South) locations is 1E-07. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under an industrial land use (OAC 3745-300-09 (C) (1) (b) (i)).

Off-Property (West)

PCBs were not detected in surface soil in this area. Therefore, no risks were calculated for construction/excavation workers at Off-Property (West) locations.

5.2.2.2 Hazards

This section discusses hazards calculated for construction/excavation workers for IA 1, the Combined IA 4, IA 9, and IA 11, as well as non-IA-specific on-property and off-property locations. It should be noted that hazards specific to IA 1. Combined IA 4, IA 9, IA 11, non-IA-specific on-property and off-property locations are based on potential exposure through incidental ingestion of, dermal contact with, and inhalation of fugitive dust from soil, as well as dermal contact with groundwater and inhalation of air in a construction trench. (Note: inhalation of fugitive dust was evaluated only for IA 1, non-IA-specific on-property and off-property locations – the other IAs are located inside the Airdock). Total hazards for each exposure scenario combination identified in Section 3.3.3 are also discussed.

IA 1

The total HI for construction/excavation workers at IA 1 is 15. This result is driven by potential exposure through inhalation of air in a construction trench (98 percent); the contribution from inhalation of construction trench air is in turn driven by potential exposure to benzene (HI = 14.3). This result exceeds the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)).

Combined IA 4

The total HI for construction/utility workers at IA 4 is 7.9E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

IA 9

The total HI for construction/excavation workers at IA 9 is 4.4. This result is driven by potential exposure through incidental ingestion of (2.5) and dermal contact with (1.2) cadmium in subsurface soil. This total HI exceeds the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)).

IA 11

The total HI for construction/excavation workers at IA 11 is 6.2E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

Southeast Area

The total HI for construction/excavation workers at the Southeast Area is 5.7E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

On-Property (non-IA-specific)

The total HI for construction/excavation workers at On-Property, non-IA-specific locations is 9.2E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

Off-Property (North)

The total HI for construction/excavation workers at Off-Property (North) locations is 1.6E-01. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

Off-Property (South)

The total HI for construction/excavation workers at Off-Property (South) locations is 7.0E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)) and is considered insignificant.

Off-Property (West)

PCBs were not detected in surface soil in this area. Therefore, no hazards were calculated for construction/excavation workers at Off-Property (West) locations.

5.2.3 Residents

The risk and hazard to potential off-property residents was evaluated semiquantitatively as described in Section 5.1.3 and summarized below:

- The risks and hazards associated with potential direct contact exposure to COPCs in surface soil were characterized by comparing off-property soil EPCs to COPC-specific residential GNS values for a single chemical (OAC 3745-300-8 Generic Numerical Standards, Table II: Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Residential Land Use Category)

- Potential exposure to COPCs in groundwater is limited to indirect exposure via inhalation of VOCs resulting from the subsurface vapor transport of VOCs from groundwater into indoor air. Therefore, risks and hazards associated with potential indirect exposure to COPCs in groundwater (inhalation of indoor air) were characterized by comparing off-property groundwater EPCs to generic groundwater screening levels recommended by EPA (see Table 2c, EPA 2002)

As discussed in Section 3.3.1 and presented in Table 5, the EPC for PCBs in Off-Property (North) surface soil is 0.31 mg/kg. This concentration is less than the residential GNS value of 1.1 mg/kg. Therefore, the risks and hazards posed to hypothetical off-property residents by the presence of PCBs in off-property soil are considered insignificant. Residences are unlikely to be constructed in Off-Property (South) and Off-Property (West) areas because of their immediate proximity to industrial operations. Nonetheless, the EPC for PCBs in the Off-Property (South) area is 0.91 mg/kg; this concentration is also less than the residential GNS value of 1.1 mg/kg. Finally, PCBs were not detected in surface soil in the Off-Property(West) area. Therefore, potential residential exposure in this area was not evaluated.

Similarly, as discussed in Section 3.3.1 and presented in Table 5, the EPCs for various COPCs in off-property groundwater are as follows: 1,1-dichloroethene (1.66 µg/L), *cis*-1,2-dichloroethene (364 µg/L), *trans*-1,2-dichloroethene (61.2 µg/L), trichloroethene (106 µg/L), and vinyl chloride (5.37 µg/L). The EPCs for 1,1-dichloroethene and *trans*-1,2-dichlorothene are less than their respective generic groundwater screening levels; therefore, these COPCs pose insignificant risks to off-property residential receptors. However, the EPCs for the remaining three COPCs – *cis*-1,2-dichloroethene, trichloroethene, and vinyl chloride exceed their respective generic groundwater screening levels as shown below.

COPC	EPC (µg/L)	Generic Groundwater Screening Level (µg/L)
cis-1,2-Dichloroethene	364	210
Trichloroethene	106	5
Vinyl chloride	5.37	2

These results demonstrate that further assessment of the vapor intrusion pathway may be needed in the event that occupied buildings are developed on the airport property in the area of the plume. If the pathway is found to be complete, a land use restriction or engineering control may be needed in the area of the groundwater plume off-property to alert future land users of the potential for adverse health effects associated with exposure to VOCs that could potentially migrate from groundwater into future, off-property residences.

5.3 HAZARD SEGREGATION

As discussed in Section 5.2, all IA-specific and total hazards were either less than the target hazard of 1 or greater than 1 and driven by chemical-specific hazards of at least 1 for one or more chemicals. Therefore, as discussed in Section 5.1.2, hazard segregation was not required.

5.4 RESULTS OF THE HALEY'S DITCH SEDIMENT AND WATER QUALITY EVALUATION

Based on the conservative assumptions described in the analysis presented in Appendix E, the maximum anticipated sustained concentration of PCBs in the waters of Haley's Ditch at the discharge point due to future contributions from the property is estimated as 0.018 nanograms per liter (ng/L). This estimated value is less than the lowest of the Lake Erie drainage basin water quality criteria for protection of human health Outside Mixing Zone Average water quality criteria of 0.026 ng/L (OAC 3745-1-33, Table 33-2).

The corresponding PCB concentration in sediment that might be contributed from the property is estimated as 0.04 mg/kg. The concentration is significantly less than the VAP Standard for Residential Direct Contact of 1.1 mg/kg (OAC 3745-300-8 Generic Numerical Standards, Table II: Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Residential Land Use Category).

6.0 UNCERTAINTY ANALYSIS

Uncertainties are associated with all elements of the risk assessment process, from selection of COPCs through the exposure and toxicity assessment and risk/hazard characterization steps. In most cases, the methodology used to prepare the risk assessment incorporates conservative assumptions so as to limit the potential to underestimate receptor-specific exposures, risks, and hazards. Areas of uncertainty associated with the risk assessment are summarized in Table 10. Some of the potentially most significant areas of uncertainty are discussed in greater detail below.

- The risk assessment screened from further evaluation those IAs at which no medium-specific analytical results exceeded Ohio EPA VAP GNS values for industrial workers. Also, COPCs were identified as those chemicals detected at maximum medium-specific concentrations that exceeded a value of one-tenth of their respective Ohio EPA VAP GNS values.

  Both of these steps may have introduced a degree of underestimation into the risk assessment process. However, any underestimation is expected to be small. The Ohio EPA VAP GNS values for industrial workers are back-calculated from a target cancer risk of 1E-05 or a target hazard index of 1. Based on the anticipated future land use of the Airdock, the overall target risk for industrial workers is 1E-04; therefore, any IA with maximum medium-specific concentrations less than GNS values back-calculated from a target risk of 1E-05 is very unlikely to have total risks equal to or exceeding 1E-04. (It should be noted that industrial workers at IAs located inside the Airdock [IAs 4, 9, and 11] are assumed to be exposed only through inhalation of indoor air. As discussed in Section 5.1, hazards associated with inhalation of indoor air are much less than 1; therefore, IAs screened from further evaluation are very unlikely to have total hazards exceeding 1).

  Also, GNS values for construction/excavation workers (see Table IV in OAC 3745-300-8) are higher than those for industrial workers (Table III in OAC 3745-300-8). Therefore, the use of industrial worker GNS values for the purpose of screening potential exposures of construction/excavation workers is conservative and unlikely to introduce any significant degree of underestimation.

- The risk assessment assumed steady-state conditions. This assumption ignores the effects of various fate and transport mechanisms that will alter the composition and distribution of chemicals in various media over time. All organic COPCs will be impacted by a variety of fate mechanisms (such as biodegradation, metabolism, and bioavailability). Consideration of these factors is expected to reduce receptor-specific exposures, risks, and hazards. Also, groundwater beneath IA 9 is being treated by ZVI injection. This process has already significantly lowered the concentration of vinyl chloride in groundwater beneath IA 9. To the extent that ZVI treatment continues at IA 9, the concentration of vinyl chloride (the risk and hazard driver at this location) will be reduced as compared to the EPC used in the risk assessment.

- The risk assessment assumes that ongoing and planned remediation of interior and exterior plant and work surfaces (cleaning, sealing, and replacing) will be completed to acceptable standards. Therefore, potential exposure pathways related to contact with PCBs on these surfaces were not evaluated in the risk assessment. To the extent these remedial efforts are not adequately completed, potential exposures may have been underestimated. However, it is worth noting that these activities are being conducted under the direct oversight of U.S. EPA. The risk assessment also assumes an institutional control will be implemented prohibiting potable groundwater use at and downgradient of the Airdock. If such an institutional control is not implemented, potential groundwater exposures may have been underestimated. It should be noted that groundwater beneath and downgradient of the Airdock is not currently used as a source of potable water.

- The risk assessment used modeling to estimate the concentrations of VOCs in indoor air (the Johnson and Ettinger model) and in construction trench air (a methodology developed by the VDEQ). A variety of general uncertainties and limitations are associated with any modeling. In particular, with regard to air modeling, uncertainty (often significant) is associated with the variability and representativeness of air modeling input parameters.

  One input parameter (air exchange rate [ER]) used in the Johnson and Ettinger modeling was the subject of discussion between Tetra Tech and Ohio EPA staff (see Section 3.3.1) (Tetra Tech 2006a). OEPA currently recommends that an ER value of 1 hr^{-1} be used (Tetra Tech 2006a, 2007a, OEPA 2007). However, LMC currently operates the building ventilation systems in Plant C (adjacent to the Airdock) in accordance with ASHRAE guidelines: office space at an ER of 6 hr^{-1} and plant space (shops and bays) at an ER of 4 to 4.5 hr^{-1}. For the purposes of the risk assessment, it was assumed that these same guidelines would be followed for future operations at the Airdock. However, in order to be health-protective, an ER value of 1 hr^{-1} was assumed for both office and plant space (about equal to one-fourth of the ASHRAE-recommended value for plant space and one-sixth of the ASHRAE-recommended value for office space).

  The impact of changes in the ER value on the results of both Johnson and Ettinger models is linear. Therefore, a change in the ER value from 1 to 2 hr^{-1} would result in a decrease in risks and hazards estimated by the models by a factor of 2 (2/1). In other words, the exposures, risks, and hazards associated with inhalation of indoor air would be reduced by a factor of 2 if the Johnson and Ettinger models were run with a more realistic (but still conservative) ER value of 2 hr^{-1}, rather than 1 hr^{-1}.

- The methodologies used to develop carcinogenic and noncarcinogenic toxicity factors often incorporate multiple uncertainty factors (usually multiples of 10) and modifying factors to account for extrapolations from animal toxicity results to human receptors, subchronic test data to assumed chronic environmental exposures, and sensitive receptors. All attempts are made to select and use appropriate uncertainty and modifying factors to ensure that the general population (including sensitive receptors) is not adversely impacted. For example, SFs are developed as upper confidence limits on the dose response relationship. As a result, the SF is a conservative estimate of the potential carcinogenic response and may result in overestimation of the true health effects associated with exposure to a given chemical.

  However, the use of these factors is not precise. While toxicity factors are designed with the intention of not underestimating a chemical’s toxicity, this may not always be the case. Therefore, use of Ohio EPA-recommended toxicity factors may introduce both some degree of under- and overestimation into the risk assessment.

- Risks associated with potential exposure to PCBs were characterized using a SF of 2 $(mg/kg\text{-}day)^{-1}$. This SF is based on toxicity tests performed on Aroclor 1254. However, the primary component of the PCBs found in the RPM used at the Airdock is Aroclor 1268. The congener composition of Aroclor 1268 differs substantially from that of Aroclor 1254. Warren and others (2004) have suggested an SF value for Aroclor 1268 of 2.7E-01 $(mg/kg\text{-}day)^{-1}$ about seven- to eightfold lower than the SF value used in the risk assessment. This alternate Aroclor 1268-specific SF value was developed “based in part on existing potency estimates for other PCB mixtures, coupled with the relative 2,3,7,8-tetrachlorodibenzo-p-dioxin toxic equivalents (TEQ) content and bioaccumulation potential of PCB mixtures” (Warren and others 2004). Therefore, the risks associated with potential exposure to PCBs in soil at the Airdock may have been overestimated.

- Potential exposures to COPCs in soil at IA 1 were evaluated only for construction/excavation workers. For the purpose of this property-specific risk assessment, all surface soil outside of the Airdock, but located on-property was evaluated as a single data set referred to as "on-property (non-IA-specific)." Several carcinogenic PAHs including benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene were detected in a single surface soil sample at IA 1 at concentrations greater then their respective industrial/commercial workers GNS values.

  Because the concentrations of these four PAHs exceeded their respective GNS values at only a one surface soil location, the average concentrations of these PAHs throughout on-property soil are less than their respective GNS values. Therefore, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene were not retained as COPCs in soil with regard to industrial/commercial workers. As a result, the risks to industrial/commercial workers were underestimated to a limited degree.

- The risk assessment used modeling to perform the Haley's Ditch sediment loading and water quality analysis. A variety of uncertainties are associated with most modeling exercises. In this case, four primary sources of uncertainty are related to (1) time-based considerations, (2) the percentage of sediment transported, (3) the assumed flow, and (4) use of the RUSLE equation. Each of these items is briefly discussed below.

  Time-Based Considerations – This analysis considers average sediment loss over a sustained period of time and does not consider sediment loss on a short-term or event basis. While the analysis is believed representative of longer-term conditions, it is possible that short-term conditions can vary significantly during a single storm event.

  Percentage of Sediment Transported – The concentration estimate assumes that 100 percent of the eroded sediment enters the stormwater system and ultimately migrates to the Haley's Ditch system. It is plausible that some of the sediment does not enter the storm sewer system but rather is redeposited on the surface. It is also plausible that some of the sediment that does enter the system separates out due to settling in stormwater structures as well as in the basin at the outfall discharge point. However, over the course of a year it is also plausible that isolated, severe storm events re-suspend this settled material. For this reason, it was assumed that all of the eroded sediment ultimately passes through to Haley's Ditch. Again, this is a conservative assumption and results in an upper bound estimate of the potential sediment loading.

  Outfall 001Flow from Limited Source - The Outfall 001 flow figure of 356,000 gallons per day to Haley's Ditch is a conservative value based on a 1989 NPDES permit application for the former Loral and ABSC facility and an estimate for groundwater infiltration. The flow value does not include other contributing water flows to the system from process areas or other point and non-point discharges upstream of Haley's Ditch. The use of a conservative flow value results in an overestimate of the modeled surface water concentration at Haley's Ditch.

  RUSLE Equation – The RUSLE equation is a widely used and generally accepted methodology for estimating long-term soil loss (erosion potential) for a given vegetated or non-vegetated soil area. However, the methodology is generally applied to estimate the potential soil loss on a large, sloped area. For this application, most of the areas are small (< 1 acre) and the slopes are minimal (<2 percent). While the equation can be applied without limitation, it is likely that the results overestimate the actual erosion loss in the two areas evaluated. Also, a number of the assumptions of the RUSLE equation (such as Practice Factor (P) at a maximum of 1.0) are conservative because there is no clear basis for selection of an alternate value, which would lower the soil loss amount.

7.0 SUMMARY AND CONCLUSIONS

This section summarizes the procedures used to complete and the results of the risk assessment (Section 7.1) and reports conclusions based on these results (Section 7.2).

7.1 RISK ASSESSMENT SUMMARY

The property-specific risk assessment was completed in a manner consistent with the procedures specified in OAC 3745-300-09. In the future the Airdock will be used to support manufacturing and testing for the aerospace and defense sectors. Consistent with a future industrial land use, the risk assessment focused on potential exposures to two groups of receptor: industrial workers and construction/excavation workers. However, the risk assessment also evaluated off-property residential exposures in a semiquantitative manner.

Exposures, risks, and hazards were evaluated and characterized for those IAs at which at least one chemical had been found at a concentration exceeding medium-specific (soil and groundwater) Ohio EPA VAP GNS values for commercial and industrial land use categories. IAs 3, 4, and 5 are located adjacent to each other and were evaluated as a single area referred to as the Combined IA 4. Also, the risk assessment did not directly evaluate IA 10 as described in Section 1.2.1 primarily because the concentration of vinyl chloride measured in groundwater beneath IA 10 is much lower than detected in groundwater beneath IA 9 located south of IA 10 and the interior airspace at IA9 is less than at IA10. As a result, IA9 represents a conservative surrogate for IA10. Any remediation found to be necessary and implemented at IA 9 would also reduce the concentration of vinyl chloride at IA 10.

The risk assessment evaluated exposures and characterized risks and hazards associated with these exposures at the following IAs:

- IA 1
- Combined IA 4
- IA 9
- IA 11
- Southeast Area
- On-Property (non-IA-specific)
- Off-Property (North)
- Off-Property (South)

- Off-Property (West).

Medium-specific concentrations detected in soil and groundwater at these IAs were evaluated to identify COPCs. Chemicals detected at a maximum concentration exceeding a value of one-tenth its medium-specific Ohio EPA VAP GNS value for industrial and commercial land use categories were identified as COPCs. The COPCs identified and carried through the risk assessment are as follows (Note: these chemicals are considered COPCs for both soil and groundwater unless otherwise noted):

- Benzene
- 1,1-Dichloroethene
- *cis*-1,2-Dichloroethene
- *trans*-1,2-Dichloroethene
- Ethyl benzene
- Toluene
- Trichloroethene
- Vinyl chloride
- Benzo(a)anthracene
- Benzo(b)fluroanthene
- Benzo(a)pyrene
- Dibenzo(a,h)anthracene
- PCBs (soil only)
- Arsenic
- Beryllium
- Cadmium (soil only)
- Lead
- Mercury
- Nickel

Risks and hazards were evaluated separately for industrial and construction/excavation workers and off-property residents (semiquantitatively). These results are summarized below.

Industrial Workers

Based on the intended future industrial use of the Airdock (to support manufacturing and testing for the aerospace and defense sectors), risks and hazards calculated for industrial workers were compared to a target cumulative risk of 1E-04 and a target cumulative hazard of 1, respectively (OAC 3745-300-09 (C) (b) (i)). The additional requirement that the cumulative cancer risk to off-property property receptors, attributable to COPCs, is less than 1E-05 (OAC 3745-300-09 (C) (1) (b) (i)) is demonstrated by (1) an evaluation of potential future residential exposure and (2) a Haley's Ditch sediment and water quality evaluation. Both of these elements are discussed below.

Risks

First, total area-specific risks were calculated. The following results were identified:

- Total IA-specific risks for Combined IA 4 (3E-07), IA 11 (4E-09), Off-Property (North) (4E-07), and Off-Property (West) are less than 1E-06 and are considered insignificant
- Total IA-specific risks for IA 9 (3E-05), the Southeast Area (6E-06), On-Property (non-IA-specific) area (2E-06), and Off-Property (South) (1E-06) exceed 1E-06 but are less than 1E-04

However, industrial workers may be exposed both inside the Airdock (at their specific work station [e.g., Combined IA 4, IA 9, or IA 11]) and outside the Airdock (on-property [non-IA-specific] and off-property). Therefore, the IA-specific risks for IAs 4, 9, and 11 were each summed with the total risks for the Southeast Area (see Section 5.2). The following overall total risks were identified:

- The overall total risks at Combined IA 4 (7E-06), IA 9 (3E-05), and IA 11 (6E-06) exceed 1E-06 but are less than the cumulative target risk of 1E-04. These risks are driven (90 percent or more) by potential exposure to PCBs at the Southeast Area.

Hazards

Second, total area-specific hazards were calculated. The following results were identified:

- Total IA-specific HIs for Combined IA 4 (4.4E-03), IA 9 (9.2E-02), IA 11 (1.2E-05), Southeast Area (4.5E-01), On-Property (non-IA-specific) (1.4E-01), Off-Property (North) (2.9E-02), Off-Property (South) (8.4E-02), and Off-Property (West) locations are less than 1 and are considered insignificant.

However, industrial workers may be exposed both inside the Airdock (at their specific work station [e.g., Combined IA 4, IA 9, or IA 11]) and outside the Airdock (on-property [non-IA-specific] and off-property locations). Therefore, the IA-specific HIs for IAs 4, 9, and 11 were each summed with the total HIs for the Southeast Area (see Section 5.2). The following overall total HIs were identified:

- The overall total HIs at Combined IA 4 (4.6E-01), IA 9 (5.4E-01), and IA 11 (4.5E-01) are less than the cumulative target hazard of 1.

Construction/Excavation Workers

Based on the intended future industrial use of the Airdock (to support manufacturing and testing for the aerospace and defense sectors), risks and hazards calculated for construction/excavation workers were compared to a target cumulative risk of 1E-05 and a target cumulative hazard of 1 (OAC 3745-300-09).

Risks

First, total area-specific risks were calculated. The following results were identified:

- Total risk for Combined IA 4 (1E-06), IA 11 (7E-07), Southeast Area (1E-06), Off-Property (South) (1E-07), and Off-Property (West) are less than 1E-06 and are considered insignificant.
- Total risks for IA 9 (9E-06), On-Property (non-IA-specific) (9E-06), and Off-Property (North) (7E-06), exceed 1E-06, but are less than or equal to the target cumulative risk of 1E-05.
- Total risk for IA 1 (3E-05) exceeds the target cumulative risk of 1E-05. The total risk for IA 1 is driven by potential exposure through inhalation of VOCs in trench air (benzene – 1.2E-05; 1,1-dichloroethene – 4.5E-06; and vinyl chloride – 2.8E-06) and dermal contact with and incidental ingestion of PAHs in soil.

Hazards

Second, total area-specific hazards were calculated. The following results were identified:

- Total HIs for the Combined IA 4 (7.9E-01), IA 11 (6.2E-02), Southeast Area (5.7E-01), On-Property (non-IA-specific) area (9.2E-01), Off-Property (North) (1.6E-01), Off-Property (South) (7.0E-02), and Off-Property (West) are less than 1 and are considered insignificant.
- Total HIs for IA 1 (15) and IA (4.4), exceed the cumulative target hazard of 1. The total HI for IA 1 is driven (95 percent) by potential exposure to benzene through inhalation of construction trench air. The total HI for IA 9 is driven by potential exposure through incidental ingestion of cadmium in subsurface soil (HI = 2.5).

Residents

Potential risks and hazards for hypothetical off-property residents were compared to a target cumulative risk of 1E-05 and a target cumulative hazard of 1 (OAC 3745-300-09).

- The average concentrations of PCBs in off-property surface soil are less than the residential GNS value for a single chemical. Therefore, risks and hazards associated with potential exposure to PCBs in surface soil are considered insignificant.

- Consistent with the existing Akron East USD Extension (see Figure 6) and a proposed use restriction, site groundwater is not now and will not in the future be used for potable purposes. In addition, further assessment of the exposure pathway, engineering controls or a use restriction may be necessary to mitigate potential indoor air issues in the event that inhabited structures are built over the off-property groundwater plume.

Haley's Ditch Sediment and Water Quality Evaluation Under Post-Remediation Conditions

The maximum concentration of PCBs at the discharge point in Haley's Ditch resulting from potential migration of low-level PCB-impacted soils from adjacent to the Airdock was estimated as 0.018 ng/L. This estimated value is less than the lowest of the Lake Erie drainage basin water quality criteria for protection of human health Outside Mixing Zone Average water quality criteria of 0.026 ng/L (OAC 3745-1-33, Table 33-2).

The corresponding PCB concentration in sediment that might migrate from the property is estimated to be 0.04 mg/kg. This concentration is significantly less than the VAP Standard for Residential Direct Contact of 1.1 mg/kg (Ohio EPA 2002).

7.2 RISK ASSESSMENT CONCLUSIONS

Based on the risk and hazard results summarized in Section 7.1, the following general conclusions may be drawn:

Risks and hazards associated with the Combined IA 4, IA 11, Southeast Area, on-property (non-IA-specific), Off-Property (North), Off-Property (South), and Off-Property (West) locations are less than receptor-specific target cumulative risks and hazards. Therefore, remediation at these IAs is not required.

- Risks and hazards at IA 1 exceed the target cumulative risk and hazard for construction/excavation workers. These risks and hazards are driven by potential exposure to benzene in construction trench air (Note: the benzene groundwater concentration, 210 µg/L, used in the calculations is associated with monitoring well NW-4; the concentration of benzene in other monitoring wells at IA 1 is significantly lower). Implementation of work restrictions when activities occur at depths below 6 feet bgs may be warranted at IA 1, particularly near monitoring well NW-4.

- Hazards at IA 9 exceed the target cumulative hazard for construction/excavation workers. The hazard for construction/excavation workers is driven by incidental ingestion of and dermal contact with cadmium in subsurface soil. Implementation of work restrictions may be warranted with regard to potential exposure to cadmium in subsurface soil.

The conclusions drawn from this risk assessment are also summarized in the following tables:

Risk Assessment Outcome for Industrial Worker Scenario

Area	Risk	Hazard	Recommended Action
Combined IA 4	Pass	Pass	No Action Required
IA 9	Pass	Pass	No Action Required
IA 11	Pass	Pass	No Action Required
Southeast Area*	Pass	Pass	No Action Required
On-Property (non-IA-specific)*	Pass	Pass	No Action Required
Off-Property (North)	Pass	Pass	No Action Required
Off-Property (South)	Pass	Pass	No Action Required
Off-Property (West)	Pass	Pass	No Action Required

* Assumes soil removal is implemented as described in Section 2.1.2.

Risk Assessment Outcome for Construction Worker Scenario

Area	Risk	Hazard	Recommended Action
IA 1	Fail	Fail	Institute Risk Mitigation Plan
Combined IA 4	Pass	Pass	No Action Required
IA 9	Pass	Fail	Institute Risk Mitigation Plan
IA 11	Pass	Pass	No Action Required
Southeast Area*	Pass	Pass	No Action Required
On-Property (non-IA-specific)*	Pass	Pass	No Action Required
Off-Property (North)	Pass	Pass	No Action Required
Off-Property (South)	Pass	Pass	No Action Required
Off-Property (West)	Pass	Pass	No Action Required

*Assumes soil removal is implemented as described in Section 2.1.2**.**

Finally, the estimated impact to both surface water and sediment in Haley's Ditch from stormwater runoff containing residual PCB-impacted soils adjacent to the Akron Airdock following completion of remedial activities was shown to be minimal.

8.0 RECOMMENDATIONS

Based on the summary and conclusions in Section 7 and consistent with VAP response requirements specified in OAC 3745-300-09 for industrial properties, additional voluntary actions are recommended at specific areas of the Airdock property to meet and maintain applicable standards. The areas at which additional remedial actions are recommended are IA 1 and IA 9. For both of these areas, the potential risks and hazards posed to construction workers are recommended to be managed through the development of risk mitigation measures.

For both IA 1 and IA 9, risk mitigation measures, are recommended to control exposure to chemicals that contribute to risks and hazards that exceed receptor-specific cumulative target risks and hazards. For construction/excavation workers, the target cumulative risk is 1E-05 and the target cumulative hazard is 1 (see OAC 3745-300-09 (C) (1) (b) (i) and OAC 3745-300-09 (C) (2), respectively). As noted in Section 7.1, the risk at IA 1 (3E-05) exceeds the target cumulative risk of 1E-05 and the hazard (15) exceeds the target cumulative hazard of 1. Both the risk and hazard are driven by potential exposure to VOCs including vinyl chloride, benzene, and 1,1-dichloroethene through inhalation of trench air. Therefore, implementation of work restrictions may be warranted to reduce or eliminate potential exposures by construction/excavation workers through inhalation of VOCs in trench air. Restrictions may include the depth of excavations in specific locations to ensure that groundwater is not contacted or use of personal protective equipment to eliminate contact with groundwater. Similarly, the hazard at IA 9 (4.4) exceeds the target cumulative hazard of 1; the hazard is driven by potential exposure through incidental ingestion of and dermal contact with cadmium in subsurface soil. Therefore, implementation of work restrictions may be warranted to reduce or eliminate potential exposures by construction/excavation workers through direct contact with cadmium in subsurface soil.

Finally, as noted in Section 1.2.1, this property-specific risk assessment is being conducted during implementation of voluntary remedial actions at the property, which are being initiated on a presumptive basis. Once confirmatory samples are collected after remediation, the property-specific risk assessment will be re-visited to demonstrate compliance with applicable standards in support of the No Further Action Letter.

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FIGURES

TABLES

APPENDIX A

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION CALCULATIONS

(Nine Pages)

APPENDIX B

GROUNDWATER-TO-OUTDOOR AIR MODEL FOR CONSTRUCTION WORKER TRENCH SCENARIO

(22 Pages)

APPENDIX C

JOHNSON AND ETTINGER MODELING RESULTS

(25 Pages)

APPENDIX D

RECEPTOR-SPECIFIC EXPOSURE, RISK, AND HAZARD CALCULATIONS

(16 Pages)

APPENDIX E

WATER QUALITY AND SEDIMENT LOADING EVALUATION UNDER POST-REMEDIATION CONDITIONS

(Eight Pages)

TABLE 1

COMPARISON OF MAXIMUM DETECTED
SOIL CONCENTRATIONS TO SCREENING LEVELS
AKRON AIRDOCK SITE
AKRON, OHIO

Compound	Maximum Detected Concentration (mg/kg)	IA with Maximum Detected Concentration	Sampling Location	Reference for Maximum Detected Concentration	Generic Direct Contact STD For a Single Chemical - Commercial and Industrial Use Categories[a] (mg/kg)	1/10 of Generic Direct Contact STD for a Single Chemical - Commercial and Industrial Use Categories (mg/kg)	Exceeds Screening Criteria?
Volatile Organic Compounds							
Acetone	0.068	IA 3	NB-25 (6-7)	Tetra Tech (2005b)	100,000	10,000	No
Benzene	0.14	IA 1	NW-1 (7-8)	Tetra Tech (2004)	100	10	No
2-Butanone	0.056	IA 3	NB-25 (6-7)	Tetra Tech (2005b)	71,600	7,160	No
Carbon Disulfide	0.017	IA 3	NB-25 (6-7)	Tetra Tech (2005b)	720	72	No
cis-1,2-Dichlorothene	4.4	IA 9	NB-21 (9-10)	Tetra Tech (2005b)	1,200	120	No
trans-1,2-Dichloroethene	0.01	IA 9	NB-22 (4-6)	Tetra Tech (2005b)	2,500	250	No
Ethylbenzene	0.066	IA 1	NW-1 (7-8)	Tetra Tech (2004)	230	23	No
n-Hexane	0.66	IA 1	NW-1 (7-8)	Tetra Tech (2004)	180	18	No
Methylene chloride	0.79	IA 9	NB-21 (9-10)	Tetra Tech (2005b)	1,300	130	No
Toluene	0.047	IA 1	NW-1 (7-8)	Tetra Tech (2004)	520	52	No
1,1,1-Trichloroethane	0.0081	IA 9	NB-23 (0-1)	Tetra Tech (2005b)	1,400	140	No
Trichloroethene	0.14 J	IA 9	NB-21 (9-10)	Tetra Tech (2005b)	380	38	No
Vinyl chloride	0.015	IA 9	NB-22 (4-6)	Tetra Tech (2005b)	25	2.5	No
Xylenes	0.2	IA 1	NW-1 (7-8)	Tetra Tech (2004)	160	16	No
Semivolatile Organic Compounds							
Anthracene	0.82	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	880,000	88,000	No
Benzo(a)anthracene	2.1	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	63	6.3	No
Benzo(b)fluoranthene	2.4	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	63	6.3	No
Benzo(ghi)perylene	0.028	IA 1	AA-13 (2-3)	Tetra Tech (2006b)	--	--	No
Benzo(k)fluoranthene	0.74	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	630	63	No
Benzo(a)pyrene	**1.6**	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	6.3	0.63	**Yes**
Bis(2-ethylhexyl)phthalate	0.073	IA 3	AA-2 (1-2)	Tetra Tech (2006b)	230	23	No
Carbazole	0.59	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	10,000	1,000	No
Chrysene	2.2	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	6,700	670	No
Dibenzo(a,h)anthracene	0.27	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	6.7	0.67	No
Fluoranthene	4.9	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	33,000	3,300	No
Fluorene	0.41	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	120,000	12,000	No
Indeno(1,2,3-cd)pyrene	0.98	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	67	6.7	No
1-Methylnaphthalene	0.24	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	120	12	No
Naphthalene	0.83	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	530	53	No
Phenanthrene	0.084	IA 1	AA-13 (2-3)	Tetra Tech (2006b)	--	--	No
Pyrene	4	IA 10	AA-11 (1-2)	Tetra Tech (2006b)	25,000	2,500	No
Polychlorinated Biphenyls							
Polychlorinated Biphenyls	**460**	IA 13 (SE Area)	LM-S0007	Tetra Tech (2005b)	16	1.6	**Yes**
Metals							
Antimony	2.7	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	1,200	120	No
Arsenic	**66.6**	IA 5	NB-28 (8-10)	Tetra Tech (2005b)	80	8	**Yes**
Beryllium	1.1	IA 3	NB-25 (6-7)	Tetra Tech (2005b)	5,700	570	No
Cadmium	**5380**	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	770	77	**Yes**
Chromium (+3)	15000	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	1,000,000	100,000	No
Chromium (+6)	30.5	IA 9	NB-21 (4-6)	Tetra Tech (2005b)	8,900	890	No
Cobalt	7.7	IA 3	AA-2 (1-2)	Tetra Tech (2006b)	40,000	4,000	No
Copper	439	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	--	--	--
Lead	1100	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	1,800	NA	NA
Mercury	0.34	IA 3	NB-25 (6-7)	Tetra Tech (2005b)	300	30	No
Nickel	133	IA 9	NB-23 (0-1)	Tetra Tech (2005b)	57,000	5,700	No
Selenium	2.9 J	IA 9	NB-20 (0-2)	Tetra Tech (2005b)	15,000	1,500	No
Silver	0.5 J	IA 9	NB-23 (0-1)	Tetra Tech (2005b)	15,000	1,500	No
Thallium	4.6	IA 3	NB-22 (4-6)	Tetra Tech (2005b)	240	24	No
Vanadium	15.8[b]	IA 1	AA-11 (3-4)	Tetra Tech (2006b)	27,000	2,700	No
Zinc	65400	IA 9	NB-23 (0-1)	Tetra Tech (2005b)	900,000	90,000	No

Notes:

Results exceeding 1/10 of Generic Direct Contact STDs are **bolded**.

[a] Ohio Administrative Code (OAC) 3745-300-08 Generic Numerical Standards, Table III: Generic Direct Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern - Commercial and Industrial Land Use Categories. Ohio Environmental Protection Agency Voluntary Action Program, Division of Emergency and Remedial Response.

[b] This value represents the mean of the investigative and duplicate analytical results at the identified sampling location.

IA = Identified Area
mg/kg = Milligram per kilogram
NA = Not applicable
SE = Southeast
STD = Standard

TABLE 2

COMPARISON OF MAXIMUM DETECTED
GROUNDWATER CONCENTRATIONS TO SCREENING LEVELS
AKRON AIRDOCK SITE
AKRON, OHIO

Compound	**Maximum Detected Concentration[a] (µg/L)**	**IA with Maximum Detected Concentration**	**Sampling Location**	**Reference for Maximum Detected Concentration**	**Generic Unrestricted Potable Use Standard[b] (µg/L)**	**1/10 of Generic Unrestricted Potable Use Standard (µg/L)**	**Exceeds Screening Criteria?**
Volatile Organic Compounds							
Acetone	16	IA 11	PLTA-1	Tetra Tech (2005b)	1,600	160	No
Benzene	**210**	IA 1	NW-4	Tetra Tech (2004)	5	NA	**Yes**
2-Butanone	1.2 J	IA 1	NW-2	Tetra Tech (2004)	6,800	680	No
Carbon Disulfide	0.39 J	IA 1	NW-2	Tetra Tech (2004)	1,400	140	No
Chlorobenzene	3.1	IA 4	NB-24	Tetra Tech (2005b)	100	10	No
1,2-Dichlorobenzene	4.1 J	IA 4	NB-24	Tetra Tech (2005b)	600	60	No
1,4-Dichlorobenzene	0.97 J	IA 4	NB-24	Tetra Tech (2005b)	75	7.5	No
1,1-Dichloroethane	45	IA 9	A-8	Goodyear (2006)	1,400	140	No
1,1-Dichloroethene	**6.4 J**	IA 1	NW-3	Tetra Tech (2004)	7	0.7	**Yes**
cis-1,2-Dichlorothene	**970**	IA 9	A-8	Goodyear (2006)	70	7	**Yes**
trans-1,2-Dichloroethene	**14**	IA 1	NW-4	Tetra Tech (2004)	100	10	**Yes**
Ethylbenzene	**90**	IA 1	NW-4	Tetra Tech (2004)	700	70	**Yes**
n-Hexane	12	IA 1	NW-4	Tetra Tech (2004)	560	56	No
Methylene chloride	3.2	IA 11	PLTA-1	Tetra Tech (2005b)	5	NA	No
Toluene	**230**	IA 1	NW-4	Tetra Tech (2004)	1,000	100	**Yes**
1,1,1-Trichloroethane	0.3 J	IA 4	NB-24	Tetra Tech (2005b)	200	20	No
Trichloroethene	**5.5**	IA 4	NB-24	Tetra Tech (2005b)	5	NA	**Yes**
Vinyl chloride	**883**	IA 9	A-8	Goodyear (2006)	2	NA	**Yes**
Xylenes	430	IA 1	NW-4	Tetra Tech (2004)	10,000	1,000	No
Semivolatile Organic Compounds							
Naphthalene	**28**	IA 1	NW-4	Tetra Tech (2004)	140	14	**Yes**
Metals							
Arsenic	**31**	IA 4	NB-24	Tetra Tech (2005b)	50	5	**Yes**
Beryllium	**0.59**	IA 4	NB-24	Tetra Tech (2005b)	4	0.4	**Yes**
Chromium (+3)	20	IA 4	NB-24	Tetra Tech (2005b)	--	--	--
Copper	61	IA 4	NB-24	Tetra Tech (2005b)	1,000	100	No
Lead	**25**	IA 4	NB-24	Tetra Tech (2005b)	15	--	**Yes**
Mercury	0.073 J	IA-4	NB-24	Tetra Tech (2005b)	2	0.2	No
Nickel	**30**	IA 4	NB-24	Tetra Tech (2005b)	100	10	**Yes**
Selenium	4.5 J	IA 4	NB-24	Tetra Tech (2005b)	50	5	No
Zinc	150	IA 4	NB-24	Tetra Tech (2005b)	4,700	470	No

Notes:

Results exceeding 1/10 of Generic Direct Contact STDs are **bolded**.

[a] Identification of the maximum detected concentration of each chemical does not consider ground water sampling results associated with sampling location NB-31 (IA 1). NB-31 was a direct push soil boring at which a grab water sample was collected; the grab sample contained free product. This sample is not considered representative of groundwater in the area. A permanent well (MW-4) was installed directly over the original location (three additional permanent wells [MW-1, MW-2, and MW-3) were also installed at IA 1. Analytical results for groundwater samples collected from these permanent wells are considered representative of groundwater at IA 1 (Tetra Tech 2004).

[b] Ohio Administrative Code (OAC) 3745-300-08 Generic Numerical Standards, Table VI: Generic Unrestricted Potable Use Standards Based on MCLs or Other Regulatory Established Criteria, and Table VII: Risk-Derived Generic Unrestricted Potable Use Standards. Ohio Environemental Protection Agency Voluntary Action Program, Division of Emergency and Remedial Response.

-- = No Value Available
ug/L = Microgram Per liter
J = Estimated value
STD = Standard

TABLE 3

MEDIUM-SPECIFIC CHEMICALS OF POTENTIAL CONCERN
PROPERTY-SPECIFIC RISK ASSESSMENT FOR THE AKRON AIRDOCK
AKRON, OHIO

Chemical	Groundwater	Soil
Volatile Organic Compounds (VOC)		
Benzene	X	X
1,1-Dichloroethene	X	X
Cis-1,2-Dichloroethene	X	X
Trans-1,2-Dichloroethene	X	X
Ethyl benzene	X	X
Toluene	X	X
Trichloroethene	X	X
Vinyl chloride	X	X
Polychlorinated Biphenyls (PCB)		
PCBs (total)	--	X
Metals		
Arsenic	X	X
Beryllium	X	X
Cadmium	--	X
Lead	X	X
Mercury	X	X
Nickel	X	X

Notes:
-- = Not Detected in Groundwater

TABLE 4

EXPOSURE PARAMETER VALUES[a]
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK SITE
AKRON, OHIO

Exposure Parameter	Industrial Worker	Construction Worker	Basis
Exposure point concentration (EPC) (various)	Medium-specific	Medium-specific	See Table 5
Exposure frequency (EF) (days/year)	250	120/ 30[b]	OEPA 2002[c], 2004[d]
Exposure duration (ED) (years)	25	1	OEPA 2002
Exposure time (ET) (hour/day)	8	8	OEPA 2002
Event frequency (EV) (event/day)	1	1	EPA 2004[e]
Inhalation rate (InR) (m^3/hour)	1.0	1.5	OEPA 2002, 2004
Ingestion rate (IR) (mg/day)	50	200	OEPA 2002
Fraction soil contaminated (FI) (unitless)	1	1	OEPA 2002
Skin surface area – soil (SA_{soil})	3,300	3,300	OEPA 2002
Skin surface area – groundwater (SA_{gw})	NA	1,225[f] / 3,300	OEPA 2004, EPA 2004
Adherence factor (AF) (mg/cm^2)	0.3	0.7	OEPA 2002
Dermal absorption (ABS) (unitless)	Chemical-specific	Chemical-specific	OEPA 2002, EPA 2004
Absorbed dose per event (DA_{event})	Chemical-specific	Chemical-specific	See note g
Particulate emission factor (PEF) (m^3/kg)	1.7E+09	Property-specific	OEPA 2002
Volatilization factor (VF) (m^3/kg)	Chemical-specific	Chemical-specific	OEPA 2002
Body weight (BW) (kg)	70	70	OEPA 2002
Averaging time - carcinogens (AT_c)	25,550	25,550	OEPA 2002
Averaging time - noncarcinogens (AT_{nc})	9,125	365	OEPA 2002
Conversion factor 1 (CF1) (mg/µg)	1E-03	1E-03	NA
Conversion factor 2 (CF2) (kg/mg)	1E-06	1E-06	NA

TABLE 4 (continued)

EXPOSURE PARAMETER VALUES[a]
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON-AIRDOCK SITE
AKRON, OHIO

Notes:

cm^2 = Square centimeter
kg = Kilogram
kg/mg = Kilogram per milligram
mg/cm^2 = Milligram per square centimeter
mg/cm^2-event = Milligram per square centimeter per event
mg/day = Milligram per day
mg/µg = Milligram per microgram
m^3/kg = Cubic meter per kilogram
NA = Not Applicable

[a] Values are presented for parameters used in the exposure pathway-specific equations presented in Figure 10.

[b] No new construction requiring excavation is expected within the Airdock. The Airdock's unique size and configuration were the primary reason this structure was selected as the site for development of new airships. Therefore, within the Airdock construction workers are expected to be exposed to groundwater only during occasional utility repair activities. Such activities are assumed to occur about 30 days per year. Exposure frequency for construction workers at other locations is based on the OEPA-recommended value.

[c] Ohio Environmental Protection Agency (Ohio EPA). 2002. "Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures." Voluntary Action Program, Division of Emergency and Remedial Response. February.

[d] Ohio EPA. 2004. "Evaluating Exposure to Ground Water for the Construction Worker and Excavation Activity Receptor Populations." Technical Decision Compendium VA30009.04.001. January.

[e] U.S. Environmental Protection Agency (EPA). 2004. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)." Final. Office of Superfund Remediation and Technology Innovation. EPA/540/R/99/005. July.

[f] No new construction requiring excavation is expected within the Airdock. The Airdock's unique size and configuration were the primary reason this structure was selected as the site for development of the airships. Therefore, within the Airdock construction workers are expected to be exposed to groundwater only during occasional utility repair activities that require excavation to depths that result in intersection with the water table (located at about 6 to 7 feet below ground surface). Because of safety concerns, it is very unlikely that groundwater will be allowed to accumulate to any significant extent in a construction trench. Therefore, it was assumed that at most construction workers (at all locations within the Airdock) may be exposed to groundwater only on their feet, with a surface area of 1,225 square centimeters (cm^2) (EPA 2004). The surface area assumed to be exposed to groundwater at other locations is based on the OEPA-recommended default value (Ohio EPA 2004).

TABLE 4 (continued)

EXPOSURE PARAMETER VALUES[a]
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON-AIRDOCK SITE
AKRON, OHIO

[g] Chemical-specific values for DA_{event} will be calculated as shown in Figure 10, using chemical-specific input parameters from EPA (2004).

TABLE 5

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATIONS (EPC)^a AND IA-SPECIFIC DA$_{EVENT}$ VALUES
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Chemical	IA 1				IA 4				IA 9				IA 11			
	Soil	Trench Air^b	Ground Water	DA$_{event}$^{c}	Soil	Trench Air^b	Ground Water	DA$_{event}$^{c}	Soil	Trench Air^b	Ground Water	DA$_{event}$^{c}	Soil	Trench Air^b	Ground Water	DA$_{event}$^{c}
Benzene	0.14	1.96E+00	210	2.49E-05	0.00073 J	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	3.17E-02	3.74	3.92E-07	--	8.46E-03	1	1.05E-07	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	0.0019	6.63E+00	793	5.34E-05	0.031	6.69E-02	8	5.38E-07	4.4	4.61E-01	55.1	3.71E-06	--	2.68E-02	3.2	2.15E-07
t-1,2-Dichloroethene	--	2.07E-01	24.6	1.66E-06	0.0045	2.11E-02	2.5	1.68E-07	0.01	4.97E-02	5.9	3.97E-07	--	--	--	--
Ethylbenzene	0.066	7.24E-01	90	3.38E-05	0.00061 J	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	0.047	1.98E+00	230	5.73E-05	0.0015 J	4.31E-03	0.5 J	1.25E-07	--	--	--	--	--	--	--	--
Trichloroethene	--	5.65E-01	78	8.00E-06	0.008	3.99E-02	5.5	5.64E-07	0.14 J	--	--	--	--	--	--	--
Vinyl Chloride	--	1.12E-01	10.6	5.03E-07	--	2.42E-02	2.3	1.09E-07	0.015 J	1.38E+00	130.6	6.20E-06	--	8.85E-02	8.4	3.99E-07
Benzo(a)anthracene	8.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	1.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	10.2	--	--	--	66.6 e	--	31	2.48E-07	19.1	--	--	--	17.1	--	--	--
Beryllium	0.31	--	--	--	1.1	--	0.59	4.72E-09	0.73	--	--	--	--	--	--	--
Cadmium	20.4	--	--	--	0.76 J	--	--	--	5380	--	--	--	--	--	--	--
Lead	76.1	--	--	--	24.2	--	25	--	1100	--	--	--	13.2	--	--	--
Mercury	0.09	--	--	--	0.34	4.28E-03	7.30E-02 J	5.84E-10	0.25	--	--	--	--	--	--	--
Nickel	14.4	--	--	--	21	--	30	4.80E-08	133	--	--	--	17.6	--	--	--

Notes:

Medium-specific values are present in the following units:
Soil = milligrams per kilogram (mg/kg)
Ground Water = micrograms per liter (μg/L)
Trench Air = milligrams per cubic meter (mg/n^3)
DA$_{event}$ = milligrams per square centimeter per event (mg/cm^2 - event)
-- = Not a chemical of concern for this medium
J = Estimated concentration
IA = Identified area
DA$_{event}$ = absorbed dose per event

[a] EPCs represent the maximum detected concentration or are calculated based on the maximun detected concentratio (Trench Air and DA$_{event}$) except for the on-and off-property soil EPCs (See Footnote d)

[b] Trench air EPCs were calculated following the methodology developed by the Virginia Department of Environment Quali (VDEQ) (VDEQ 2005) (See Appendix B)

[c] DA$_{event}$ values were evaluated as presented in Figure 10 using parameter values presented in Table 6.

[d] On- and off-property EPCs were calculated using EPA's ProUCL Software (EPA 2006) (See Appendix A

[e] This value is for IA 3 which is located adjacent to IA

[f] The soil EPCs for the Southeast Area, used in evaluating potential industrial and construction worker exposures, are 4.9 a 14 mg/kg (the maximum detected values), respectively.

[g] The soil EPCs for the On-Property (Non-IA-specific) area, used in evaluating potential industrial and construction worker exposur are 1.5 and 15 mg/kg (the maximum detected values), respectively.

[h] The soil EPCs for the Off-Property (North) area, used in evaluating potential industrial and construction worker exposures, 0.31 and 0.87 mg/kg (the maximum detected values), respectively.

[i] The soil EPCs for the Off-Property (South) area, used in evaluating potential industrial and construction worker exposures, 0.91 and 1.7 mg/kg (the maximum detected values), respectively.

[j] No COPCs were identified in the Off-Property (West) locatio

TABLE 5

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATIONS (EPC)^a AND IA-SPECIFIC DA$_{EVENT}$ VALUES
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Chemical	Southeast Area					On-Property (Non-IA-specific)				
	Soil^d		Trench Air	Ground Water	DA$_{event}$^{c}	Soil^d		Trench Air^b	Ground Water	DA$_{event}$^{c}
Benzene	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	2.48E-02	2.93	3.07E-07
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	3.13E+00	374	2.52E-05
t-1,2-Dichloroethene	--	--	--	--	--	--	--	1.00E-01	11.9	8.01E-07
Ethylbenzene	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	1.27E-02	1.75	1.80E-07
Vinyl Chloride	--	--	--	--	--	--	--	1.49E-01	14.1	6.70E-07
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--
PCBs	4.9 f	14	--	--	--	1.5 g	15	--	--	--
Arsenic	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--

Notes:
Medium-specific values are present in the following units:
Soil = milligrams per kilogram (mg/kg
Ground Water = micrograms per liter (µg/L)
Trench Air = milligrams per cubic meter (mg/n^3)
DA$_{event}$ = milligrams per square centimeter per event (mg/cm^2 - event)
-- = Not a chemical of concern for this medium
J = Estimated concentration
IA = Identified area
DA$_{event}$ = absorbed dose per event

[a] EPCs represent the maximum detected concentration or are calculated based on the maximun detected concentratio (Trench Air and DA$_{event}$) except for the on-and off-property soil EPCs (See Footnote d)

[b] Trench air EPCs were calculated following the methodology developed by the Virginia Department of Environment Quali (VDEQ) (VDEQ 2005) (See Appendix B)

[c] DA$_{event}$ values were evaluated as presented in Figure 10 using parameter values presented in Table 6.

[d] On- and off-property EPCs were calculated using EPA's ProUCL Software (EPA 2006) (See Appendix A

[e] This value is for IA 3 which is located adjacent to IA

[f] The soil EPCs for the Southeast Area, used in evaluating potential industrial and construction worker exposures, are 4.9 a 14 mg/kg (the maximum detected values), respectively.

[g] The soil EPCs for the On-Property (Non-IA-specific) area, used in evaluating potential industrial and construction worker exposur are 1.5 and 15 mg/kg (the maximum detected values), respectively.

[h] The soil EPCs for the Off-Property (North) area, used in evaluating potential industrial and construction worker exposures, 0.31 and 0.87 mg/kg (the maximum detected values), respectively.

[i] The soil EPCs for the Off-Property (South) area, used in evaluating potential industrial and construction worker exposures, 0.91 and 1.7 mg/kg (the maximum detected values), respectively.

[j] No COPCs were identified in the Off-Property (West) locatio

TABLE 5

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATIONS (EPC)[a] AND IA-SPECIFIC DA_{EVENT} VALUES
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

	Off-Property (North)[j]					Off-Property (South)[j]				
Chemical	**Soil[d]**		**Trench Air[b]**	**Ground Water**	**DA_{event}[c]**	**Soil[d]**		**Trench Air**	**Ground Water**	**DA_{event}[c]**
Benzene	--		--	--	--	--	--	--	--	--
1,1-Dichloroethene	--		1.40E-02	1.66	1.74E-07	--	--	--	--	--
cis-1,2-Dichloroethene	--		3.04E+00	364	2.45E-05	--	--	--	--	--
t-1,2-Dichloroethene	--		5.16E-01	61.2	4.12E-06	--	--	--	--	--
Ethylbenzene	--		--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--
Toluene	--		--	--	--	--	--	--	--	--
Trichloroethene	--		7.68E-01	106	1.09E-05	--	--	--	--	--
Vinyl Chloride	--		5.66E-02	5.37	2.55E-07	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--
PCBs	0.31 h	0.87	--	--	--	0.91 i	1.7	--	--	--
Arsenic	--		--	--	--	--	--	--	--	--
Beryllium	--		--	--	--	--	--	--	--	--
Cadmium	--		--	--	--	--	--	--	--	--
Lead	--		--	--	--	--	--	--	--	--
Mercury	--		--	--	--	--	--	--	--	--
Nickel	--		--	--	--	--	--	--	--	--

Notes:
Medium-specific values are present in the following units:
Soil = milligrams per kilogram (mg/kg)
Ground Water = micrograms per liter (µg/L)
Trench Air = milligrams per cubic meter (mg/n^3)
DA_{event} = milligrams per square centimeter per event (mg/cm^2 - event)
-- = Not a chemical of concern for this medium
J = Estimated concentration
IA = Identified area
DA_{event} = absorbed dose per event

[a] EPCs represent the maximum detected concentration or are calculated based on the maximun detected concentratio
(Trench Air and DA_{event}) except for the on-and off-property soil EPCs (See Footnote d)

[b] Trench air EPCs were calculated following the methodology developed by the Virginia Department of Environment Quali
(VDEQ) (VDEQ 2005) (See Appendix B)

[c] DA_{event} values were evaluated as presented in Figure 10 using parameter values presented in Table 6.

[d] On- and off-property EPCs were calculated using EPA's ProUCL Software (EPA 2006) (See Appendix A

[e] This value is for IA 3 which is located adjacent to IA

[f] The soil EPCs for the Southeast Area, used in evaluating potential industrial and construction worker exposures, are 4.9 a
14 mg/kg (the maximum detected values), respectively.

[g] The soil EPCs for the On-Property (Non-IA-specific) area, used in evaluating potential industrial and construction worker exposur
are 1.5 and 15 mg/kg (the maximum detected values), respectively.

[h] The soil EPCs for the Off-Property (North) area, used in evaluating potential industrial and construction worker exposures,
0.31 and 0.87 mg/kg (the maximum detected values), respectively.

[i] The soil EPCs for the Off-Property (South) area, used in evaluating potential industrial and construction worker exposures,
0.91 and 1.7 mg/kg (the maximum detected values), respectively.

[j] No COPCs were identified in the Off-Property (West) locatio

TABLE 6

CHEMICAL-SPECIFIC PARAMETER VALUES
PROPERTY-SPECIFIC RISK ASSESSMENT --AKRON AIRDOCK
AKRON, OHIO

Chemical	Di	H'	Dw	Kd	ABS	FA	Kp	τ_{event}	t*	B
Benzene	8.80E-02	2.28E-01	9.80E-06	6.20E-01	0.1	1	1.50E-02	0.29	0.7	0.1
1,1-Dichloroethene	9.00E-02	1.07E+00	1.04E-05	6.50E-01	0.1	1	1.20E-02	0.37	0.89	0
cis-1,2-Dichloroethene	7.36E-02	1.67E-01	1.13E-05	4.98E+00	0.1	1	7.70E-03	0.37	0.89	0
trans-1,2-Dichloroethene	7.07E-02	3.85E-01	1.19E-05	3.80E-01	0.1	1	7.70E-03	0.37	0.89	0
Ethylbenzene	7.50E-02	3.23E-01	7.80E-06	2.04E+00	0.1	1	4.90E-02	0.42	1.01	0.2
Toluene	8.70E-02	2.72E-01	8.60E-06	1.40E+00	0.1	1	3.10E-02	0.35	0.84	0.1
Trichloroethene	7.90E-02	4.22E-01	9.10E-06	9.40E-01	0.1	1	1.20E-02	0.58	1.39	0.1
Vinyl chloride	1.06E-01	1.11E+00	1.23E-06	1.11E-01	0.1	1	5.60E-03	0.24	0.57	0
Arsenic	--	--	--	2.90E+01	0.03	--	1.00E-03	--	--	--
Beryllium	--	--	--	7.90E+02	0.01	--	1.00E-03	--	--	--
Cadmium	--	--	--	7.50E+01	0.001	--	1.00E-03	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--
Mercury	3.07E-02	4.67E-01	6.30E-06	5.20E+01	0.01	--	1.00E-03	--	--	--
Nickel	--	--	--	6.50E+01	0.01	--	2.00E-04	--	--	--
PCB	4.00E-02	1.55E-01	4.64E-06	9.83E+04	0.14	0.5	4.30E-01	11.29	47.9	3.2

Notes:

For cis-1,2-DCE used trans-1,2-DCE as surrogate for DAevent inputs (FA, K_p, τ_{event}, t*, and B).

FA, Kp, τ_{event}, t*, and B values were obtained from EPA (2004).

ABS values obtained from OEPA (2002).

Di, H', and Dw values obtained from EPA (1996), Kd values and all PCB (Aroclor 1254) values obtained from EPA (1998).

-- = Not applicable or available

ABS = Dermal absorption factor (unitless)

FA = Fraction absorbed water (unitless)

K_p = Dermal permeability coefficient in water (centimeter per hour [cm/hr])

B = Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (unitless)

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

t* = time to reach steady-state (hr) = 2.4 * τ_{event}

H' = Dimensionless Henry's law constant

Di = Air diffusivity (square centimeter per second [cm^2/s])

Dw = Water diffusivity (cm^2/s)

K_d = Soil-water partition coefficient (cubic centimeter per gram [cm^3/g])

TABLE 7

COPC-SPECIFIC TOXICITY FACTORS
PROPERTY-SPECIFIC RISK ASSESSMENT -- AKRON AIRDOCK
AKRON, OHIO

	Reference Dose								Slope Factor				
Chemical	**Oral**		**Oral - Construction**		**Inhalation**		**Inhalation - Construction**		**Oral**		**Inhalation**		**Oral Absorption**
Benzene	1.00E-03	NCEA	3.00E-03	NCEA	2.57E-03	NCEA	7.72E-03	ATSDR	1.50E-02	IRIS	7.70E-03	IRIS	1
1,1-Dichloroethene	9.00E-03	IRIS	9.00E-03	HEAST	NA	NA	NA	NA	6.00E-01	IRIS	1.75E-01	IRIS	1
cis-1,2-Dichloroethene	1.00E-02	HEAST	1.00E-01	HEAST	NA	NA	NA	NA	NA	NA	NA	NA	1
trans-1,2-Dichloroethene	2.00E-02	IRIS	2.00E-01	IRIS	NA	NA	NA	NA	NA	NA	NA	NA	1
Ethylbenzene	1.00E-01	IRIS	1.00E+00	IRIS	2.86E-01	IRIS	2.86E+00	IRIS	NA	NA	NA	NA	1
Toluene	2.00E-01	IRIS	2.00E+00	HEAST	1.14E-01	IRIS	4.29E-01	ATSDR	NA	NA	NA	NA	1
Trichloroethene	6.00E-03	NCEA	6.00E-02	NCEA	NA	NA	NA	NA	1.10E-02	NCEA	5.95E-03	NCEA	1
Vinyl chloride	3.00E-03	IRIS	3.00E-03	IRIS[a]	2.86E-02	IRIS	2.86E-02	IRIS	1.40E+00	IRIS	3.08E-02	IRIS	1
Arsenic	3.00E-04	IRIS	3.00E-04	HEAST	NA	NA	NA	NA	1.50E+00	IRIS	1.50E+01	IRIS	1
Beryllium	2.00E-03	IRIS	5.00E-03	HEAST	5.72E-06	IRIS	5.72E-06	IRIS	NA	NA	8.40E+00	IRIS	0
Cadmium	5.00E-04	IRIS	5.00E-04	IRIS	NA	NA	NA	NA	NA	NA	6.30E+00	IRIS	0.025
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	1.00E-04	IRIS	1.00E-04	HEAST	8.58E-05	IRIS	8.58E-05	HEAST	NA	IRIS	NA	IRIS	0.07
Nickel	2.00E-02	IRIS	2.00E-02	HEAST	5.72E-05	ATSDR	5.72E-05	ATSDR	NA	NA	NA	NA	0.04
PCB	2.00E-05	OEPA	6.00E-05	IRIS	NA	NA	NA	NA	2.00E+00	IRIS	3.50E-01	OEPA	1

Notes:
All values obtained from OEPA (2002)
Reference doses are in units of milligram per kilogram-day (mg/kg-day)
Slope factors are in units of $(mg/kg\text{-}day)^{-1}$
ATSDR = Agency for Toxic substances and Disease Registry
COPC = Chemical of potential concern
HEAST = EPA's Health Effects Assessment Summary Tables
IRIS = U.S. Environmental Protection Agency's Integrated Risk Information System
NA = Not available
NCEA = EPA's National Center for Environmental Assessment
OEPA = Ohio Environmental Protection Agency

[a] Use of the chronic RfD as the subchronic RfD is as directed by OEPA (2005).

TABLE 8
RISK SUMMARY[a]
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Exposure Pathway	IA 1	IA 4	IA 9	IA 11	Southeast Area	On-Property (Non-IA-Specific)	Off-Property (North)[b]	Off-Property (South)[b]
	Industrial Worker[c]							
Inhalation of indoor air	--	3.2E-07	2.5E-05	3.5E-09	--	--	--	--
Incidental ingestion of surface soil	--	1.7E-06	1.7E-06	1.7E-06	1.7E-06	5.2E-07	1.1E-07	3.2E-07
Dermal contact with surface soil	--	4.7E-06	4.7E-06	4.7E-06	4.7E-06	1.5E-06	3.0E-07	8.8E-07
Inhalation of fugitive dust	--	1.8E-08	1.8E-08	1.8E-08	1.8E-08	5.5E-09	1.1E-09	3.4E-09
Total Risk (IA-specific)	--	3E-07	3E-05	4E-09	--	--	--	--
Total Risk (overall)	--	7E-06	3E-05	6E-06	6E-06	2E-06	4E-07	1E-06
	Construction Worker							
Inhalation of trench air	2.2E-05	5.0E-07	8.6E-06	5.5E-07	--	7.3E-06	7.1E-06	--
Dermal contact with groundwater	3.1E-07	1.2E-08	1.8E-07	1.1E-08	--	2.5E-07	1.3E-07	--
Incidental ingestion of soil	1.6E-06	3.4E-07	9.6E-08	8.6E-08	3.8E-07	4.0E-07	2.3E-08	4.6E-08
Dermal contact with soil	2.1E-06	1.2E-07	1.2E-08	3.0E-08	6.1E-07	6.5E-07	3.8E-08	7.4E-08
Inhalation of fugitive dust	5.8E-09	--	--	--	1.5E-09	1.6E-09	9.3E-11	1.8E-10
Total Risk	3E-05	1E-06	9E-06	7E-07	1E-06	9E-06	7E-06	1E-07

-- = Not applicable
COPC = Chemical of potential concern
IA = Identified area

[a] Receptor-specific risks are detailed in Tables D-1 Through D-8 in Appendix D, with one exception. Risks for industrial workers associated with inhalation of indoor air are detailed in Appendix C.

[b] No COPCs were identified in the Off-Property (West) location.

[c] The industrial worker outdoor exposures for the identified areas (IAs) assume exposure to soils in the Southeast Area.

TABLE 9
HAZARD SUMMARY[a]
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Exposure Pathway	IA 1	IA 4	IA 9	IA 11	Southeast Area	On-Property (Non-IA-Specific)	Off-Property (North)[b]	Off-Property (South)[b]
Industrial Worker[c]								
Inhalation of indoor air	--	4.4E-03	9.2E-02	1.2E-05	--	--	--	--
Incidental ingestion of surface soil	--	1.2E-01	1.2E-01	1.2E-01	1.2E-01	3.7E-02	7.6E-03	2.2E-02
Dermal contact with surface soil	--	3.3E-01	3.3E-01	3.3E-01	3.3E-01	1.0E-01	2.1E-02	6.2E-02
Inhalation of fugitive dust	--	--	--	--	--	--	--	--
Total Hazard (IA-specific)	--	4E-03	9E-02	1E-05	--	--	--	--
Total Hazard (overall)	--	5E-01	5E-01	5E-01	5E-01	1E-01	3E-02	8E-02
Construction Worker								
Inhalation of trench air	1.5E+01	7.1E-01	6.8E-01	4.4E-02	--	2.9E-01	1.1E-01	--
Dermal contact with groundwater	1.4E-01	1.3E-03	3.0E-03	1.9E-04	--	8.0E-03	8.5E-03	--
Incidental ingestion of soil	7.2E-02	5.4E-02	2.5E+00	1.4E-02	2.2E-01	2.3E-01	1.4E-02	2.7E-02
Dermal contact with soil	3.2E-02	2.1E-02	1.2E+00	4.7E-03	3.5E-01	3.8E-01	2.2E-02	4.3E-02
Inhalation of fugitive dust	1.7E-03	--	--	--	--	--	--	--
Total Hazard	2E+01	8E-01	4E+00	6E-02	6E-01	9E-01	2E-01	7E-02

-- Not applicable

COPC = Chemical of potential concern

IA = Identified area

[a] Receptor-specific hazards are detailed in Tables D-1 through D-8 in Appendix D, with one exception. Hazards for industrial workers associated with inhalation of indoor air are detailed in Appendix C.

[b] No COPCs were identified in the Off-Property (West) location.

[c] The industrial worker outdoor exposures for the identified areas (IAs) assume exposure to soils in the Southeast Area.

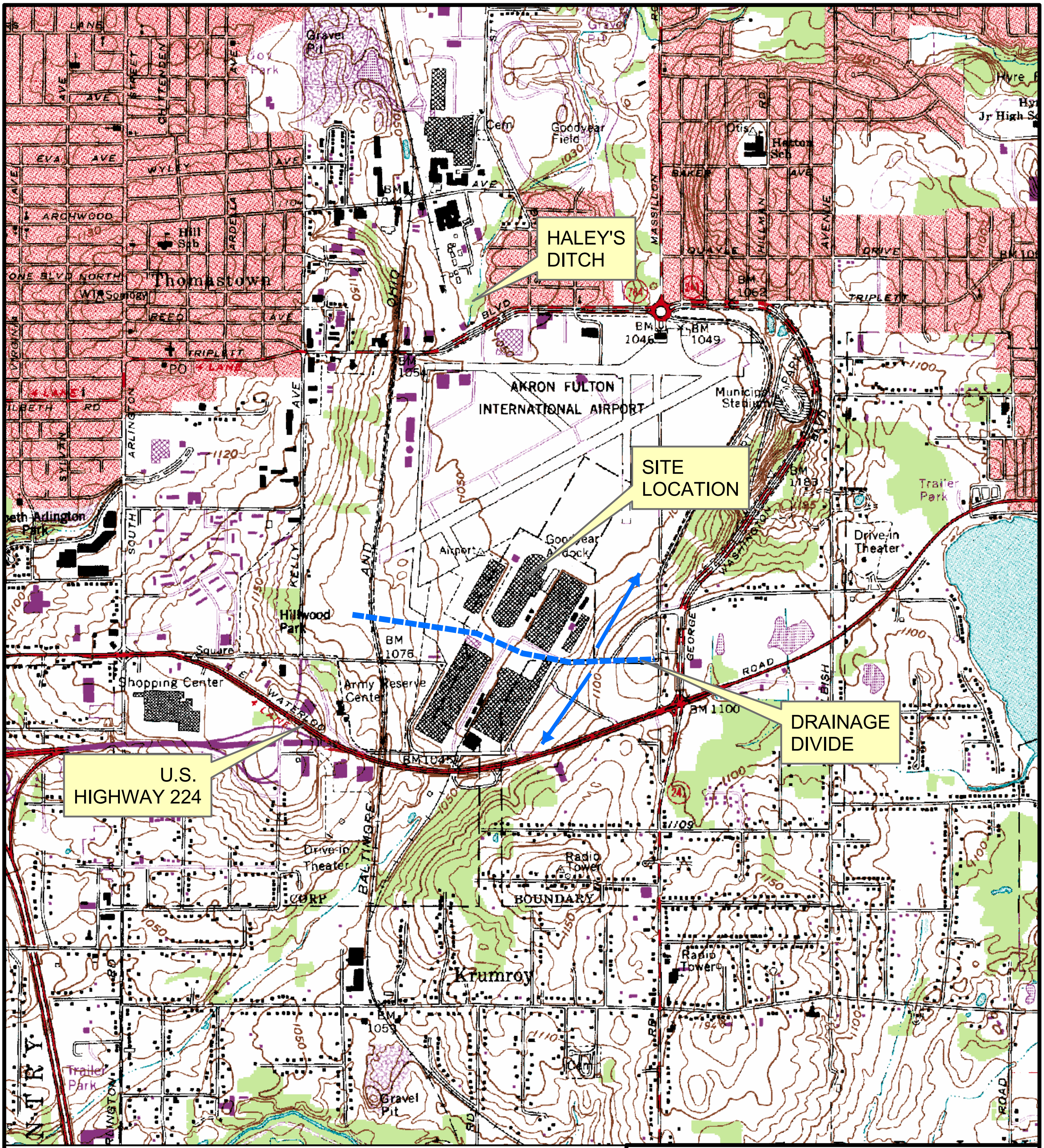
TABLE 10

MAJOR UNCERTAINTIES IN PROPERTY-SPECIFIC HUMAN HEALTH RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Major Element of the Risk Assessment	Effect on Cumulative Risk and Hazard Estimates		
	Underestimate	Overestimate	Unknown
Data Evaluation and COPC Selection			
Use of screening levels (for example, Ohio EPA VAP GNS values) to select IAs and COPCs for evaluation in the risk assessment	•		
Exposure Assessment			
Assumption of steady-state conditions			•
Identification of potentially complete exposure pathways			•
Identification and use of default exposure parameter assumptions			•
On-going remediation (cleaning, sealing, and replacing) of interior and exterior surface at the Airdock will be completed and institutional controls (prohibition of potable groundwater use) will be implemented	•		
General uncertainties and limitations associated with air modeling – J&E and construction trench models (for example, variability and representativeness of air modeling input parameters)			•
Toxicity Assessment			
General uncertainties associated with toxicity factors (e.g., extrapolation of animal data to humans; modeling of slope factors, and use of oral toxicity factors to characterize dermal exposures)			•
PCB SF based on Aroclor 1254 toxicity rather than Aroclor 1268 (form of PCB present in RPM)		•	
Risk Characterization			
Summation of risks and hazards associated with potential exposures both inside and outside of the Airdock		•	
Stormwater Modeling Exercise			
Assumption of steady-state (annualized) conditions			•
Transport of 100 percent of the eroded soil from the Airdock parcel to Haley's Ditch through the stormsewer conveyance system		•	
Assumed stormwater flow ignores groundwater seepage, process flows, and other facility inputs upstream of Haley's Ditch		•	
Use of the RUSLE equation for long-term soil loss		•	

Notes:

COPC	Chemical of potential concern
IA	Identified area
GNS	Generic Numerical Standards
J&E	Johnson and Ettinger
Ohio EPA	Ohio Environmental Protection Agency
RPM	Robertson Protected Metal
VAP	Voluntary Action Program



SOURCE: MODIFIED FROM USGS, AKRON WEST,
OHIO QUADRANGLE, 1967, PHOTOREVISED, 1984.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 1
SITE LOCATION MAP

TETRA TECH, INC.

2006-07-10 s:\cadd\ip382\04\airdock_ra_1.mxd TTEMI-NV joel.peters

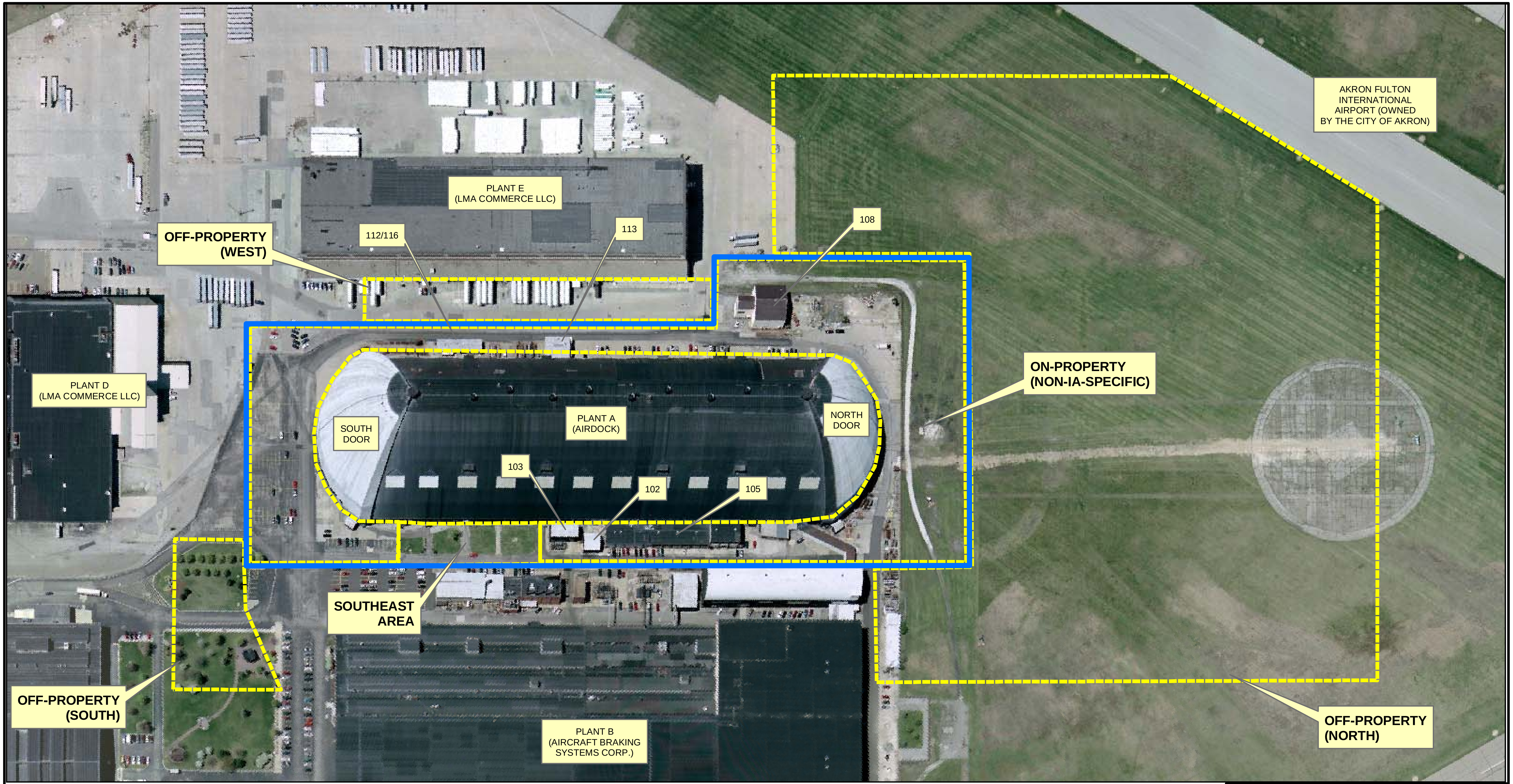
SOURCE: SUMMIT COUNTY GIS AERIAL PHOTOGRAPHY, 2000, AND SUMMIT COUNTY GIS, 2004.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 2
SITE AERIAL PHOTOGRAPH AND SURROUNDING PROPERTIES

TETRA TECH, INC.

2006-07-10 s:\cadd\lp382\04\airdock_ra_2.mxd TTEMI-NV joel.peters



LEGEND

▭ Approximate Airdock Boundary

▭ Evaluated Property Area

Building Legend

102 - Helium Compressor/Fire Suppression
103 - Electrical Substation/Transformer House
105 - Outer Press Shop
108 - Motor Run-In
112 - Former Flame Cutting
113 - Former Acid/Alkali Waste Storage Facility
116 - Storage

SOURCE: MODIFIED FROM SUMMIT COUNTY GIS, 2004.

N W S E

0 100 200 Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 3
AIRDOCK PROPERTY FEATURES

TETRA TECH, INC.

2007-12-26 s:\cadd\lp382\04\airdock_ra_3.mxd TTEMI-NV andrew.dye

LEGEND

● Alluvial Well

● Alluvial Piezometer Well

● Bedrock Well

▲ Extraction Well

▭ Approximate VOC Plume (Alluvial and Bedrock Aquifers)

▭ Building

▭ Approximate Site Boundary

N
W E
S

0 250 500
Feet

NOTE: Plume Configuration is schematic.

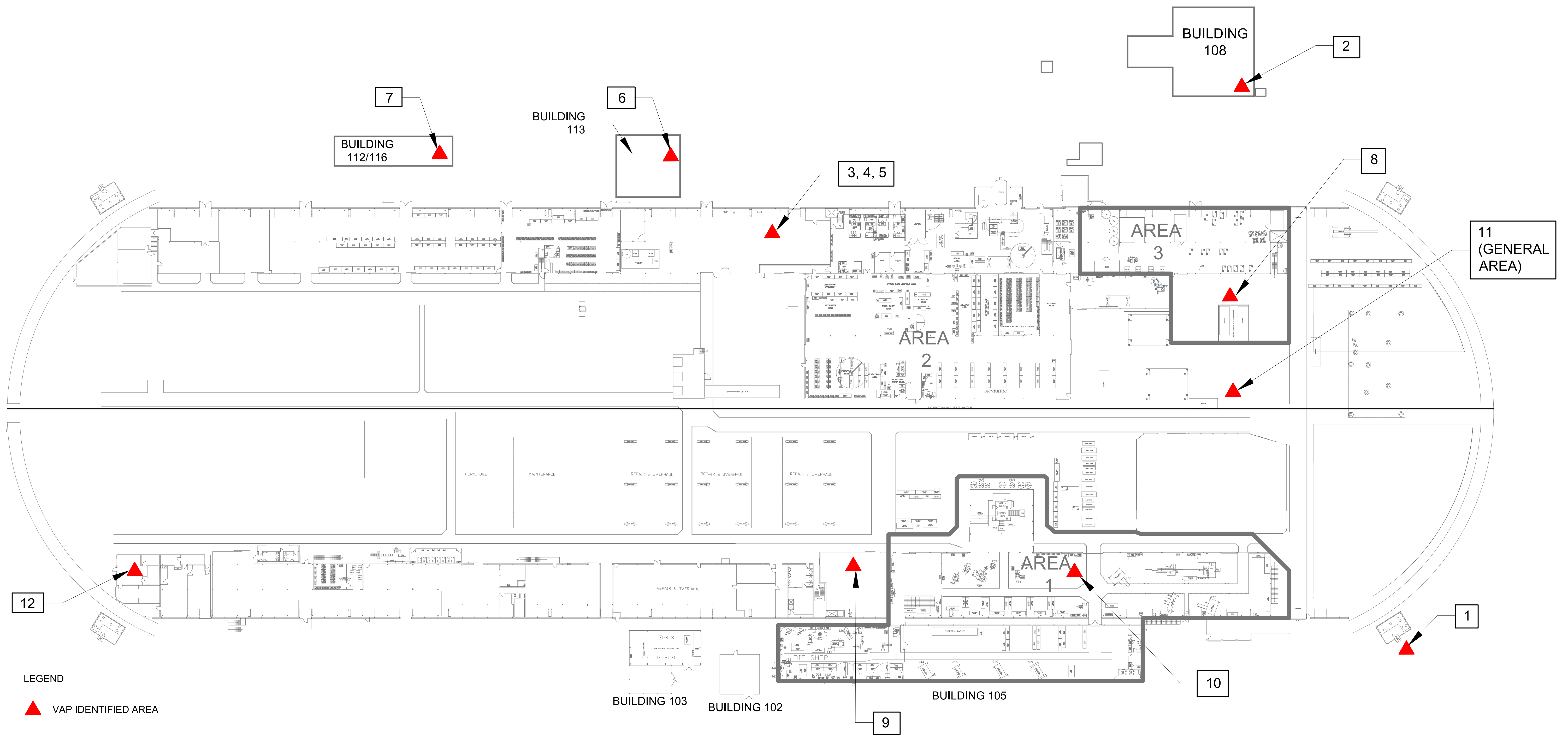
SOURCE: MODIFIED FROM SUMMIT COUNTY GIS,
SHARP AND ASSOCIATES, INC., 2004, AND BROWNFIELD
RESTORATION GROUP, LLC, 2007.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 4
EXTRACTION AND MONITORING
WELL LOCATION MAP

TETRA TECH, INC.

2007-12-21 s:\cadd\l\p382\04\airdock_ra_4.mxd TTEMI-NV joel.peters



NOTE: VAP IDENTIFIED AREA 13 NOT SHOWN ON MAP.

Identified Area No.	Feature - Description	Phase II Soil Boring IDs
1	Former USTs - NE Corner of Plant A (LMC Location 4)	NB-31
2	Former UST - Motor Run-In Building (LMC Location 8)	NB-29, NB-34
3	Former RCRA Drummed Waste Storage Area	NB-25
4	Former RCRA Waste Oil Storage / Former Bondolite Process Area	NB-24
5	Former RCRA Drummed Cyanide Waste Storage Area	NB-28
6	Former RCRA Acid / Alkali waste storage tanks (Building #113)	NB-26
7	Former RCRA Flammable Liquid Storage Building (Building #116)	NB-27
8	Airdock ABS Operations: Coolant Sump in NW Corner	NB-18, NB-19
9	Airdock ABS Operations: Former Plate Shop and Degreaser	NB-20, NB-21, NB-22, NB-23, PLTA-4, PLTA-5
10	Airdock ABS Operations: Press Shop (Area 1)	PLTA-6, PLTA-7, PLTA-8, PLTA-9
11	Airdock ABS Operations: Open Area at North End of Airdock	PLTA-1, PLTA-2, PLTA-3
12	Plant A Photocopy Lab / X-ray Area	NB-30
13	Airdock Roofing and Siding, and PCB-Impacted Areas	Sampling locations not shown

0 40 80

SCALE IN FEET

SOURCE: MODIFIED FROM LOCKHEED MARTIN

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 5
VAP IDENTIFIED AREAS
ON AIRDOCK PARCEL

TETRA TECH, Inc.

Legend

🟨 Airdock (Plant A)

🟦 USD Extension Boundary

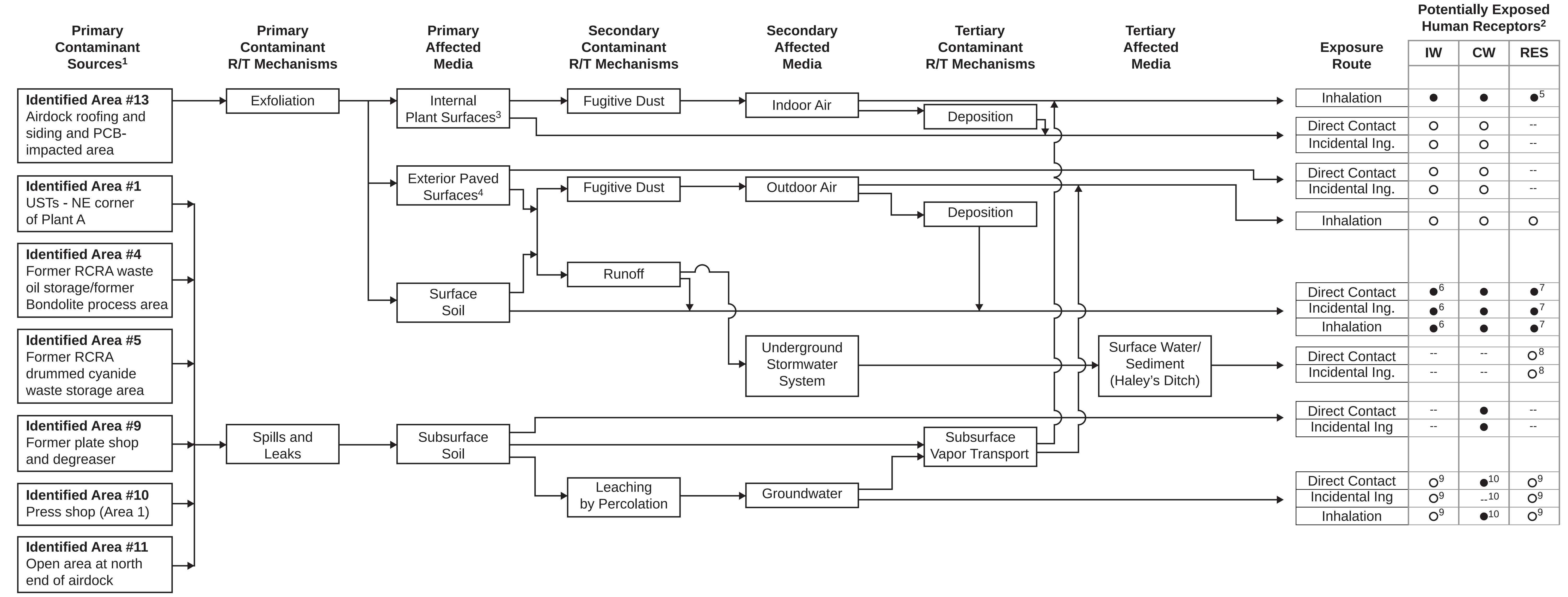
SOURCE: SUMMIT COUNTY GIS AERIAL PHOTOGRAPHY,
2000, AND SUMMIT COUNTY GIS, 2004.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 6
LOCATION OF AKRON EAST
USD EXTENSION

TETRA TECH, INC.

2007-04-17 s:\cadd\\p382\04\airdock_ra_6.mxd TTEMI-NV andrew.dye



Exposure Route	IW	CW	RES
Inhalation	●	●	●[5]
Direct Contact	○	○	--
Incidental Ing.	○	○	--
Direct Contact	○	○	--
Incidental Ing.	○	○	--
Inhalation	○	○	○
Direct Contact	●[6]	●	●[7]
Incidental Ing.	●[6]	●	●[7]
Inhalation	●[6]	●	●[7]
Direct Contact	--	--	○[8]
Incidental Ing.	--	--	○[8]
Direct Contact	--	●	--
Incidental Ing	--	●	--
Direct Contact	○[9]	●[10]	○[9]
Incidental Ing	○[9]	--[10]	○[9]
Inhalation	○[9]	●[10]	○[9]

Potentially Exposed Human Receptors[2]

Notes:

BUSTR = Bureau of Underground Storage Tank Regulations
cm² = Square centimeter
CORF = Clean Ohio Revitalization Fund
CW = Construction worker
EPA = U.S. Environmental Protection Agency
Ing = Ingestion
IW = Industrial worker
mg/kg = Milligram per kilogram
PCB = Polychlorinated biphenyl
RCRA = Resource Conservation and Recovery Act
RES = Resident
R/T = Release/Transport
TSCA = Toxic Substances Control Act
UST = Underground storage tank
VAP = Voluntary Action Program
● = Potentially complete exposure pathway – retained for quantitative analysis
○ = Potentially complete, but insignificant, exposure pathway – will not be retained for quantitative analysis
-- = Incomplete exposure pathway – will not be retained for quantitative analysis

[1] Primary contaminant sources were identified as those associated with soil and/or groundwater analytical results above Ohio VAP Generic Direct Contact Standards for a single chemical – commercial and industrial land use, and action levels associated with BUSTR.

[2] On-site potentially exposed human receptors (IW and CW) are those associated with the intended future land use at the site – industrial. Off-site potentially exposed human receptors include residents.

[3] Potential exposures to interior plant surfaces (and any fugitive dust originating from these surfaces) are assumed to be insignificant because these surfaces were cleaned to EPA-approved levels for non-porous surfaces – 10 ug/100 cm² (high occupancy) and 100 ug/100 cm² (low access areas).

[4] Potential exposures to exterior paved surfaces are assumed to be insignificant for three primary reasons: (1) all exterior building surfaces will be remediated to prevent further exfoliation, (2) all pavement debris will be cleaned up and removed, and (3) PCB concentrations in pavement are all less than 1 mg/kg.

[5] Potential exposure at off-property locations through inhalation of indoor air containing volatile chemicals that have entered a residence through subsurface vapor transport is evaluated semi-quantitatively by comparison of off-property groundwater concentrations to generic groundwater screening levels as presented in EPA (2002) (see Section 5.1.3).

[6] Industrial workers are assumed to be exposed to surface soil only outside the Airdock. Within the Airdock, it is assumed that the concrete slab will prevent exposure.

[7] Potential exposure at off-property locations through exposure to surface soil was evaluated semi-quantitatively by comparison of off-property surface soil concentrations to chemical-specific generic numerical standards for a single chemical (OAC 3745-300-8 Generic Numerical Standards, Table II).

[8] Haley's Ditch is located about 0.75 mile north-northwest of the Akron Airdock facility and is not part of the VAP/CORF property. Investigation of potential surface water and sediment contamination in Haley's Ditch was evaluated by quantifying the migration of post-remedial residual PCB-impacted soils via run-off, through the underground stormwater system, and into Haley's Ditch (see Sections 3.4 and 5.4 of the risk assessment).

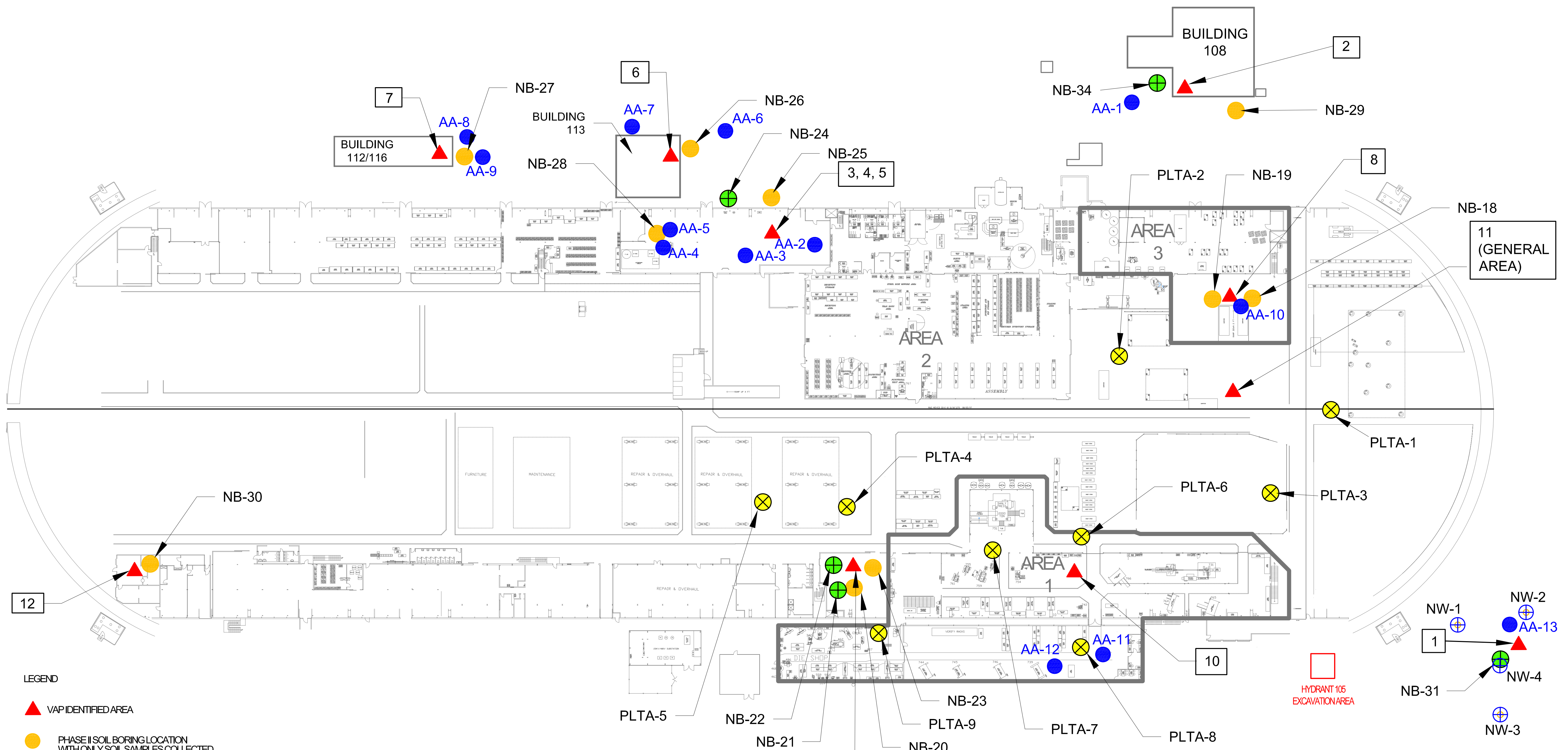
[9] It is assumed that institutional controls will prevent potable use of groundwater until concentrations reach acceptable levels.

[10] Construction workers may be exposed to groundwater during construction activities.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 7
HUMAN HEALTH CONCEPTUAL SITE MODEL

TETRA TECH



LEGEND

- 🔺 VAP IDENTIFIED AREA
- ● PHASE II SOIL BORING LOCATION WITH ONLY SOIL SAMPLES COLLECTED
- ⊕ PHASE II SOIL BORING LOCATION WITH SOIL AND GROUNDWATER SAMPLES COLLECTED (2004)
- ⊗ GOODYEAR PHASE II BORING SAMPLED BY LMC (2004)
- ● SUPPLEMENTAL PHASE II BORING LOCATION (MARCH 2006)
- ⊕ LOCKHEED MONITORING WELL

NOTE: VAP IDENTIFIED AREA 13 NOT SHOWN ON MAP.

NOTE: SIDEWALL SOIL SAMPLES COLLECTED FROM THE HYDRANT 105 EXCAVATION AREA BY BBL, 2006.

SOURCE: MODIFIED FROM LOCKHEED MARTIN

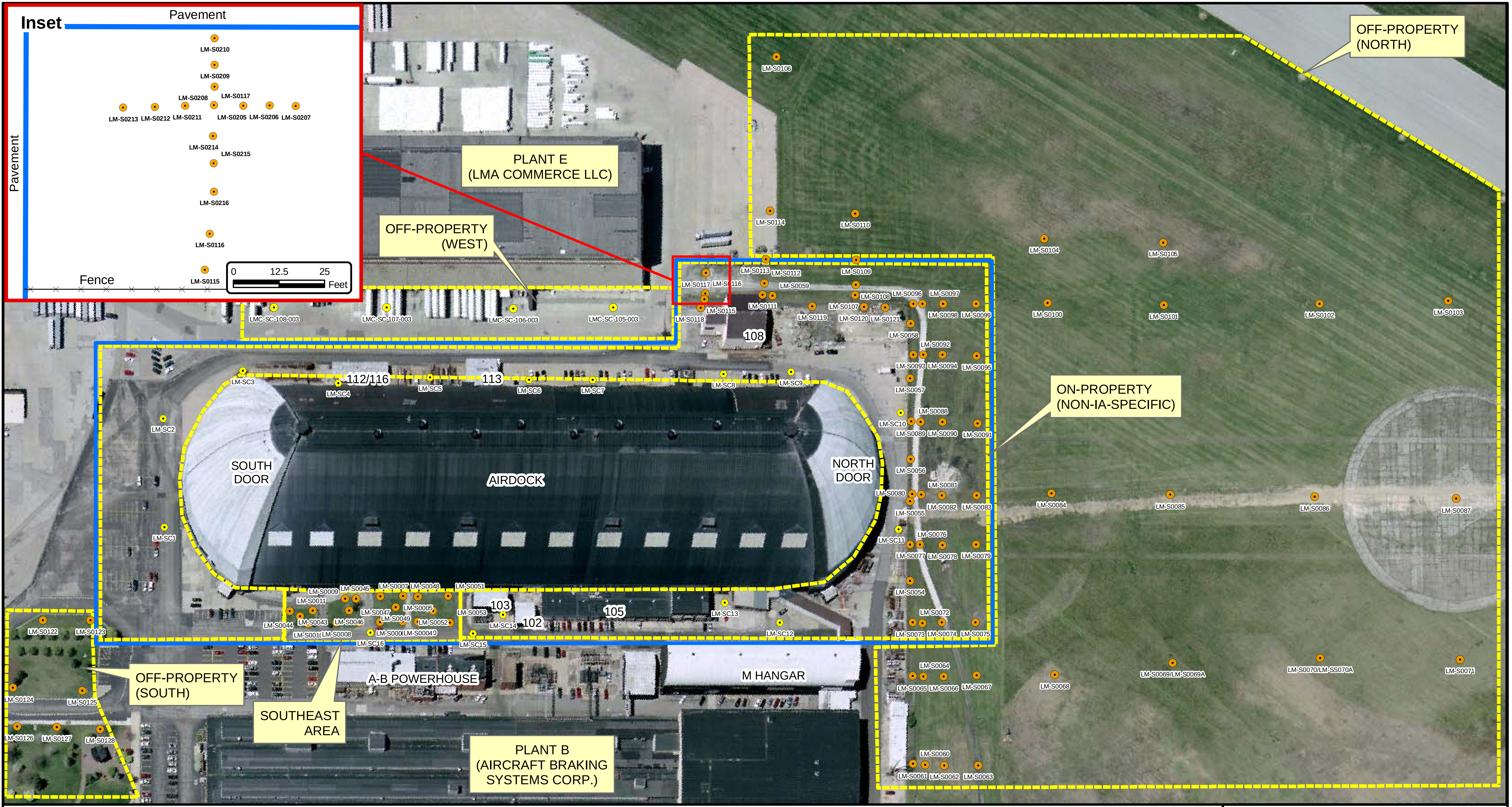
Identified Area No.	Feature - Description	Supplemental Phase II Boring IDs
1	Former USTs - NE Corner of Plant A (LMC Location 4)	AA-13
2	Former UST – Motor Run-In Building (LMC Location 8)	AA-1
3	Former RCRA Drummed Waste Storage Area	AA-2, AA-3
4	Former RCRA Waste Oil Storage / Former Bondolite Process Area	AA-2, AA-3
5	Former RCRA Drummed Cyanide Waste Storage Area	AA-4, AA-5
6	Former RCRA Acid / Alkali waste storage tanks (Building #113)	AA-6, AA-7
7	Former RCRA Flammable Liquid Storage (Building #116)	AA-8, AA-9
8	Airdock ABS Operations: Coolant Sump in NW Corner	AA-10
9	Airdock ABS Operations: Former Plate Shop and Degreaser	None
10	Airdock ABS Operations: Press Shop (Area 1)	AA-11, AA-12
11	Airdock ABS Operations: Open Area at North End of Airdock	None
12	Plant A Photocopy Lab/X-ray Area	None
13	Airdock Roofing and Siding, and PCB Impacted Areas	None

0 40 80
SCALE IN FEET

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 8
LOCATIONS OF SUPPLEMENTAL
PHASE II SOIL BORINGS

TETRA TECH, INC.



LEGEND

● Surface Soil Sample

⬢ Sub-Pavement Soil Sample

▭ Approximate Airdock Boundary

⬚ Evaluated Property Area

Building Legend

102 - Helium Compressor/Fire Suppression
103 - Electrical Substation/Transformer House
105 - Outer Press Shop
108 - Motor Run-In
112 - Former Flame Cutting
113 - Former Acid/Alkali Waste Storage Facility
116 - Storage

SOURCES:

MODIFIED FROM SUMMIT COUNTY GIS, 2004.
WESTON (2004)
BBL (2005)
BBL (2006)
Brownfield Restoration Group, 2006

0 75 150 Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 9
AIRDOCK SOIL SAMPLE
LOCATIONS: 2003-2007

TETRA TECH

2007-12-11 s:\caddi\p382\04\airdock_ra_10.mxd TTEMI-NV joel.peters

FIGURE 10

EXPOSURE DOSE EQUATIONS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

Indoor Air – Construction Trench

Inhalation

$$\mathrm{ADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC_{ia}} \times \mathrm{InR} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{ET} \times \mathrm{CF1}}{\mathrm{BW} \times \mathrm{AT_{nc}}}$$

$$\mathrm{LADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC_{ia}} \times \mathrm{InR} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{ET} \times \mathrm{CF1}}{\mathrm{BW} \times \mathrm{AT_{c}}}$$

Soil

Ingestion

$$\mathrm{ADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC_{soil}} \times \mathrm{IR} \times \mathrm{FI}\ \mathrm{x}\ \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF2}}{\mathrm{BW} \times \mathrm{AT_{nc}}}$$

$$\mathrm{LADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC_{soil}} \times \mathrm{IR} \times \mathrm{FI}\ \mathrm{x}\, \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF2}}{\mathrm{BW} \times \mathrm{AT_{c}}}$$

FIGURE 10 (Continued)

EXPOSURE DOSE EQUATIONS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Dermal Contact

$$\mathrm{ADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC}_{\mathrm{soil}} \times \mathrm{SA}_{\mathrm{soil}} \times \mathrm{AF} \times \mathrm{ABS} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF2}}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{nc}}}$$

$$\mathrm{LADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC}_{\mathrm{soil}} \times \mathrm{SA}_{\mathrm{soil}} \times \mathrm{AF} \times \mathrm{ABS} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{CF2}}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{c}}}$$

Inhalation

$$\mathrm{ADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC}_{\mathrm{soil}} \times \mathrm{InR} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{ET} \times \mathrm{FI} \times (\frac{1}{\mathrm{PEF}} + \frac{1}{\mathrm{VF}})}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{nc}}}$$

$$\mathrm{LADD}_{(\mathrm{mg/kg\text{-}day})} = \frac{\mathrm{EPC}_{\mathrm{soil}} \times \mathrm{InR} \times \mathrm{EF} \times \mathrm{ED} \times \mathrm{ET} \times \mathrm{FI} \times (\frac{1}{\mathrm{PEF}} + \frac{1}{\mathrm{VF}})}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{c}}}$$

Groundwater

Dermal Contact

$$\mathrm{ADD} = \frac{\mathrm{DA}_{\mathrm{event}} \times \mathrm{SA}_{\mathrm{gw}} \times \mathrm{EV} \times \mathrm{EF} \times \mathrm{ED}}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{nc}}}$$

$$\mathrm{LADD} = \frac{\mathrm{DA}_{\mathrm{event}} \times \mathrm{SA}_{\mathrm{gw}} \times \mathrm{EV} \times \mathrm{EF} \times \mathrm{ED}}{\mathrm{BW} \times \mathrm{AT}_{\mathrm{c}}}$$

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

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

DA$_{event}$ for inorganics will be calculated using Equation 3.4 from EPA (2004).

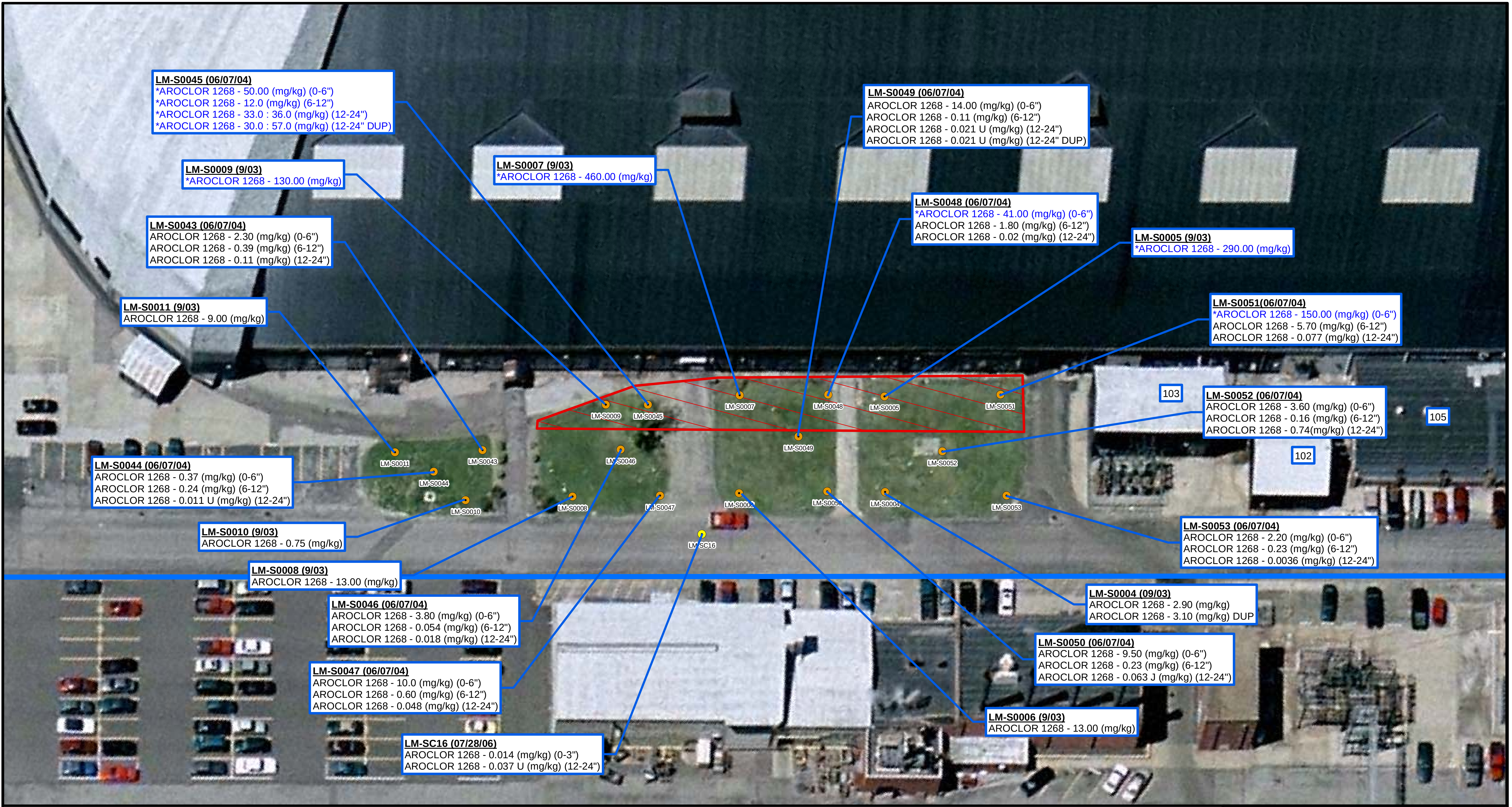
FIGURE 10 (Continued)

EXPOSURE DOSE EQUATIONS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Notes:

ABS = Dermal absorption (unitless)
AF = Adherence factor (milligram per square centimeter [mg/cm^2])
AT_c = Averaging time – carcinogens (days)
AT_{nc} = Averaging time – noncarcinogens (days)
B = Dimensionless ratio of the permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (unitless)
BW = Body weight (kilograms [kg])
CF1 = Conversion factor 1 (milligram per microgram [mg/µg])
CF2 = Conversion factor 2 (kg/mg)
C_w = Chemical concentration in water (mg/cm^3)
DA_{event} = Absorbed dose per event (mg/cm^2 – event)
ED = Exposure duration (years)
EF = Exposure frequency (days/year)
EPC_{soil} = Exposure point concentration – soil (mg/kg)
EPC_{ia} = Exposure point concentration – indoor air (microgram per cubic meter [$\mu g/m^3$])
EPC_{gw} = Exposure point concentration – groundwater (µg/L for organic compounds and mg/L for inorganic compounds)
ET = Exposure time (hour/day)
EV = Event frequency (event/day)
FA = Fraction absorbed water (unitless)
FI = Fraction soil contaminated (unitless)
InR = Inhalation rate (m^3/hour)
IR = Ingestion rate (mg/day)
K_p = Dermal permeability coefficient of compound in water (cm/hr)
PEF = Particulate emission factor (m^3/kg)
SA_{soil} = Skin surface area – soil (cm^2)
SA_{gw} = Skin surface area – groundwater (cm^2)
τ_{event} = Lag time per event (hr/event)
t_{event} = Event duration (hr/event)
T* = Time to reach steady-state (hr) = 2.4 τ_{event}
VF = Volatilization factor (m^3/kg)

U.S. Environmental Protection Agency (EPA). 2004. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment." Final. Office of Superfund Remediation and Technology Innovation. EPA/540/R/99/005. July.



LEGEND

- ● Sub-Pavement Soil Sample
- ● Surface Soil Sample
- 🟥 Excavation Area
- 🟦 Approximate Airdock Boundary

Notes:
Sample Results in blue type and marked *
will be removed during remediation.

U = Not Detected. The associated numerical
result represents the detection limit.

SOURCES:

MODIFIED FROM SUMMIT COUNTY GIS, 2004.
WESTON (2004)
BBL (2005)
BBL (2006)

W N S E

0 25 50
Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 11
SOUTHEAST AREA SOIL SAMPLING DATA AND PROPOSED EXCAVATION

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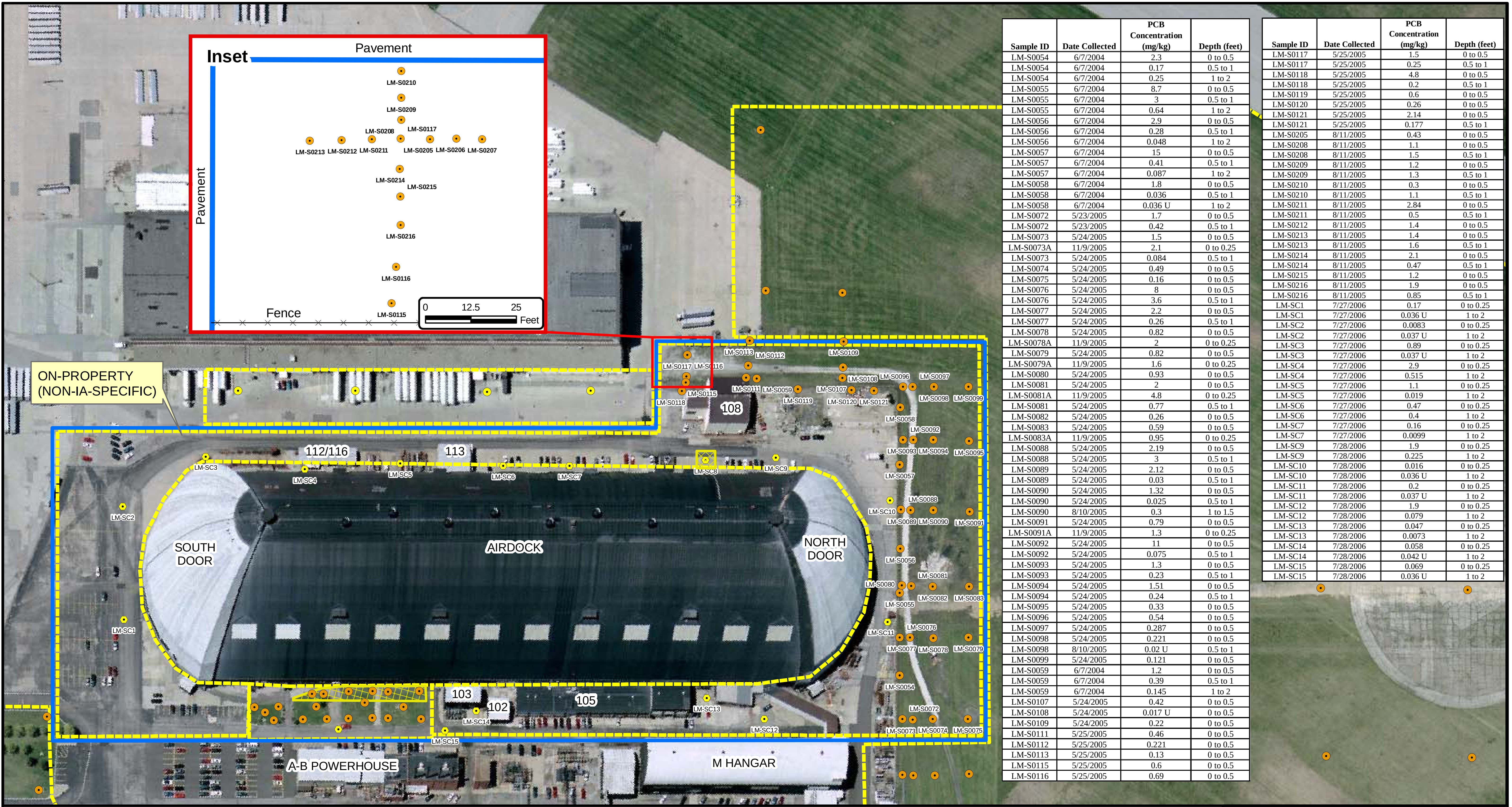


Sample ID	Date Collected	PCB Concentration (mg/kg)	Depth (feet)
LM-S0054	6/7/2004	2.3	0 to 0.5
LM-S0054	6/7/2004	0.17	0.5 to 1
LM-S0054	6/7/2004	0.25	1 to 2
LM-S0055	6/7/2004	8.7	0 to 0.5
LM-S0055	6/7/2004	3	0.5 to 1
LM-S0055	6/7/2004	0.64	1 to 2
LM-S0056	6/7/2004	2.9	0 to 0.5
LM-S0056	6/7/2004	0.28	0.5 to 1
LM-S0056	6/7/2004	0.048	1 to 2
LM-S0057	6/7/2004	15	0 to 0.5
LM-S0057	6/7/2004	0.41	0.5 to 1
LM-S0057	6/7/2004	0.087	1 to 2
LM-S0058	6/7/2004	1.8	0 to 0.5
LM-S0058	6/7/2004	0.036	0.5 to 1
LM-S0058	6/7/2004	0.036 U	1 to 2
LM-S0072	5/23/2005	1.7	0 to 0.5
LM-S0072	5/23/2005	0.42	0.5 to 1
LM-S0073	5/24/2005	1.5	0 to 0.5
LM-S0073A	11/9/2005	2.1	0 to 0.25
LM-S0073	5/24/2005	0.084	0.5 to 1
LM-S0074	5/24/2005	0.49	0 to 0.5
LM-S0075	5/24/2005	0.16	0 to 0.5
LM-S0076	5/24/2005	8	0 to 0.5
LM-S0076	5/24/2005	3.6	0.5 to 1
LM-S0077	5/24/2005	2.2	0 to 0.5
LM-S0077	5/24/2005	0.26	0.5 to 1
LM-S0078	5/24/2005	0.82	0 to 0.5
LM-S0078A	11/9/2005	2	0 to 0.25
LM-S0079	5/24/2005	0.82	0 to 0.5
LM-S0079A	11/9/2005	1.6	0 to 0.25
LM-S0080	5/24/2005	0.93	0 to 0.5
LM-S0081	5/24/2005	2	0 to 0.5
LM-S0081A	11/9/2005	4.8	0 to 0.25
LM-S0081	5/24/2005	0.77	0.5 to 1
LM-S0082	5/24/2005	0.26	0 to 0.5
LM-S0083	5/24/2005	0.59	0 to 0.5
LM-S0083A	11/9/2005	0.95	0 to 0.25
LM-S0088	5/24/2005	2.19	0 to 0.5
LM-S0088	5/24/2005	3	0.5 to 1
LM-S0089	5/24/2005	2.12	0 to 0.5
LM-S0089	5/24/2005	0.03	0.5 to 1
LM-S0090	5/24/2005	1.32	0 to 0.5
LM-S0090	5/24/2005	0.025	0.5 to 1
LM-S0090	8/10/2005	0.3	1 to 1.5
LM-S0091	5/24/2005	0.79	0 to 0.5
LM-S0091A	11/9/2005	1.3	0 to 0.25
LM-S0092	5/24/2005	11	0 to 0.5
LM-S0092	5/24/2005	0.075	0.5 to 1
LM-S0093	5/24/2005	1.3	0 to 0.5
LM-S0093	5/24/2005	0.23	0.5 to 1
LM-S0094	5/24/2005	1.51	0 to 0.5
LM-S0094	5/24/2005	0.24	0.5 to 1
LM-S0095	5/24/2005	0.33	0 to 0.5
LM-S0096	5/24/2005	0.54	0 to 0.5
LM-S0097	5/24/2005	0.287	0 to 0.5
LM-S0098	5/24/2005	0.221	0 to 0.5
LM-S0098	8/10/2005	0.02 U	0.5 to 1
LM-S0099	5/24/2005	0.121	0 to 0.5
LM-S0059	6/7/2004	1.2	0 to 0.5
LM-S0059	6/7/2004	0.39	0.5 to 1
LM-S0059	6/7/2004	0.145	1 to 2
LM-S0107	5/24/2005	0.42	0 to 0.5
LM-S0108	5/24/2005	0.017 U	0 to 0.5
LM-S0109	5/24/2005	0.22	0 to 0.5
LM-S0111	5/25/2005	0.46	0 to 0.5
LM-S0112	5/25/2005	0.221	0 to 0.5
LM-S0113	5/25/2005	0.13	0 to 0.5
LM-S0115	5/25/2005	0.6	0 to 0.5
LM-S0116	5/25/2005	0.69	0 to 0.5

Sample ID	Date Collected	PCB Concentration (mg/kg)	Depth (feet)
LM-S0117	5/25/2005	1.5	0 to 0.5
LM-S0117	5/25/2005	0.25	0.5 to 1
LM-S0118	5/25/2005	4.8	0 to 0.5
LM-S0118	5/25/2005	0.2	0.5 to 1
LM-S0119	5/25/2005	0.6	0 to 0.5
LM-S0120	5/25/2005	0.26	0 to 0.5
LM-S0121	5/25/2005	2.14	0 to 0.5
LM-S0121	5/25/2005	0.177	0.5 to 1
LM-S0205	8/11/2005	0.43	0 to 0.5
LM-S0208	8/11/2005	1.1	0 to 0.5
LM-S0208	8/11/2005	1.5	0.5 to 1
LM-S0209	8/11/2005	1.2	0 to 0.5
LM-S0209	8/11/2005	1.3	0.5 to 1
LM-S0210	8/11/2005	0.3	0 to 0.5
LM-S0210	8/11/2005	1.1	0.5 to 1
LM-S0211	8/11/2005	2.84	0 to 0.5
LM-S0211	8/11/2005	0.5	0.5 to 1
LM-S0212	8/11/2005	1.4	0 to 0.5
LM-S0213	8/11/2005	1.4	0 to 0.5
LM-S0213	8/11/2005	1.6	0.5 to 1
LM-S0214	8/11/2005	2.1	0 to 0.5
LM-S0214	8/11/2005	0.47	0.5 to 1
LM-S0215	8/11/2005	1.2	0 to 0.5
LM-S0216	8/11/2005	1.9	0 to 0.5
LM-S0216	8/11/2005	0.85	0.5 to 1
LM-SC1	7/27/2006	0.17	0 to 0.25
LM-SC1	7/27/2006	0.036 U	1 to 2
LM-SC2	7/27/2006	0.0083	0 to 0.25
LM-SC2	7/27/2006	0.037 U	1 to 2
LM-SC3	7/27/2006	0.89	0 to 0.25
LM-SC3	7/27/2006	0.037 U	1 to 2
LM-SC4	7/27/2006	2.9	0 to 0.25
LM-SC4	7/27/2006	0.515	1 to 2
LM-SC5	7/27/2006	1.1	0 to 0.25
LM-SC5	7/27/2006	0.019	1 to 2
LM-SC6	7/27/2006	0.47	0 to 0.25
LM-SC6	7/27/2006	0.4	1 to 2
LM-SC7	7/27/2006	0.16	0 to 0.25
LM-SC7	7/27/2006	0.0099	1 to 2
LM-SC9	7/28/2006	1.9	0 to 0.25
LM-SC9	7/28/2006	0.225	1 to 2
LM-SC10	7/28/2006	0.016	0 to 0.25
LM-SC10	7/28/2006	0.036 U	1 to 2
LM-SC11	7/28/2006	0.2	0 to 0.25
LM-SC11	7/28/2006	0.037 U	1 to 2
LM-SC12	7/28/2006	1.9	0 to 0.25
LM-SC12	7/28/2006	0.079	1 to 2
LM-SC13	7/28/2006	0.047	0 to 0.25
LM-SC13	7/28/2006	0.0073	1 to 2
LM-SC14	7/28/2006	0.058	0 to 0.25
LM-SC14	7/28/2006	0.042 U	1 to 2
LM-SC15	7/28/2006	0.069	0 to 0.25
LM-SC15	7/28/2006	0.036 U	1 to 2

LEGEND

●	Surface Soil Sample
●	Sub-Pavement Soil Sample
▨	Excavated Area - Remediation per LMC 2007c (See Section 2.1.2)
▭	Approximate Airdock Boundary
▭	Evaluated Property Area

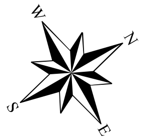
Notes:
U = Not Detected. The associated numerical result represents the detection limit.

Building Legend

102 - Helium Compressor/Fire Suppression
103 - Electrical Substation/Transformer House
105 - Outer Press Shop
108 - Motor Run-In
112 - Former Flame Cutting
113 - Former Acid/Alkali Waste Storage Facility
116 - Storage

SOURCES:

MODIFIED FROM SUMMIT COUNTY GIS, 2004.
WESTON (2004)
BBL (2005)
BBL (2006)
Brownfield Restoration Group, 2006



0 75 150 Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 12
ON-PROPERTY
(NON-IA-SPECIFIC) SAMPLING MAP

TETRA TECH, INC.

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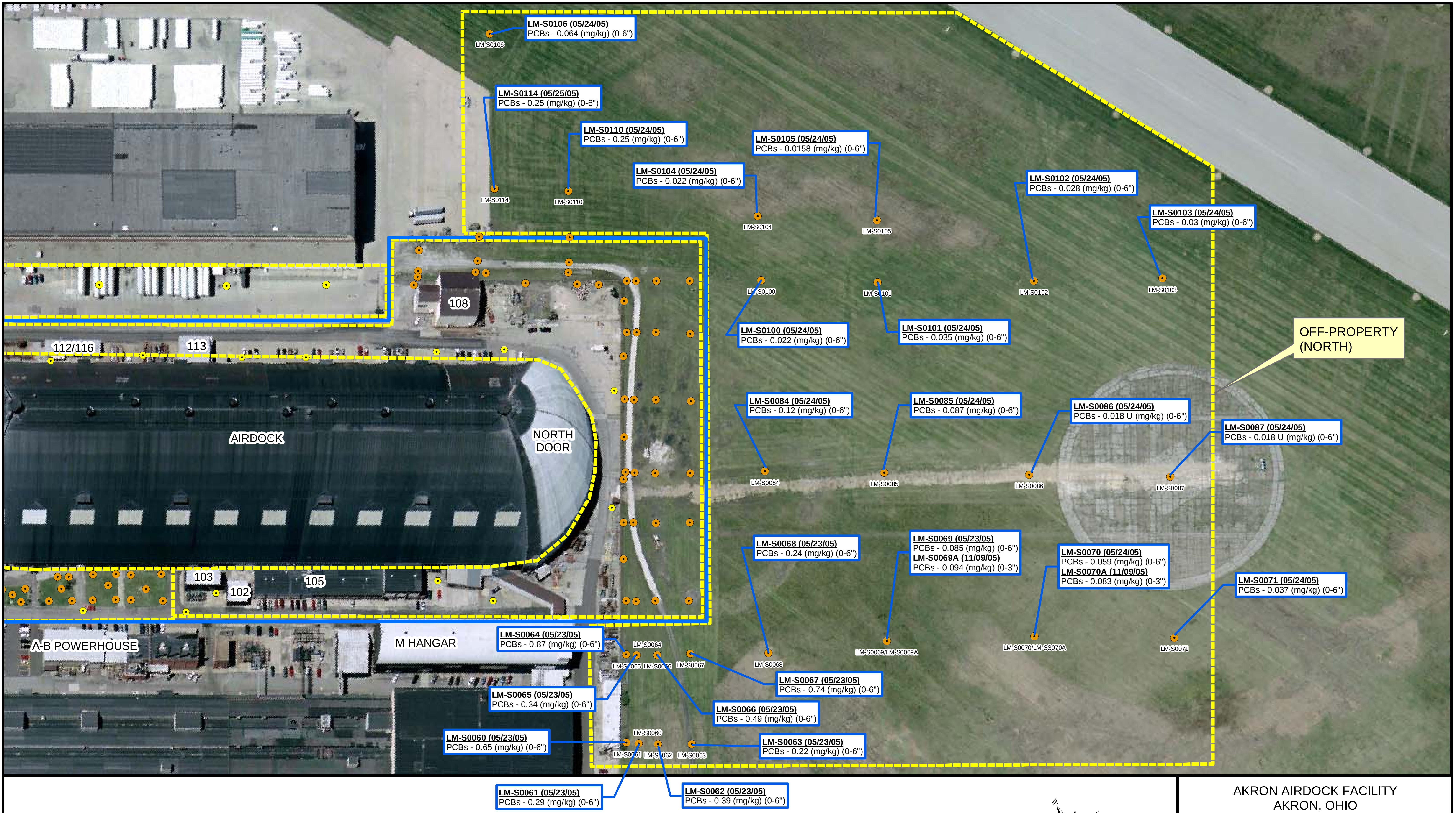

LEGEND

● Surface Soil Sample
● Sub-Pavement Soil Sample
▭ Approximate Airdock Boundary
▭ Evaluated Property Area

Notes:
U = Not Detected. The associated numerical result represents the detection limit.

Building Legend

102 - Helium Compressor/Fire Suppression
103 - Electrical Substation/Transformer House
105 - Outer Press Shop
108 - Motor Run-In
112 - Former Flame Cutting
113 - Former Acid/Alkali Waste Storage Facility
116 - Storage

SOURCES:

MODIFIED FROM SUMMIT COUNTY GIS, 2004.
WESTON (2004)
BBL (2005)
BBL (2006)

0 75 150
Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 13
OFF-PROPERTY (NORTH)
SAMPLING MAP

TETRA TECH, INC.

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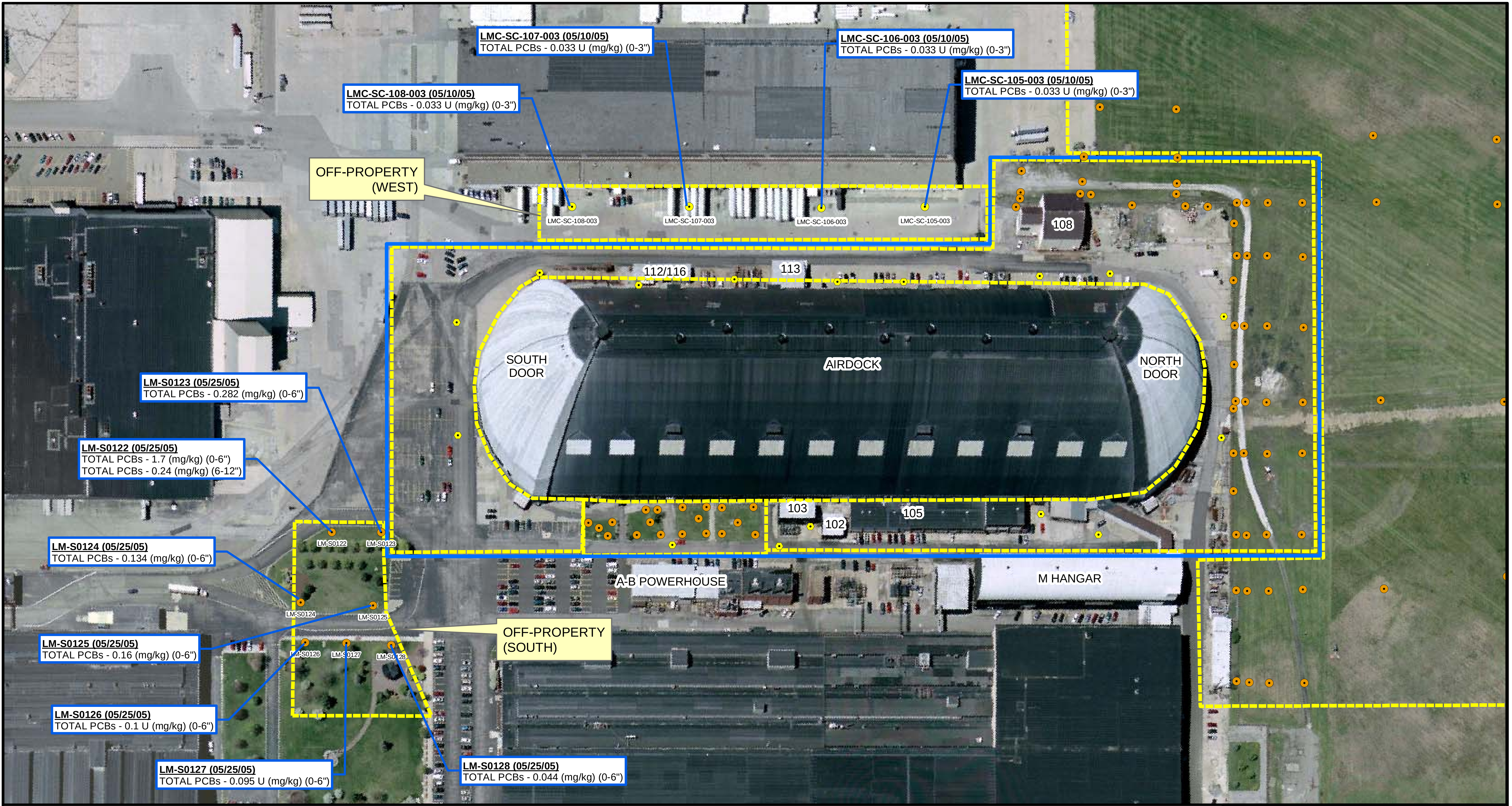

LEGEND

- ● Surface Soil Sample
- ● Sub-Pavement Soil Sample
- ▭ Approximate Airdock Boundary
- ▭ Evaluated Property Area

Notes:
U = Not Detected. The associated numerical result represents the detection limit.

Building Legend

102 - Helium Compressor/Fire Suppression
103 - Electrical Substation/Transformer House
105 - Outer Press Shop
108 - Motor Run-In
112 - Former Flame Cutting
113 - Former Acid/Alkali Waste Storage Facility
116 - Storage

SOURCES:

MODIFIED FROM SUMMIT COUNTY GIS, 2004.
WESTON (2004)
BBL (2005)
BBL (2006)
Brownfield Restoration Group, 2006

W N S E

0 75 150
Feet

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE 14
OFF-PROPERTY (WEST) AND
OFF-PROPERTY (SOUTH) SAMPLING MAP

TETRA TECH, INC.

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TABLE A-1

EXPOSURE POINT CONCENTRATION CALCULATIONS
POLYCHLORINATED BIPHENYLS IN SOIL -- SOUTHEAST AREA
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Raw Statistics		**Normal Distribution Test**			**PCB Concentrations (mg/kg)**
Number of Valid Samples	35	Shapiro-Wilk Test Statisitic	0.6686671		3
Number of Unique Samples	32	Shapiro-Wilk 5% Critical Value	0.934		13
Minimum	0.0036	Data not normal at 5% significance level			13
Maximum	14				0.75
Mean	2.7189171	**95% UCL (Assuming Normal Distribution)**			9
Median	0.37	Student's-t UCL	3.9499879		2.3
Standard Deviation	4.3071793				0.39
Variance	18.551793	**Gamma Distribution Test**			0.11
Coefficient of Variation	1.5841525	A-D Test Statistic	0.9441553		0.37
Skewness	1.6472397	A-D 5% Critical Value	0.8474048		0.24
		K-S Test Statistic	0.1487738		0.0055
Gamma Statistics		K-S 5% Critical Value	0.1604648		3.8
k hat	0.3409191	Data follow approximate gamma distibution			0.054
k star (bias corrected)	0.3307451	at 5% significance level			0.018
Theta hat	7.975256				10
Theta star	8.2205821	**95% UCLs (Assuming Gamma Distribution)**			0.6
nu hat	23.864337	Approximate Gamma UCL	4.7673773		0.048
nu star	23.152156	Adjusted Gamma UCL	4.8998812		1.8
Approx.Chi Square Value (.05)	13.204072				0.02
Adjusted Level of Significance	0.0425	**Lognormal Distribution Test**			14
Adjusted Chi Square Value	12.847004	Shapiro-Wilk Test Statisitic	0.9419891		0.11
		Shapiro-Wilk 5% Critical Value	0.934		0.0105
Log-transformed Statistics		Data are lognormal at 5% significance level			9.5
Minimum of log data	-5.626821				0.23
Maximum of log data	2.6390573	**95% UCLs (Assuming Lognormal Distribution)**			0.063
Mean of log data	-0.980658	95% H-UCL	55.56859		5.7
Standard Deviation of log data	2.4839778	95% Chebyshev (MVUE) UCL	22.058123		0.077
Variance of log data	6.1701455	97.5% Chebyshev (MVUE) UCL	28.964058		3.6
		99% Chebyshev (MVUE) UCL	42.52943		0.16
					0.74
		95% Non-parametric UCLs			2.2
		CLT UCL	3.9164465		0.23
		Adj-CLT UCL (Adjusted for skewness)	4.1330484		0.0036
		Mod-t UCL (Adjusted for skewness)	3.9837734		0.014
		Jackknife UCL	3.9499879		0.0185
		Standard Bootstrap UCL	3.8863384		
		Bootstrap-t UCL	4.3569845		
RECOMMENDATION		Hall's Bootstrap UCL	4.0211132		
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	3.9920286		
		BCA Bootstrap UCL	4.0632714		
Use Adjusted Gamma UCL		95% Chebyshev (Mean, Sd) UCL	5.8923968		
		97.5% Chebyshev (Mean, Sd) UCL	7.2655641		
		99% Chebyshev (Mean, Sd) UCL	9.9628851		
Note:					

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

TABLE A-2

EXPOSURE POINT CONCENTRATION CALCULATIONS
POLYCHLORINATED BIPHENYLS -- ON-SITE (NON-IA-SPECIFIC)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Raw Statistics		**Normal Distribution Test**		**PCB Concentrations (mg/kg)**		
Number of Valid Samples	122	Lilliefors Test Statisitic	0.2830904	2.3	0.3	1.4
Number of Unique Samples	88	Lilliefors 5% Critical Value	0.0802147	0.17	0.79	1.4
Minimum	0.0073	Data not normal at 5% significance level		0.25	1.3	1.6
Maximum	15			8.7	11	2.1
Mean	1.1926844	**95% UCL (Assuming Normal Distribution)**		3	0.075	0.47
Median	0.48	Student's-t UCL	1.5027623	0.64	1.3	1.2
Standard Deviation	2.0662634			2.9	0.23	1.9
Variance	4.2694445	**Gamma Distribution Test**		0.28	1.51	0.85
Coefficient of Variation	1.7324477	A-D Test Statistic	0.8904615	0.048	0.24	0.17
Skewness	4.1776539	A-D 5% Critical Value	0.8137075	15	0.33	0.018
		K-S Test Statistic	0.0671219	0.41	0.54	0.0083
Gamma Statistics		K-S 5% Critical Value	0.0882625	0.087	0.287	0.0185
k hat	0.5555578	Data follow approximate gamma distibution		1.8	0.221	0.89
k star (bias corrected)	0.547361	at 5% significance level		0.036	0.01	0.0185
Theta hat	2.1468234			0.018	0.121	2.9
Theta star	2.1789722	**95% UCLs (Assuming Gamma Distribution)**		1.7	1.2	0.515
nu hat	135.5561	Approximate Gamma UCL	1.4769294	0.42	0.39	1.1
nu star	133.55609	Adjusted Gamma UCL	1.4806952	1.5	0.145	0.019
Approx.Chi Square Value (.05)	107.85232			2.1	0.42	0.47
Adjusted Level of Significance	0.0480328	**Lognormal Distribution Test**		0.084	0.0085	0.4
Adjusted Chi Square Value	107.57802	Lilliefors Test Statisitic	0.0841311	0.49	0.22	0.16
		Lilliefors 5% Critical Value	0.0802147	0.16	0.46	0.0099
Log-transformed Statistics		Data not lognormal at 5% significance level		8	0.221	1.9
Minimum of log data	-4.919881			3.6	0.13	0.225
Maximum of log data	2.7080502	**95% UCLs (Assuming Lognormal Distribution)**		2.2	0.6	0.016
Mean of log data	-0.948818	95% H-UCL	2.9307393	0.26	0.69	0.018
Standard Deviation of log data	1.7601716	95% Chebyshev (MVUE) UCL	3.6127438	0.82	1.5	0.2
Variance of log data	3.0982041	97.5% Chebyshev (MVUE) UCL	4.4116176	2	0.25	0.0185
		99% Chebyshev (MVUE) UCL	5.9808505	0.82	4.8	1.9
				1.6	0.2	0.079
		95% Non-parametric UCLs		0.93	0.6	0.047
		CLT UCL	1.5003883	2	0.26	0.0073
		Adj-CLT UCL (Adjusted for skewness)	1.5759913	4.8	2.14	0.058
		Mod-t UCL (Adjusted for skewness)	1.5145549	0.77	0.177	0.021
		Jackknife UCL	1.5027623	0.26	0.43	0.069
		Standard Bootstrap UCL	1.5017339	0.59	1.1	0.018
		Bootstrap-t UCL	1.6185363	0.95	1.5	
RECOMMENDATION		Hall's Bootstrap UCL	1.6681688	2.19	1.2	
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	1.5340795	3	1.3	
		BCA Bootstrap UCL	1.5912246	2.12	0.3	
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	2.0081067	0.03	1.1	
		97.5% Chebyshev (Mean, Sd) UCL	2.3609406	1.32	2.84	
		99% Chebyshev (Mean, Sd) UCL	3.0540144	0.025	0.5	
Note:						

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

TABLE A-3

EXPOSURE POINT CONCENTRATION CALCULATIONS
POLYCHLORINATED BIPHENYLS IN SOIL -- OFF PROPERTY (NORTH)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Raw Statistics		**Normal Distribution Test**		**PCB Concentrations (mg/kg)**
Number of Valid Samples	27	Shapiro-Wilk Test Statisitic	0.7852901	0.65
Number of Unique Samples	25	Shapiro-Wilk 5% Critical Value	0.923	0.29
Minimum	0.009	Data not normal at 5% significance level		0.39
Maximum	0.87			0.22
Mean	0.2056593	**95% UCL (Assuming Normal Distribution)**		0.87
Median	0.087	Student's-t UCL	0.2836456	0.34
Standard Deviation	0.2375848			0.49
Variance	0.0564465	**Gamma Distribution Test**		0.74
Coefficient of Variation	1.1552351	A-D Test Statistic	0.4814624	0.24
Skewness	1.5471807	A-D 5% Critical Value	0.7810282	0.085
		K-S Test Statistic	0.1494156	0.094
Gamma Statistics		K-S 5% Critical Value	0.1744342	0.059
k hat	0.8179897	Data follow gamma distribution		0.083
k star (bias corrected)	0.7517933	at 5% significance level		0.037
Theta hat	0.2514203			0.12
Theta star	0.2735582	**95% UCLs (Assuming Gamma Distribution)**		0.087
nu hat	44.171444	Approximate Gamma UCL	0.3092973	0.009
nu star	40.596839	Adjusted Gamma UCL	0.3176497	0.009
Approx.Chi Square Value (.05)	26.993823			0.022
Adjusted Level of Significance	0.0401	**Lognormal Distribution Test**		0.035
Adjusted Chi Square Value	26.284034	Shapiro-Wilk Test Statisitic	0.961003	0.028
		Shapiro-Wilk 5% Critical Value	0.923	0.03
Log-transformed Statistics		Data are lognormal at 5% significance level		0.045
Minimum of log data	-4.710531			0.0158
Maximum of log data	-0.139262	**95% UCLs (Assuming Lognormal Distribution)**		0.064
Mean of log data	-2.304973	95% H-UCL	0.5172287	0.25
Standard Deviation of log data	1.3294427	95% Chebyshev (MVUE) UCL	0.5365651	0.25
Variance of log data	1.7674179	97.5% Chebyshev (MVUE) UCL	0.6700487	
		99% Chebyshev (MVUE) UCL	0.9322515	
		95% Non-parametric UCLs		
		CLT UCL	0.2808673	
		Adj-CLT UCL (Adjusted for skewness)	0.2954144	
		Mod-t UCL (Adjusted for skewness)	0.2859146	
		Jackknife UCL	0.2836456	
		Standard Bootstrap UCL	0.2797588	
		Bootstrap-t UCL	0.2996704	
RECOMMENDATION		Hall's Bootstrap UCL	0.2920095	
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	0.2806222	
		BCA Bootstrap UCL	0.2944074	
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	0.4049621	
		97.5% Chebyshev (Mean, Sd) UCL	0.4912006	
		99% Chebyshev (Mean, Sd) UCL	0.6605995	
Note:				

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

TABLE A-4

EXPOSURE POINT CONCENTRATION CALCULATIONS
POLYCHLORINATED BIPHENYLS IN SOIL -- OFF-PROPERTY (SOUTH)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Raw Statistics		Normal Distribution Test			PCB Concentrations (mg/kg)
Number of Valid Samples	8	Shapiro-Wilk Test Statisitic	0.562422		1.7
Number of Unique Samples	8	Shapiro-Wilk 5% Critical Value	0.818		0.24
Minimum	0.044	Data not normal at 5% significance level			0.282
Maximum	1.7				0.134
Mean	0.3321875	**95% UCL (Assuming Normal Distribution)**			0.16
Median	0.147	Student's-t UCL	0.7072423		0.05
Standard Deviation	0.5599214				0.0475
Variance	0.313512	**Gamma Distribution Test**			0.044
Coefficient of Variation	1.6855584	A-D Test Statistic	0.7534724		
Skewness	2.6864028	A-D 5% Critical Value	0.745007		
		K-S Test Statistic	0.2745604		
Gamma Statistics		K-S 5% Critical Value	0.3040268		
k hat	0.7531921	Data follow approximate gamma distibution			
k star (bias corrected)	0.5540784	at 5% significance level			
Theta hat	0.4410395				
Theta star	0.5995316	**95% UCLs (Assuming Gamma Distribution)**			
nu hat	12.051074	Approximate Gamma UCL	0.907522		
nu star	8.8652543	Adjusted Gamma UCL	1.20349		
Approx.Chi Square Value (.05)	3.2450197				
Adjusted Level of Significance	0.01946	**Lognormal Distribution Test**			
Adjusted Chi Square Value	2.446989	Shapiro-Wilk Test Statisitic	0.8854948		
		Shapiro-Wilk 5% Critical Value	0.818		
Log-transformed Statistics		Data are lognormal at 5% significance level			
Minimum of log data	-3.123566				
Maximum of log data	0.5306283	**95% UCLs (Assuming Lognormal Distribution)**			
Mean of log data	-1.896395	95% H-UCL	2.1467359		
Standard Deviation of log data	1.2284516	95% Chebyshev (MVUE) UCL	0.8156696		
Variance of log data	1.5090934	97.5% Chebyshev (MVUE) UCL	1.0480766		
		99% Chebyshev (MVUE) UCL	1.504595		
		95% Non-parametric UCLs			
		CLT UCL	0.6578062		
		Adj-CLT UCL (Adjusted for skewness)	0.8587102		
		Mod-t UCL (Adjusted for skewness)	0.7385792		
		Jackknife UCL	0.7072423		
		Standard Bootstrap UCL	0.6437273		
		Bootstrap-t UCL	2.0192038		
RECOMMENDATION		Hall's Bootstrap UCL	2.0456836		
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	0.70675		
		BCA Bootstrap UCL	0.9134375		
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	1.1950844		
		97.5% Chebyshev (Mean, Sd) UCL	1.5684605		
		99% Chebyshev (Mean, Sd) UCL	2.3018857		
Note:					

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

TABLE A-5

ON-PROPERTY (SOUTHEAST AREA AND NON-IA-SPECIFIC)
SURFACE SOIL SAMPLES
AKRON AIRDOCK

Sample ID		Depth (feet)		Date Collected		PCB Concentration (mg/kg)
SOUTHEAST AREA						
LM-S0004		SS		9/2003		3
LM-S0006		SS		9/2003		13
LM-S0008		SS		9/2003		13
LM-S0010		SS		9/2003		0.75
LM-S0011		SS		9/2003		9
LM-S0043		0 to 0.5		6/7/2004		2.3
LM-S0043		0.5 to 1		6/7/2004		0.39
LM-S0043		1 to 2		6/7/2004		0.11
LM-S0044		0 to 0.5		6/7/2004		0.37
LM-S0044		0.5 to 1		6/7/2004		0.24
LM-S0044		1 to 2		6/7/2004		0.0055
LM-S0046		0 to 0.5		6/7/2004		3.8
LM-S0046		0.5 to 1		6/7/2004		0.054
LM-S0046		1 to 2		6/7/2004		0.018
LM-S0047		0 to 0.5		6/7/2004		10
LM-S0047		0.5 to 1		6/7/2004		0.6
LM-S0047		1 to 2		6/7/2004		0.048
LM-S0048		0.5 to 1		6/7/2004		1.8
LM-S0048		1 to 2		6/7/2004		0.02
LM-S0049		0 to 0.5		6/7/2004		14
LM-S0049		0.5 to 1		6/7/2004		0.11
LM-S0049		1 to 2		6/7/2004		0.0105
LM-S0050		0 to 0.5		6/7/2004		9.5
LM-S0050		0.5 to 1		6/7/2004		0.23
LM-S0050		1 to 2		6/7/2004		0.063
LM-S0051		0.5 to 1		6/7/2004		5.7
LM-S0051		1 to 2		6/7/2004		0.077
LM-S0052		0 to 0.5		6/7/2004		3.6
LM-S0052		0.5 to 1		6/7/2004		0.16
LM-S0052		1 to 2		6/7/2004		0.74
LM-S0053		0 to 0.5		6/7/2004		2.2
LM-S0053		0.5 to 1		6/7/2004		0.23
LM-S0053		1 to 2		6/7/2004		0.0036
LM-SC16		0 to 0.25		7/28/2006		0.014
LM-SC16		1 to 2		7/28/2006		0.0185

TABLE A-5

ON-PROPERTY (SOUTHEAST AREA AND NON-IA-SPECIFIC)
SURFACE SOIL SAMPLES
AKRON AIRDOCK

Sample ID		Depth (feet)		Date Collected		PCB Concentration (mg/kg)
NON-IA-SPECIFIC						
LM-S0054		0 to 0.5		6/7/2004		2.3
LM-S0054		0.5 to 1		6/7/2004		0.17
LM-S0054		1 to 2		6/7/2004		0.25
LM-S0055		0 to 0.5		6/7/2004		8.7
LM-S0055		0.5 to 1		6/7/2004		3
LM-S0055		1 to 2		6/7/2004		0.64
LM-S0056		0 to 0.5		6/7/2004		2.9
LM-S0056		0.5 to 1		6/7/2004		0.28
LM-S0056		1 to 2		6/7/2004		0.048
LM-S0057		0 to 0.5		6/7/2004		15
LM-S0057		0.5 to 1		6/7/2004		0.41
LM-S0057		1 to 2		6/7/2004		0.087
LM-S0058		0 to 0.5		6/7/2004		1.8
LM-S0058		0.5 to 1		6/7/2004		0.036
LM-S0058		1 to 2		6/7/2004		0.018
LM-S0072		0 to 0.5		5/23/2005		1.7
LM-S0072		0.5 to 1		5/23/2005		0.42
LM-S0073		0 to 0.5		5/24/2005		1.5
LM-S0073A		0 to 0.25		11/9/2005		2.1
LM-S0073		0.5 to 1		5/24/2005		0.084
LM-S0074		0 to 0.5		5/24/2005		0.49
LM-S0075		0 to 0.5		5/24/2005		0.16
LM-S0076		0 to 0.5		5/24/2005		8
LM-S0076		0.5 to 1		5/24/2005		3.6
LM-S0077		0 to 0.5		5/24/2005		2.2
LM-S0077		0.5 to 1		5/24/2005		0.26
LM-S0078		0 to 0.5		5/24/2005		0.82
LM-S0078A		0 to 0.25		11/9/2005		2
LM-S0079		0 to 0.5		5/24/2005		0.82
LM-S0079A		0 to 0.25		11/9/2005		1.6
LM-S0080		0 to 0.5		5/24/2005		0.93
LM-S0081		0 to 0.5		5/24/2005		2
LM-S0081A		0 to 0.25		11/9/2005		4.8
LM-S0081		0.5 to 1		5/24/2005		0.77
LM-S0082		0 to 0.5		5/24/2005		0.26
LM-S0083		0 to 0.5		5/24/2005		0.59
LM-S0083A		0 to 0.25		11/9/2005		0.95
LM-S0088		0 to 0.5		5/24/2005		2.19
LM-S0088		0.5 to 1		5/24/2005		3
LM-S0089		0 to 0.5		5/24/2005		2.12
LM-S0089		0.5 to 1		5/24/2005		0.03
LM-S0090		0 to 0.5		5/24/2005		1.32
LM-S0090		0.5 to 1		5/24/2005		0.025
LM-S0090		1 to 1.5		8/10/2005		0.3
LM-S0091		0 to 0.5		5/24/2005		0.79

TABLE A-5

ON-PROPERTY (SOUTHEAST AREA AND NON-IA-SPECIFIC)
SURFACE SOIL SAMPLES
AKRON AIRDOCK

Sample ID		Depth (feet)		Date Collected		PCB Concentration (mg/kg)
LM-S0091A		0 to 0.25		11/9/2005		1.3
LM-S0092		0 to 0.5		5/24/2005		11
LM-S0092		0.5 to 1		5/24/2005		0.075
LM-S0093		0 to 0.5		5/24/2005		1.3
LM-S0093		0.5 to 1		5/24/2005		0.23
LM-S0094		0 to 0.5		5/24/2005		1.51
LM-S0094		0.5 to 1		5/24/2005		0.24
LM-S0095		0 to 0.5		5/24/2005		0.33
LM-S0096		0 to 0.5		5/24/2005		0.54
LM-S0097		0 to 0.5		5/24/2005		0.287
LM-S0098		0 to 0.5		5/24/2005		0.221
LM-S0098		0.5 to 1		8/10/2005		0.01
LM-S0099		0 to 0.5		5/24/2005		0.121
LM-S0059		0 to 0.5		6/7/2004		1.2
LM-S0059		0.5 to 1		6/7/2004		0.39
LM-S0059		1 to 2		6/7/2004		0.145
LM-S0107		0 to 0.5		5/24/2005		0.42
LM-S0108		0 to 0.5		5/24/2005		0.0085
LM-S0109		0 to 0.5		5/24/2005		0.22
LM-S0111		0 to 0.5		5/25/2005		0.46
LM-S0112		0 to 0.5		5/25/2005		0.221
LM-S0113		0 to 0.5		5/25/2005		0.13
LM-S0115		0 to 0.5		5/25/2005		0.6
LM-S0116		0 to 0.5		5/25/2005		0.69
LM-S0117		0 to 0.5		5/25/2005		1.5
LM-S0117		0.5 to 1		5/25/2005		0.25
LM-S0118		0 to 0.5		5/25/2005		4.8
LM-S0118		0.5 to 1		5/25/2005		0.2
LM-S0119		0 to 0.5		5/25/2005		0.6
LM-S0120		0 to 0.5		5/25/2005		0.26
LM-S0121		0 to 0.5		5/25/2005		2.14
LM-S0121		0.5 to 1		5/25/2005		0.177
LM-S0205		0 to 0.5		8/11/2005		0.43
LM-S0208		0 to 0.5		8/11/2005		1.1
LM-S0208		0.5 to 1		8/11/2005		1.5
LM-S0209		0 to 0.5		8/11/2005		1.2
LM-S0209		0.5 to 1		8/11/2005		1.3
LM-S0210		0 to 0.5		8/11/2005		0.3
LM-S0210		0.5 to 1		8/11/2005		1.1
LM-S0211		0 to 0.5		8/11/2005		2.84
LM-S0211		0.5 to 1		8/11/2005		0.5
LM-S0212		0 to 0.5		8/11/2005		1.4
LM-S0213		0 to 0.5		8/11/2005		1.4
LM-S0213		0.5 to 1		8/11/2005		1.6
LM-S0214		0 to 0.5		8/11/2005		2.1
LM-S0214		0.5 to 1		8/11/2005		0.47

TABLE A-5

ON-PROPERTY (SOUTHEAST AREA AND NON-IA-SPECIFIC)
SURFACE SOIL SAMPLES
AKRON AIRDOCK

Sample ID		Depth (feet)		Date Collected		PCB Concentration (mg/kg)
LM-S0215		0 to 0.5		8/11/2005		1.2
LM-S0216		0 to 0.5		8/11/2005		1.9
LM-S0216		0.5 to 1		8/11/2005		0.85
LM-SC1		0 to 0.25		7/27/2006		0.17
LM-SC1		1 to 2		7/27/2006		0.018
LM-SC2		0 to 0.25		7/27/2006		0.0083
LM-SC2		1 to 2		7/27/2006		0.0185
LM-SC3		0 to 0.25		7/27/2006		0.89
LM-SC3		1 to 2		7/27/2006		0.0185
LM-SC4		0 to 0.25		7/27/2006		2.9
LM-SC4		1 to 2		7/27/2006		0.515
LM-SC5		0 to 0.25		7/27/2006		1.1
LM-SC5		1 to 2		7/27/2006		0.019
LM-SC6		0 to 0.25		7/27/2006		0.47
LM-SC6		1 to 2		7/27/2006		0.4
LM-SC7		0 to 0.25		7/27/2006		0.16
LM-SC7		1 to 2		7/27/2006		0.0099
LM-SC9		0 to 0.25		7/28/2006		1.9
LM-SC9		1 to 2		7/28/2006		0.225
LM-SC10		0 to 0.25		7/28/2006		0.016
LM-SC10		1 to 2		7/28/2006		0.018
LM-SC11		0 to 0.25		7/28/2006		0.2
LM-SC11		1 to 2		7/28/2006		0.0185
LM-SC12		0 to 0.25		7/28/2006		1.9
LM-SC12		1 to 2		7/28/2006		0.079
LM-SC13		0 to 0.25		7/28/2006		0.047
LM-SC13		1 to 2		7/28/2006		0.0073
LM-SC14		0 to 0.25		7/28/2006		0.058
LM-SC14		1 to 2		7/28/2006		0.021
LM-SC15		0 to 0.25		7/28/2006		0.069
LM-SC15		1 to 2		7/28/2006		0.018

Note:

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

TABLE A-6

OFF-PROPERTY SURFACE SOIL SAMPLES
AKRON AIRDOCK

Sample ID		Depth (feet)		Date Collected		PCB Concentration (mg/kg)
OFF-PROPERTY (NORTH)						
LM-S0060		0 to 0.5		5/23/2005		0.65
LM-S0061		0 to 0.5		5/23/2005		0.29
LM-S0062		0 to 0.5		5/23/2005		0.39
LM-S0063		0 to 0.5		5/23/2005		0.22
LM-S0064		0 to 0.5		5/23/2005		0.87
LM-S0065		0 to 0.5		5/23/2005		0.34
LM-S0066		0 to 0.5		5/23/2005		0.49
LM-S0067		0 to 0.5		5/23/2005		0.74
LM-S0068		0 to 0.5		5/23/2005		0.24
LM-S0069		0 to 0.5		5/23/2005		0.085
LM-S0069A		0 to 0.25		11/9/2005		0.094
LM-S0070		0 to 0.5		5/24/2005		0.059
LM-S0070A		0 to 0.25		11/9/2005		0.083
LM-S0071		0 to 0.5		5/24/2005		0.037
LM-S0084		0 to 0.5		5/24/2005		0.12
LM-S0085		0 to 0.5		5/24/2005		0.087
LM-S0086		0 to 0.5		5/24/2005		0.009
LM-S0087		0 to 0.5		5/24/2005		0.009
LM-S0100		0 to 0.5		5/24/2005		0.022
LM-S0101		0 to 0.5		5/24/2005		0.035
LM-S0102		0 to 0.5		5/24/2005		0.028
LM-S0103		0 to 0.5		5/24/2005		0.03
LM-S0104		0 to 0.5		5/24/2005		0.045
LM-S0105		0 to 0.5		5/24/2005		0.0158
LM-S0106		0 to 0.5		5/25/2005		0.064
LM-S0110		0 to 0.5		5/24/2005		0.25
LM-S0114		0 to 0.5		5/25/2005		0.25
OFF-PROPERTY (SOUTH)						
LM-S0122		0 to 0.5		5/25/2005		1.7
LM-S0122		0.5 to 1		5/25/2005		0.24
LM-S0123		0 to 0.5		5/25/2005		0.282
LM-S0124		0 to 0.5		5/25/2005		0.134
LM-S0125		0 to 0.5		5/25/2005		0.16
LM-S0126		0 to 0.5		5/25/2005		0.05
LM-S0127		0 to 0.5		5/25/2005		0.0475
LM-S0128		0 to 0.5		5/25/2005		0.044
OFF-PROPERTY (WEST)						
LMC-CC-105-003		0 to 0.25		5/10/2007		0.0165
LMC-CC-106-003		0 to 0.25		5/10/2005		0.0165
LMC-CC-107-003		0 to 0.25		5/10/2005		0.0165
LMC-CC-108-003		0 to 0.25		5/10/2005		0.0165

Note:

Highlighted values represent censored (nondetected) analytical results. The numerical values presented represent one-half of the detection limit.

APPENDIX B

GROUNDWATER-TO-OUTDOOR AIR MODEL FOR CONSTRUCTION WORKER TRENCH

Chemical-specific volatilization factors (VF) that relate concentrations of volatile chemicals in groundwater accumulated in a construction trench to airborne concentrations that may be inhaled by construction workers were used to estimate exposure point concentrations (EPC) from volatile chemicals of potential concern (COPC) in groundwater beneath Identified Areas (IA) at the Akron Airdock Site in Akron, Ohio. Calculation of the VFs for this scenario were based on Virginia Department of Environmental Quality (VDEQ) guidance, which provides a combination of a vadose zone model to estimate volatilization of gaseous COPCs from groundwater into a trench and a box model to estimate dispersion of the COPCs from the air inside the trench into aboveground air (VDEQ 2005). These models, which can be described by five equations, are detailed below. Tables B-1 through B-4 present the estimated EPCs in construction trench air from the construction trench groundwater-to-outdoor air modeling for IAs 1, 4, 9, and 11, respectively.

Ctrench = CGW x VF (Equation 1)

where

Ctrench = Concentration of contaminant in the trench (micrograms per cubic meter [$\mu g/m^3$])

CGW = Concentration of contaminant in groundwater (micrograms per liter [$\mu g/L$])

VF = Volatilization factor (see Equations 2 through 5) (liters per cubic meter [L/m^3])

VF = (K_i x A x F x 10^{-3} x 10^4 x 3,600) / (ACH x V) (Equation 2)

where

K_i = Mass transfer coefficient of contaminant (see Equation 3) (centimeters per second [cm/s])

A = Area of the trench (square meters [m^2])

F = Fraction of floor through which contaminant can enter (unitless)

ACH = Air changes per hour (hour^{-1} [h^{-1}])

V = Volume of trench (cubic meters [m^3])

10^{-3} = Conversion factor (liter per cubic centimeter [L/cm^3])

10^4 = Conversion factor (square centimeters per square meter [cm^2/m^2])

3,600 = Conversion factor (seconds per hour [s/hr])

If the ratio of trench width to trench depth is less than or equal to 1, VDEQ (2005) recommends an ACH of 2 per hour. If the ratio of trench width to trench depth is greater than one, VDEQ (2005) recommends an ACH of 360 per hour. A depth to groundwater of 9.4 feet below ground surface (bgs) for Exposure Areas A and B was used to calculate the volume of the trench (V) and to determine the ratio of a trench's width to depth. For both areas, the width and length of the trench were assumed to be 10 and 12 feet, respectively. Based on the assumed trench dimensions, the ratio of the trench width to the trench depth is 1.06 for both areas. Based upon the model recommendations, an ACH of 360 per hour would be used for both sites. The model offers an ACH of 360 to 2 for trench width to trench depth ratio for values near just above to just below unity. Because it is unlikely that the ACH could vary that much based on the trench width-to-depth ratio, an ACH of 100 per hour was chosen to calculate the VF in Equation 2. This ACH was selected to ensure that the evaluation remains conservative.

$$K_i = 1 / \{(1/k_{iL}) + [(R\ T) / (H_i\ k_{iG})]\} \qquad \text{(Equation 3)}$$

where

k_{iL} = Liquid-phase mass transfer coefficient of i (see Equation 4) (cm/s)

R = Ideal gas constant (atmosphere – cubic meter per mole – degree Kelvin [atm-m^3/mol-K])

T = Average system absolute temperature (degree Kelvin [K])

H_i = Henry's Law Constant of I (atmosphere – cubic meter per mol [atm-m^3/mol])

k_{iG} = Gas-phase mass transfer coefficient of i (see Equation 5) (cm/s)

The value for R is 8.2 x 10^{-5} atm-m^3/mol-K. A default value of 298 K was used for T in Equation 3.

$$k_{iL} = (MW_{O2}/MW_i)^{0.5} \text{ x } (T/298) \text{ x } k_L,O_2 \qquad \text{(Equation 4)}$$

where

k_{iL} = Liquid-phase mass transfer coefficient of component I (cm/s)

MW_{O2} = Molecular weight of O_2 (gram per mole [g/mol])

MW_i = Molecular weight of component I (g/mol)

k_L,O_2 = Liquid-phase mass transfer coefficient of oxygen at 25 °C (cm/s)

The value of k_L,O_2 in Equation 4 is 0.002 cm/s.

k_{iG} = $(MW_{H2O}/MW_i)^{0.335}$ x $(T/298)^{1.005}$ x k_G, H_2O (Equation 5)

where

k_{iG} = Gas-phase mass transfer coefficient of component I (cm/s)
MW_{H2O} = Molecular weight of water (g/mol)
k_G,H_2O = Gas-phase mass transfer coefficient of water vapor at 25°C (cm/s)

The value of k_G,H_2O in Equation 5 is 0.833 cm/s.

REFERENCE

Virginia Department of Environmental Quality (VDEQ). 2005. "Voluntary Remediation Program Risk Assessment Guidance." Accessed on January 30. On-line Address: http://www.deq.virginia.gov/vrprisk/raguide.html

TABLE B-1

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 1
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92								
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01								
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20								
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04				
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69								
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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	2.10E+02	9.35E+00	1.96E+03	1.96E+00
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				
1,4-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	3.74E+00	8.46E+00	3.17E+01	3.17E-02
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	7.93E+02	8.36E+00	6.63E+03	6.63E+00
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	2.46E+01	8.43E+00	2.07E+02	2.07E-01
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				
Ethylbenzene	100-41-4	106.17	7.88E-03	4.60E-01	1.10E-03	1.09E-03	9.00E+01	8.05E+00	7.24E+02	7.24E-01
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				
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 ether	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	2.30E+02	8.62E+00	1.98E+03	1.98E+00
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	7.80E+01	7.25E+00	5.65E+02	5.65E-01
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	1.06E+01	1.05E+01	1.12E+02	1.12E-01
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				

TABLE B-1

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 1
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				

TABLE B-1

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 1
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

a Calculations were performed using the spreadsheet developed by the Virginia Department of Environmental Quality (VDEQ) (VDEQ 2005).

TABLE B-2

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 4
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92					3.10E+01			
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01					5.90E-01			
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20					2.50E+01			
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04	7.30E-02	5.87E+00	4.28E-01	4.28E-04
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69					3.00E+01			
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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				
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				
1,4-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	1.00E+00	8.46E+00	8.46E+00	8.46E-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	8.00E+00	8.36E+00	6.69E+01	6.69E-02
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	2.50E+00	8.43E+00	2.11E+01	2.11E-02
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				
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				
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 ether	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	5.00E-01	8.62E+00	4.31E+00	4.31E-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	5.50E+00	7.25E+00	3.99E+01	3.99E-02
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	2.30E+00	1.05E+01	2.42E+01	2.42E-02
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				

TABLE B-2

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 4
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				

TABLE B-2

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 4
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

a Calculations were performed using a spreadsheet developed by the Virginia Department of Environmental Quality (VDEQ) (VDEQ 2005).

TABLE B-3

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 9
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92								
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01								
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20								
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04				
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69								
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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				
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				
1,4-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	5.51E+01	8.36E+00	4.61E+02	4.61E-01
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	5.90E+00	8.43E+00	4.97E+01	4.97E-02
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				
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				
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 ether	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				
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	1.31E+02	1.05E+01	1.38E+03	1.38E+00
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				

TABLE B-3

TRENCH AIR EXPOSURE POINT CONCENTRATIONS^{a}
FOR IDENTIFIED AREA 9
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				

TABLE B-3

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 9
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

[a] Calculations were performed using a spreadsheet developed by the Virginia Department of Environmental Quality (VDEQ) (VDEQ 2005).

TABLE B-4

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 11
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92								
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01								
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20								
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04				
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69								
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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				
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				
1,4-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	3.20E+00	8.36E+00	2.68E+01	2.68E-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				
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				
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 ether	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				
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	8.40E+00	1.05E+01	8.85E+01	8.85E-02
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				

TABLE B-4

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 11
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				

TABLE B-4

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
FOR IDENTIFIED AREA 11
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

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[a] Calculations were performed using a spreadsheet developed by the Virginia Department of Environmental Quality (VDEQ) (VDEQ 2005).

TABLE B-5

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
OFF-PROPERTY (NORTH)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92								
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01								
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20								
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04				
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69								
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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				
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				
1,4-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	1.66E+00	8.46E+00	1.40E+01	1.40E-02
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	3.64E+02	8.36E+00	3.04E+03	3.04E+00
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	6.12E+01	8.43E+00	5.16E+02	5.16E-01
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				
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				
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 ether	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	1.06E+02	7.25E+00	7.68E+02	7.68E-01
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	5.37E+00	1.05E+01	5.66E+01	5.66E-02
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				

TABLE B-5

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
OFF-PROPERTY (NORTH)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										

TABLE B-5

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
OFF-PROPERTY (NORTH)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

[a] Calculations were performed using a spreadsheet developed by the Virginia Department of Environmental Quality (VDEQ) (VDEQ 2005).

TABLE B-6

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
ON-PROPERTY (NON-IA-SPECIFIC) AREAS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Inorganics										
Aluminum	7429-90-5	26.98								
Antimony	7440-36-0	121.76								
Arsenic	7440-38-2	74.92								
Barium	7440-39-3	137.33								
Beryllium	7440-41-7	9.01								
Cadmium (water)	7440-43-9	112.41								
Calcium	7440-70-2	40.08								
Chromium	7440-47-3	52.00								
Cobalt	7440-48-4	58.93								
Copper	7440-50-8	63.55								
Cyanide	57-12-5	26.02								
Iron	7439-89-6	55.85								
Lead	7439-92-1	207.20								
Magnesium	7439-95-4	24.31								
Manganese (nonfood)	7439-96-5	54.94								
Mercuric chloride	7487-94-7	271.50								
Mercury	7439-97-6	200.59	1.14E-02	3.71E-01	7.99E-04	7.95E-04				
Methylmercury	22967-92-6	215.63								
Nickel	7440-02-0	58.69								
Potassium	7440-09-7	39.10								
Selenium	7782-49-2	78.96								
Silver	7440-22-4	107.87								
Sodium	7440-23-5	22.99								
Thallium	7440-28-0	204.38								
Vanadium	7440-62-2	50.94								
Zinc	7440-66-6	65.39								
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				
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				
1,4-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	2.93E+00	8.46E+00	2.48E+01	2.48E-02
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	3.74E+02	8.36E+00	3.13E+03	3.13E+00
trans-1,2-Dichloroethene	156-60-5	96.94	9.38E-03	4.74E-01	1.15E-03	1.14E-03	1.19E+01	8.43E+00	1.00E+02	1.00E-01
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				
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				
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 ether	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	1.75E+00	7.25E+00	1.27E+01	1.27E-02
Trichlorofluoromethane	75-69-4	137.37	9.70E-02	4.22E-01	9.65E-04	9.65E-04				
Vinyl Chloride (commercial, construction)	75-01-4	62.50	2.70E-02	5.49E-01	1.43E-03	1.43E-03	1.41E+01	1.05E+01	1.49E+02	1.49E-01
Total Xylenes	1330-20-7	106.16	5.18E-03	4.60E-01	1.10E-03	1.09E-03				

TABLE B-6

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
ON-PROPERTY (NON-IA-SPECIFIC) AREAS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Semivolatile Organic Compounds (SVOCs)										
Acenaphthene	83-32-9	154.21	1.55E-04	4.06E-01	9.11E-04	6.73E-04				
Acenaphthylene	208-96-8	152.19	1.13E-04	4.07E-01	9.17E-04	6.17E-04				
Acetophenone	98-86-2	120.15	1.07E-05	4.41E-01	1.03E-03	1.63E-04				
Anthracene	120-12-7	178.23	6.50E-05	3.86E-01	8.47E-04	4.65E-04				
Atrazine	1912-24-9	215.68	2.36E-09	3.63E-01	7.70E-04	3.50E-08				
Benzaldehyde	100-52-7	106.12	2.67E-05	4.60E-01	1.10E-03	3.45E-04				
Benzo(a)anthracene	56-55-3	228.29	3.35E-06	3.56E-01	7.49E-04	4.58E-05				
Benzo(a)pyrene	50-32-8	252.31	1.13E-06	3.44E-01	7.12E-04	1.56E-05				
Benzo(b)fluoranthene	205-99-2	252.31	1.11E-04	3.44E-01	7.12E-04	4.89E-04				
Benzo(g,h,i)perylene	191-24-2	276.33	1.41E-07	3.34E-01	6.81E-04	1.92E-06				
Benzo(k)fluoranthene	207-08-9	252.31	8.29E-07	3.44E-01	7.12E-04	1.15E-05				
1,1'-Biphenyl	92-52-4	154.21	3.00E-04	4.06E-01	9.11E-04	7.70E-04				
bis(2-Chloroethoxy)methane	111-91-1	173.04	1.70E-07	3.90E-01	8.60E-04	2.71E-06				
bis(2-chloroethyl)ether	111-44-4	143.01	1.80E-05	4.16E-01	9.46E-04	2.31E-04				
bis-(2-Ethylhexyl)phthalate	117-81-7	390.56	1.02E-07	2.97E-01	5.72E-04	1.24E-06				
4-Bromophenyl-phenylether	101-55-3	249.10	1.17E-04	3.45E-01	7.17E-04	5.00E-04				
Butylbenzylphthalate	85-68-7	312.36	1.26E-06	3.20E-01	6.40E-04	1.61E-05				
Caprolactam	105-60-2	113.16	2.53E-08	4.50E-01	1.06E-03	4.66E-07				
Carbazole	86-74-8	167.21	1.54E-08	3.95E-01	8.75E-04	2.49E-07				
4-Chloro-3-methylphenol	59-50-7	142.58	2.45E-06	4.16E-01	9.47E-04	4.00E-05				
4-Chloroaniline	106-47-8	127.57	3.31E-07	4.32E-01	1.00E-03	5.82E-06				
2-Chloronaphthalene	91-58-7	162.62	3.14E-04	3.98E-01	8.87E-04	7.56E-04				
2-Chlorophenol	95-57-8	128.56	3.91E-04	4.31E-01	9.98E-04	8.72E-04				
4-Chlorophenyl-phenylether	7005-72-3	204.65	9.00E-05	3.69E-01	7.91E-04	5.00E-04				
Chrysene	218-01-9	228.29	9.46E-05	3.56E-01	7.49E-04	4.85E-04				
Di-n-butylphthalate	84-74-2	278.34	9.38E-10	3.33E-01	6.78E-04	1.28E-08				
Di-n-octylphthalate	117-84-0	390.56	6.68E-05	2.97E-01	5.72E-04	3.36E-04				
Dibenzo(a,h)anthracene	53-70-3	278.35	1.47E-08	3.33E-01	6.78E-04	2.00E-07				
Dibenzofuran	132-64-9	168.19	1.26E-05	3.94E-01	8.72E-04	1.65E-04				
3,3'-Dichlorobenzidine	91-94-1	253.13	4.00E-09	3.44E-01	7.11E-04	5.62E-08				
2,4-Dichlorophenol	120-83-2	163.00	3.16E-06	3.98E-01	8.86E-04	4.87E-05				
Diethylphthalate	84-66-2	222.24	4.50E-07	3.59E-01	7.59E-04	6.55E-06				
2,4-Dimethylphenol	105-67-9	122.16	2.00E-06	4.39E-01	1.02E-03	3.47E-05				
Dimethylphthalate	131-11-3	194.18	1.05E-07	3.76E-01	8.12E-04	1.61E-06				
4,6-Dinitro-2-methylphenol	534-52-1	198.13	4.27E-07	3.73E-01	8.04E-04	6.47E-06				
2,4-Dinitrophenol	51-28-5	184.11	4.43E-07	3.82E-01	8.34E-04	6.87E-06				
2,4-Dinitrotoluene	121-14-2	182.13	9.26E-08	3.84E-01	8.38E-04	1.45E-06				
2,6-Dinitrotoluene	606-20-2	182.13	7.47E-07	3.84E-01	8.38E-04	1.16E-05				
Fluoranthene	206-44-0	202.25	1.61E-05	3.70E-01	7.96E-04	1.87E-04				
Fluorene	86-73-7	166.22	6.36E-05	3.96E-01	8.78E-04	4.74E-04				
Hexachlorobenzene	118-74-1	284.78	1.32E-03	3.30E-01	6.70E-04	6.46E-04				
Hexachlorobutadiene	87-68-3	260.76	8.15E-03	3.40E-01	7.01E-04	6.96E-04				
Hexachlorocyclopentadiene	77-47-4	272.77	2.70E-02	3.35E-01	6.85E-04	6.84E-04				
Hexachloroethane	67-72-1	236.74	3.89E-03	3.51E-01	7.35E-04	7.26E-04				
Indeno(1,2,3-cd)pyrene	193-39-5	276.33	1.60E-06	3.34E-01	6.81E-04	2.12E-05				
Isophorone	78-59-1	138.21	6.64E-06	4.21E-01	9.62E-04	1.02E-04				
2-Methylnaphthalene	91-57-6	142.20	5.18E-04	4.17E-01	9.49E-04	8.57E-04				
2-Methylphenol	95-48-7	108.14	1.20E-06	4.57E-01	1.09E-03	2.20E-05				
3-Methylphenol	108-39-4	108.14	8.65E-07	4.57E-01	1.09E-03	1.59E-05				
4-Methylphenol	106-44-5	108.14	7.92E-07	4.57E-01	1.09E-03	1.46E-05				
N-Nitroso-di-n-propylamine	621-64-7	130.19	2.25E-06	4.29E-01	9.92E-04	3.80E-05				
N-Nitrosodiphenylamine	86-30-6	198.22	5.00E-06	3.73E-01	8.04E-04	6.97E-05				
Naphthalene	91-20-3	128.17	4.83E-04	4.32E-01	9.99E-04	8.95E-04				
2-Nitroaniline	88-74-4	138.12	1.09E-07	4.21E-01	9.63E-04	1.87E-06				
3-Nitroaniline	99-09-2	138.12	1.44E-07	4.21E-01	9.63E-04	2.47E-06				
4-Nitroaniline	100-01-6	138.12	2.07E-09	4.21E-01	9.63E-04	3.57E-08				
Nitrobenzene	98-95-3	123.11	2.40E-05	4.37E-01	1.02E-03	3.02E-04				
2-Nitrophenol	88-75-5	139.11	9.47E-06	4.20E-01	9.59E-04	1.39E-04				
4-Nitrophenol	100-02-7	139.11	4.15E-10	4.20E-01	9.59E-04	7.13E-09				
2,2'-Oxybis(1-chloropropane)	108-60-1	171.06	1.17E-04	3.92E-01	8.65E-04	5.92E-04				
Pentachlorophenol	87-86-5	266.34	2.44E-08	3.38E-01	6.93E-04	3.37E-07				
Phenanthrene	85-01-8	178.23	2.33E-05	3.86E-01	8.47E-04	2.57E-04				
Phenol	108-95-2	94.11	3.97E-07	4.79E-01	1.17E-03	7.72E-06				
Pyrene	129-00-0	202.25	1.10E-05	3.70E-01	7.96E-04	1.38E-04				
1,2,4,5-Tetrachlorobenzene	95-94-3	215.89	2.58E-03	3.62E-01	7.70E-04	7.55E-04				
2,4,5-Trichlorophenol	95-95-4	197.45	4.33E-06	3.73E-01	8.05E-04	6.11E-05				
2,4,6-Trichlorophenol	88-06-2	197.45	7.79E-06	3.73E-01	8.05E-04	1.04E-04				

TABLE B-6

TRENCH AIR EXPOSURE POINT CONCENTRATIONS[a]
ON-PROPERTY (NON-IA-SPECIFIC) AREAS
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIRDOCK
AKRON, OHIO

Table 3.8 Exposure-point concentrations (inhalation) for construction/utility workers in a trench: Groundwater less than 15 feet deep	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
Pesticides/Polychlorinated Biphenyls (PCBs)										
Aldrin	309-00-2	364.91	1.70E-04	3.04E-01	5.92E-04	4.63E-04				
Aroclor-1016	12674-11-2	257.90	2.90E-04	3.41E-01	7.04E-04	6.00E-04				
Aroclor-1221	11104-28-2	200.70	3.50E-03	3.71E-01	7.99E-04	7.87E-04				
Aroclor-1232	11141-16-5	232.20	7.36E-04	3.54E-01	7.42E-04	6.94E-04				
Aroclor-1242	53469-21-9	266.50	5.20E-04	3.38E-01	6.93E-04	6.32E-04				
Aroclor-1248	12672-29-6	299.50	2.80E-03	3.25E-01	6.54E-04	6.42E-04				
Aroclor-1254	11097-69-1	328.00	2.00E-03	3.15E-01	6.25E-04	6.10E-04				
Aroclor-1260	11096-82-5	375.70	4.60E-03	3.01E-01	5.84E-04	5.78E-04				
alpha-BHC	319-84-6	290.83	1.06E-05	3.28E-01	6.63E-04	1.17E-04				
beta-BHC	319-85-7	290.83	7.43E-07	3.28E-01	6.63E-04	9.82E-06				
delta-BHC	319-86-8	290.83	4.29E-07	3.28E-01	6.63E-04	5.71E-06				
gamma-BHC (lindane)	58-89-9	290.83	1.40E-05	3.28E-01	6.63E-04	1.46E-04				
Chlordane	57-74-9	409.78	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
alpha-Chlordane	5103-71-9	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
gamma-Chlordane	5103-74-2	409.76	4.86E-05	2.92E-01	5.59E-04	2.85E-04				
4,4'-DDD	72-54-8	320.04	4.00E-06	3.18E-01	6.32E-04	4.80E-05				
4,4'-DDE	72-55-9	318.02	2.10E-05	3.18E-01	6.34E-04	1.91E-04				
4,4'-DDT	50-29-3	354.48	8.10E-06	3.07E-01	6.01E-04	8.70E-05				
Dieldrin	60-57-1	380.91	1.51E-05	3.00E-01	5.80E-04	1.40E-04				
Endosulfan	115-29-7	406.92	1.12E-05	2.93E-01	5.61E-04	1.08E-04				
Endosulfan I	959-98-8	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan II	33213-65-9	406.92	6.50E-05	2.93E-01	5.61E-04	3.26E-04				
Endosulfan Sulfate	1031-07-8	422.92	3.25E-07	2.89E-01	5.50E-04	3.82E-06				
Endrin	72-20-8	380.91	7.52E-06	3.00E-01	5.80E-04	7.96E-05				
Endrin Aldehyde	7421-93-4	380.91	4.18E-06	3.00E-01	5.80E-04	4.71E-05				
Endrin Ketone	53494-70-5	380.90	1.25E-05	3.00E-01	5.80E-04	1.21E-04				
Heptachlor	76-44-8	373.32	1.09E-03	3.02E-01	5.86E-04	5.61E-04				
Heptachlor epoxide	1024-57-3	389.32	9.50E-06	2.97E-01	5.73E-04	9.62E-05				
Methoxychlor	72-43-5	345.65	1.58E-05	3.10E-01	6.09E-04	1.51E-04				
Toxaphene	8001-35-2	414.00	6.00E-06	2.91E-01	5.56E-04	6.34E-05				
Chlorinated dioxins/dibenzofurans (CDDs/CDFs)										
2,3,7,8-TCDD	1746-01-6	322.00	7.92E-05	3.17E-01	6.30E-04	3.91E-04				
2,3,7,8-TCDF	51207-31-9	305.97	2.64E-04	3.22E-01	6.47E-04	5.46E-04				

TABLE C-1

JOHNSON AND ETTINGER
INPUT PARAMETER VALUES
FOR USE IN GW-ADV, VERSION 3.1; 02/04
AKRON AIRDOCK SITE
AKRON, OHIO

Parameter	Units	Value	Basis
Average soil/groundwater temperature (T_S)	^oC	11.1	Figure 3 of EPA (2003) shows Akron is on 52 ^oF isopleth line.
Depth below grade to bottom of enclosed space (L_F)	cm	15	Site-specific: existing 6-inch concrete slab
Depth below grade to water table (L_{WT}) - IA 4	cm	207	Site-specific: 6.8 feet (shallowest depth to groundwater measured at well MWA-8 in May 2005]) (Tetra Tech 2005c)
Thickness of stratum A (h_A) - IA 4	cm	207	Site-specific: 6.8 feet -- Boring NB-28 (Tetra Tech 2005b) shows approximately 1.5 feet of silty sand fill with gravel, 4 feet of clay, and 1.3 feet of sandy clay extending from the surface to the water table. Based on the potential presence of preferential pathways through sand surrounding piping and sand striations within the clay and sandy clay layers, it was conservatively assumed that a single layer of sand extended from the surface to the water table.
Thickness of stratum B (h_B) - IA 4	cm	0	Conservative assumption -- see basis for thickness of Stratum A.
Thickness of stratum C (h_C) - IA 4	cm	0	Conservative assumption -- see basis for thickness of Stratum A.
Soil stratum directly above water table - IA 4	NA	A	Conservative assumption -- see basis for thickness of Stratum A.
SCS soil type directly above water table - IA 4	NA	S	Conservative assumption -- see basis for thickness of Stratum A.
Depth below grade to water table (L_{WT}) - IA 9	cm	207	Site-specific: 6.8 feet (shallowest depth to groundwater measured at well A-8 in 2005 [May]) (Tetra Tech 2005c)
Thickness of stratum A (h_A) - IA 9	cm	207	Site-specific: 6.8 feet -- sand with gravel fill or trace gravel [will assume sand] (see boring NB-21) (Tetra Tech 2005b)
Thickness of stratum B (h_B) - IA 9	cm	0	NA
Thickness of stratum C (h_C) - IA 9	cm	0	NA
Soil stratum directly above water table - IA 9	NA	A	Site-specific: see boring NB-21 (Tetra Tech 2005b)
SCS soil type directly above water table - IA 9	NA	S	Site-specific: see boring NB-21 (Tetra Tech 2005b)
Depth below grade to water table (L_{WT}) - IA 11	cm	207	Site-specific: 6.8 feet (shallowest depth to groundwater measured at well A-8 in 2005 [May])
Thickness of stratum A (h_A) - IA 11	cm	207	Site-specific: 6.8 feet -- Borings NB-18 and NB-19 (Tetra Tech 2005b) show approximately 1.5 feet of sand and gravel fill and 5.3 feet of clay extending from the surface to the water table. Based on the potential presence of preferential pathways throug
Thickness of stratum B (h_B) - IA 11	cm	0	Conservative assumption -- see basis for thickness of Stratum A.
Thickness of stratum C (h_C) - IA 11	cm	0	NA
Soil stratum directly above water table - IA 11	NA	A	Conservative assumption -- see basis for thickness of Stratum A.
SCS soil type directly above water table - IA 11	NA	S	Conservative assumption -- see basis for thickness of Stratum A.
Soil vapor permeability (k_v)	cm^2	Model default	Based on SCS soil type
Statum A SCS soil type	NA	S	See explanations for thickness of Stratum A at IA #4, IA #9, and IA #11.
Stratum A soil bulk density ($P_b{}^A$)	g/cm^3	1.66	Based on SCS soil type
Stratum A soil total porosity (n^A)	Unitless	0.375	Based on SCS soil type
Stratum A soil water-filled porosity ($\Theta_w{}^A$)	cm^3/cm^3	0.054	Based on SCS soil type
Enclosed floor space thickness (L_{crack})	cm	15	Site-specific: existing 6-inch concrete slab
Soil-bldg pressure differential (ΔP)	$g/cm\text{-}s^2)$	40	Default
Enclosed space floor length L_B)	cm	IA #4 - 4,572 IA #9 - 1648 IA #11 - 35,814	Site-specific: assumed building lengths of 150, 54, and 1,175 feet for IAs #4, # 9, and 11, respectively (see Figure 7-1; Tetra Tech 2005a)
Enclosed space floor width (W_B)	cm	IA #4 - 1554 IA #9 - 1554 IA #11 - 9,906	Site-specific: assumed building widths of 51, 51, and 325 feet for IAs #4, #9, and #11, respectively (see Figure 7-1; Tetra Tech 2005a)
Enclosed space height (H_B)	cm	IA #4 - 610 IA #9 - 610 IA #11 - 6,431	Site-specific: assumed building heights of 20, 20, and 211 feet for IAs #4, #9, and #11, respectively (Building Plans and Tetra Tech 2005a)
Floor-wall seam crack width (w)	cm	0.1	Default
Indoor air exchange rate (ER)	1/h	1	Value recommended by OEPA (2007); based on CalEPA (2004).
Average vapor flor rate into bldg (Q_{soil})	L/m	10	Maximum recommended Qsoil value (EPA 2002).
Averaging time for carcinogens (ATc)	yrs	70	Default
Averaging time for noncarcinogens (AT_{NC})	yrs	25	Default (Table III, OEPA 2002)
Exposure duration - industrial workers (ED_{IW})	yrs	25	Default (Table III, OEPA 2002)
Exposure frequency - industrial workers (EF_{IW})	days/yr	250	Default (Table III, OEPA 2002)
Target risk for carcinogens - industrial (TR_I)	Unitless	1.00E-04	Default - Ohio Administrative Code (OAC) 3745-300-09 (C) (1) (b) (i)
Target hazard index for noncarcinogens - industrial (THQ_I)	Unitless	1	Default - OAC 3745-300-09 (C) (2)

Notes:
Parameters based on use of the Johnson & Ettinger model GW-ADV, Version 3.1; 02/04.

California Environmental Protection Agency (CalEPA). 2004. "Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air." December.

Ohio Environmental Protection Agency (OEPA). 2002. "Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures." The Voluntary Action Program. Division of Emergency and Remedial Response. February.

OEPA. 2007. Record of Electronic Mail Correspondence Regarding An Acceptable Air Exchange Rate for Commercial/Industrial Buildings. From Vanessa Steigerwald, Ph.D., Division of Emergency and Remedial Response. To Jennifer Krueger, PG, Tetra Tech Inc.

Tetra Tech Inc. (Tetra Tech). 2005a. "Ohio VAP Phase I Property Assessment, Lockheed Martin MS2 Akron-Airdock Parcel." June.

Tetra Tech. 2005b. "Phase II Property Assessment Report, Lockheed Martin MS2 Akron-Airdock Parcel." June.

Tetra Tech. 2005c. Record of Elecronic Mail Correspondence Regarding Depth to Water at Monitoring Well MWA-8 Located Near Identified Area (IA) #9 at the Akron-Airdock Parcel. Between Jennifer Krueger, PG and Julia Miller, Los Alamos Technical Associat

U.S. Environmental Protection Agency (EPA). 2002. "OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)." OSWER. EPA530-D-02-004. November.

EPA. 2003. "User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings." Prepared by Environmental Quality Management, Inc. for the Office of Emergency and Remedial Response. Draft. March 14.

TABLE C-2

DATA ENTRY SHEET FOR 1,1-DICHLOROETHENE -- IDENTIFIED AREA 4

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
75354	1.00E+00	1,1-Dichloroethylene

MORE ↓

ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER
			Totals must add up to value of L_{WT} (cell G28)							
Average soil/ groundwater temperature, T_S (^oC)	Depth below grade to bottom of enclosed space floor, L_F (cm)	Depth below grade to water table, L_{WT} (cm)	Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k_v (cm^2)
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1		10

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-04	1
				Used to calculate risk-based groundwater concentration.	

END

TABLE C-2 (CONTINUED)

RESULTS SHEET FOR 1,1-DICHLOROETHENE -- IDENTIFIED AREA 4

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	2.25E+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	1.6E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE C-3

DATA ENTRY SHEET FOR CIS-1,2-DICHLOROETHENE -- IDENTIFIED AREA 4

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	8.00E+00	cis-1,2-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}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 Totals must add up to value of L_{WT} (cell G28) 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)
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-3 (CONTINUED)

RESULTS SHEET FOR CIS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 4

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	9.2E-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

TABLE C-4

DATA ENTRY SHEET FOR MERCURY -- IDENTIFIED AREA 4

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
7439976	7.30E-02	Mercury (elemental)

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}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 Totals must add up to value of L_{WT} (cell G28) 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)
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-4 (CONTINUED)

RESULTS SHEET FOR MERCURY -- IDENTIFIED AREA 4

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	2.00E+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	7.8E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE C-5

DATA ENTRY SHEET FOR TRICHLOROETHYLENE -- IDENTIFIED AREA 4

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
79016	5.50E+00	Trichloroethylene

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 Totals must add up to value of L_{WT} (cell G28) 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)
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1	10

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-04	1
				Used to calculate risk-based groundwater concentration.	

END

TABLE C-5 (CONTINUED)

RESULTS SHEET FOR TRICHLOROETHYLENE -- IDENTIFIED AREA 4

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)
3.3E-08	1.3E-03

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

TABLE C-6

DATA ENTRY SHEET FOR TOLUENE -- IDENTIFIED AREA 4

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
108883	5.00E-01	Toluene

MORE ↓

ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER
			Totals must add up to value of L_{WT} (cell G28)							
Average soil/ groundwater temperature, T_S (^{o}C)	Depth below grade to bottom of enclosed space floor, L_F (cm)	Depth below grade to water table, L_{WT} (cm)	Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k_v (cm^2)
11.1	15	207	207			A	S	S		

MORE ↓

ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, $\rho_b{}^A$ (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, $\theta_w{}^A$ (cm^3/cm^3)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, $\rho_b{}^B$ (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, $\theta_w{}^B$ (cm^3/cm^3)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, $\rho_b{}^C$ (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, $\theta_w{}^C$ (cm^3/cm^3)
S	1.66	0.375	0.054	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1		10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-6 (CONTINUED)

RESULTS SHEET FOR TOLUENE -- IDENTIFIED AREA 4

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	5.26E+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	7.9E-06

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE C-7

DATA ENTRY SHEET FOR TRANS-1,2-DICHLOROETHENE -- IDENTIFIED AREA 4

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
156605	2.50E+00	trans-1,2-Dichloroethylene

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)
11.1	15	207	207			A	S	S		

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-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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-7 (CONTINUED)

RESULTS SHEET FOR TRANS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 4

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	6.30E+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	3.4E-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

TABLE C-8

DATA ENTRY SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 4

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	2.30E+00	Vinyl chloride (chloroethene)

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)
			Totals must add up to value of L_{WT} (cell G28)							
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	4572	1554	610	0.1	1	10

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-04	1
				Used to calculate risk-based groundwater concentration.	

END

TABLE C-8 (CONTINUED)

RESULTS SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 4

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)
2.9E-07	9.1E-04

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE C-9

DATA ENTRY SHEET FOR CIS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 9

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
156592	5.51E+01	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 Totals must add up to value of L_{WT} (cell G28) 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)
11.1	15	207	207	0	0	A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	1648	1554	610	0.1	1		10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-9 (CONTINUED)

RESULTS SHEET FOR CIS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 9

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	9.0E-03

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

TABLE C-10

DATA ENTRY SHEET FOR TRANS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 9

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 ☒

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)		Chemical
156605	5.90E+00		trans-1,2-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}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 Totals must add up to value of L_{WT} (cell G28) 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)
11.1	15	207	207	0	0	A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	1648	1554	610	0.1	1		10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-10 (CONTINUED)

RESULTS SHEET FOR TRANS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 9

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	6.30E+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	1.1E-03

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

TABLE C-11

DATA ENTRY SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 9

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	1.31E+02	Vinyl chloride (chloroethene)

MORE ↓

ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER
			Totals must add up to value of L_{WT} (cell G28)							
Average soil/ groundwater temperature, T_S (°C)	Depth below grade to bottom of enclosed space floor, L_F (cm)	Depth below grade to water table, L_{WT} (cm)	Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k_v (cm^2)
11.1	15	207	207	0	0	A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	1648	1554	610	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-11 (CONTINUED)

RESULTS SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 9

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)
2.5E-05	8.0E-02

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE C-12

DATA ENTRY SHEET FOR CIS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 11

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	3.20E+00	cis-1,2-Dichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (^{o}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 Totals must add up to value of L_{WT} (cell G28) 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)		ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
11.1	15	207	207			A	S	S	OR	

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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	36814	9906	6431	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-12 (CONTINUED)

RESULTS SHEET FOR CIS-1,2-DICHLOROETHYLENE -- IDENTIFIED AREA 11

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	1.4E-06

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

TABLE C-13

DATA ENTRY SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 11

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	8.40E+00	Vinyl chloride (chloroethene)

MORE ↓

ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER
			Totals must add up to value of L_{WT} (cell G28)							
Average soil/ groundwater temperature, T_S (^oC)	Depth below grade to bottom of enclosed space floor, L_F (cm)	Depth below grade to water table, L_{WT} (cm)	Thickness of soil stratum A, h_A (cm)	Thickness of soil stratum B, (Enter value or 0) h_B (cm)	Thickness of soil stratum C, (Enter value or 0) h_C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k_v (cm^2)
11.1	15	207	207			A	S	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	C	1.43	0.459	0.215	C	1.43	0.459	0.215

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	36814	9906	6431	0.1	1	10

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-04	1

Used to calculate risk-based groundwater concentration.

END

TABLE C-13 (CONTINUED)

RESULTS SHEET FOR VINYL CHLORIDE -- IDENTIFIED AREA 11

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)
3.5E-09	1.1E-05

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

SCROLL DOWN TO "END"

END

TABLE D-1

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #1
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater							
	Inhalation - Trench Air				Dermal Contact			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	1.1E-01	1.4E+01	1.6E-03	1.2E-05	3.9E-04	1.3E-01	5.5E-06	8.3E-08
1,1-Dichloroethene	1.8E-03	--	2.6E-05	4.5E-06	6.1E-06	6.8E-04	8.7E-08	5.2E-08
cis-1,2-Dichloroethene	3.7E-01	--	5.3E-03	--	8.3E-04	8.3E-03	1.2E-05	--
t-1,2-Dichloroethene	1.2E-02	--	1.7E-04	--	2.6E-05	1.3E-04	3.7E-07	--
Ethylbenzene	4.1E-02	1.4E-02	5.8E-04	--	5.2E-04	5.2E-04	7.5E-06	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	1.1E-01	2.6E-01	1.6E-03	--	8.9E-04	4.4E-04	1.3E-05	--
Trichloroethene	3.2E-02	--	4.5E-04	2.7E-06	1.2E-04	2.1E-03	1.8E-06	1.9E-08
Vinyl Chloride	6.3E-03	2.2E-01	9.0E-05	2.8E-06	7.8E-06	2.6E-03	1.1E-07	1.6E-07
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--
Total		1.5E+01		2.2E-05		1.4E-01		3.1E-07

Total Risk =	2.E-05
Total Hazard =	1.E+01

Notes:
Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

TABLE D-1

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #1
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Soil											
Inh	Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	1.5E-07	5.1E-05	2.2E-09	3.3E-11	1.3E-07	4.4E-05	1.9E-09	2.8E-11	1.9E-06	2.5E-04	2.7E-08	2.1E-10
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	2.1E-09	2.1E-08	2.9E-11	--	1.8E-09	1.8E-08	2.5E-11	--	7.9E-09	--	1.1E-10	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	7.2E-08	7.2E-08	1.0E-09	--	6.2E-08	6.2E-08	8.9E-10	--	5.9E-07	2.0E-07	8.4E-09	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	5.1E-08	2.5E-08	7.3E-10	--	4.4E-08	2.2E-08	6.3E-10	--	4.9E-07	1.1E-06	7.0E-09	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	1.2E-05	--	1.8E-07	1.3E-07	8.2E-06	--	1.2E-07	8.5E-08	4.1E-08	--	5.9E-10	1.8E-10
Benzo(b)fluoranthene	1.8E-05	--	2.6E-07	1.9E-07	1.2E-05	--	1.7E-07	1.3E-07	1.1E-06	--	1.5E-08	4.7E-09
Benzo(a)pyrene	1.4E-05	--	2.0E-07	1.5E-06	9.4E-06	--	1.3E-07	9.8E-07	1.6E-08	--	2.2E-10	6.8E-10
Dibenz(a,h)anthracene	2.3E-06	--	3.2E-08	2.4E-07	1.5E-06	--	2.1E-08	1.6E-07	8.7E-10	--	1.2E-11	3.8E-11
PCBs	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	3.3E-06	1.1E-02	4.7E-08	7.1E-08	9.6E-06	3.2E-02	1.4E-07	2.1E-07	--	--	--	--
Beryllium	3.4E-08	2.7E-04	4.8E-10	--	2.9E-07	5.8E-05	4.2E-09	--	--	--	--	--
Cadmium	2.2E-07	1.8E-02	3.2E-09	--	1.9E-05	3.8E-02	2.7E-07	--	--	--	--	--
Lead	--	--	--	--	7.1E-05	--	1.0E-06	--	--	--	--	--
Mercury	9.8E-09	2.4E-03	1.4E-10	--	8.5E-08	8.5E-04	1.2E-09	--	1.3E-07	1.5E-03	1.8E-09	--
Nickel	1.6E-06	7.8E-05	2.2E-08	--	1.4E-05	6.8E-04	1.9E-07	--	--	--	--	--
Total		3.2E-02		2.1E-06		7.2E-02		1.6E-06		1.7E-03		5.8E-09

Total Risk =	4.E-06
Total Hazard =	1.E-01

Notes:
Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

TABLE D-2

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #4
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Groundwater							
	Inhalation - Trench Air				Dermal Contact			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	--	--	--	--	--	--	--	--
1,1-Dichloroethene	1.2E-04	--	1.7E-06	3.0E-07	1.5E-07	1.7E-05	2.2E-09	1.3E-09
cis-1,2-Dichloroethene	9.4E-04	--	1.3E-05	--	7.7E-07	7.7E-06	1.1E-08	--
t-1,2-Dichloroethene	3.0E-04	--	4.2E-06	--	2.4E-07	1.2E-06	3.5E-09	--
Ethylbenzene	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	6.1E-05	1.4E-04	8.7E-07	--	1.8E-07	9.0E-08	2.6E-09	--
Trichloroethene	5.6E-04	--	8.0E-06	4.8E-08	8.1E-07	1.4E-05	1.2E-08	1.3E-10
Vinyl Chloride	3.4E-04	1.2E-02	4.9E-06	1.5E-07	1.6E-07	5.2E-05	2.2E-09	3.1E-09
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	3.6E-07	1.2E-03	5.1E-09	7.6E-09
Beryllium	--	--	--	--	6.8E-09	3.4E-08	9.7E-11	--
Cadmium	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--
Mercury	6.0E-05	7.0E-01	8.6E-07	--	8.4E-10	3.4E-07	1.2E-11	--
Nickel	--	--	--	--	6.9E-08	3.5E-06	9.9E-10	--
Total	--	7.1E-01	--	5.0E-07	--	1.3E-03	--	1.2E-08

Total Risk =	5.E-07
Total Hazard =	7.E-01

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-2

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #4
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Soil							
	Dermal Contact				Ingestion			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	2.0E-10	6.6E-08	2.8E-12	4.2E-14	1.7E-10	5.7E-08	2.4E-12	3.7E-14
1,1-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	8.4E-09	8.4E-08	1.2E-10	--	7.3E-09	7.3E-08	1.0E-10	--
t-1,2-Dichloroethene	1.2E-09	6.1E-09	1.7E-11	--	1.1E-09	5.3E-09	1.5E-11	--
Ethylbenzene	1.7E-10	1.7E-10	2.4E-12	--	1.4E-10	1.4E-10	2.0E-12	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	4.1E-10	2.0E-10	5.8E-12	--	3.5E-10	1.8E-10	5.0E-12	--
Trichloroethene	2.2E-09	3.6E-08	3.1E-11	3.4E-13	1.9E-09	3.1E-08	2.7E-11	3.0E-13
Vinyl Chloride	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	5.4E-06	1.8E-02	7.7E-08	1.2E-07	1.6E-05	5.2E-02	2.2E-07	3.4E-07
Beryllium	3.0E-08	2.4E-04	4.3E-10	--	2.6E-07	5.2E-05	3.7E-09	--
Cadmium	2.1E-09	1.6E-04	2.9E-11	--	1.8E-07	3.6E-04	2.5E-09	--
Lead	--	--	--	--	5.7E-06	--	8.1E-08	--
Mercury	9.2E-09	2.3E-03	1.3E-10	--	8.0E-08	8.0E-04	1.1E-09	--
Nickel	5.7E-07	2.8E-05	8.1E-09	--	4.9E-06	2.5E-04	7.0E-08	--
Total	--	2.1E-02	--	1.2E-07		5.4E-02		3.4E-07

Total Risk =	5.E-07
Total Hazard =	7.E-02

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-3

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #9
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Groundwater							
	Inhalation - Trench Air				Dermal Contact			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	6.5E-03	--	9.3E-05	--	5.3E-06	5.3E-05	7.6E-08	--
t-1,2-Dichloroethene	7.0E-04	--	1.0E-05	--	5.7E-07	2.9E-06	8.2E-09	--
Ethylbenzene	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl Chloride	1.9E-02	6.8E-01	2.8E-04	8.6E-06	8.9E-06	3.0E-03	1.3E-07	1.8E-07
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--
Total	--	6.8E-01	--	8.6E-06	--	3.0E-03	--	1.8E-07

Total Risk =	9.E-06
Total Hazard =	7.E-01

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-3

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #9
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Soil							
	Dermal Contact				Ingestion			
Chemical	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk
Benzene	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	1.2E-06	1.2E-05	6.3E-09	--	1.0E-06	1.0E-05	1.5E-08	--
t-1,2-Dichloroethene	2.7E-09	1.4E-08	1.4E-11	--	2.3E-09	1.2E-08	3.4E-11	--
Ethylbenzene	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
Trichloroethene	3.8E-08	6.3E-07	2.0E-10	2.2E-12	3.3E-08	5.5E-07	4.7E-10	5.2E-12
Vinyl Chloride	4.1E-09	1.4E-06	2.2E-11	3.0E-11	3.5E-09	1.2E-06	5.0E-11	7.0E-11
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	1.6E-06	5.2E-03	8.2E-09	1.2E-08	4.5E-06	1.5E-02	6.4E-08	9.6E-08
Beryllium	2.0E-08	1.6E-04	1.1E-10	--	1.7E-07	3.4E-05	2.4E-09	--
Cadmium	1.5E-05	1.2E+00	7.7E-08	--	1.3E-03	2.5E+00	1.8E-05	--
Lead	--	--	--	--	2.6E-04	--	3.7E-06	--
Mercury	6.8E-09	1.7E-03	3.6E-11	--	5.9E-08	5.9E-04	8.4E-10	--
Nickel	3.6E-06	1.8E-04	1.9E-08	--	3.1E-05	1.6E-03	4.5E-07	--
Total	--	1.2E+00	--	1.2E-08	--	2.5E+00	--	9.6E-08

Total Risk =	1.E-07
Total Hazard =	4.E+00

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-4

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #11
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Groundwater							
	Inhalation - Trench Air				Dermal Contact			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	3.8E-04	--	5.4E-06	--	3.1E-07	3.1E-06	4.4E-09	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl Chloride	1.2E-03	4.4E-02	1.8E-05	5.5E-07	5.7E-07	1.9E-04	8.2E-09	1.1E-08
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--
Total	--	4.4E-02	--	5.5E-07	--	1.9E-04	--	1.1E-08

Total Risk =	6.E-07
Total Hazard =	4.E-02

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-4

EXPOSURES, RISKS, AND HAZARDS FOR CONSTRUCTION WORKERS
IDENTIFIED AREA #11
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO[a]

	Soil							
	Dermal Contact				Ingestion			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
Benzene	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--
Arsenic	1.4E-06	4.6E-03	2.0E-08	3.0E-08	4.0E-06	1.3E-02	5.7E-08	8.6E-08
Beryllium	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--
Lead	--	--	--	--	3.1E-06	--	4.4E-08	--
Mercury	--	--	--	--	--	--	--	--
Nickel	4.8E-07	2.4E-05	6.8E-09	--	4.1E-06	2.1E-04	5.9E-08	--
Total	--	4.7E-03	--	3.0E-08	--	1.4E-02	--	8.6E-08

Total Risk =	1.E-07
Total Hazard =	2.E-02

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

[a] Exposures, risks, and hazards do not include potential exposure through inhalation of indoor air. Indoor air exposures are calculated in Appendix C. Total receptor specific risks and hazards are summarized in Tables 8 and 9 respectively.

TABLE D-5

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
Southeast Area
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Industrial Worker								**Industrial Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	6.6E-06	3.3E-01	2.4E-06	4.7E-06	2.4E-06	1.2E-01	8.6E-07	1.7E-06	1.4E-07	--	5.2E-08	1.8E-08
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		3.3E-01		4.7E-06		1.2E-01		1.7E-06		--		1.8E-08

Total Risk = --
Total Hazard = --

Total Risk = 6.E-06
Total Hazard = 5.E-01

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

TABLE D-5

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
Southeast Area
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Construction Worker								**Construction Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	2.1E-05	3.5E-01	3.0E-07	6.1E-07	1.3E-05	2.2E-01	1.9E-07	3.8E-07	3.0E-07	--	4.3E-09	1.5E-09
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		3.5E-01		6.1E-07		2.2E-01		3.8E-07		--		1.5E-09

Total Risk = --
Total Hazard = --

Total Risk = 1.E-06
Total Hazard = 6.E-01

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

TABLE D-6

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
ON-PROPERTY (Non-IA-Specific)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

Chemical	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk
	Industrial Worker								Industrial Worker											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	2.0E-06	1.0E-01	7.3E-07	1.5E-06	7.3E-07	3.7E-02	2.6E-07	5.2E-07	4.4E-08	--	1.6E-08	5.5E-09
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		1.0E-01		1.5E-06		3.7E-02		5.2E-07		--		5.5E-09

Total Risk =	--	Total Risk =	2.E-06
Total Hazard =	--	Total Hazard =	1.E-01

Notes:
Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of
milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

TABLE D-6

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
ON-PROPERTY (Non-IA-Specific)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

Chemical	**Groundwater**								**Soil**											
	Inhalation - Trench Air				**Dermal Contact**				**Dermal Contact**				**Ingestion**				**Inhalation**			
	ADD	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Construction Worker								**Construction Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	1.4E-03	--	2.0E-05	3.5E-06	4.8E-06	5.3E-04	6.8E-08	4.1E-08	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	1.8E-01	--	2.5E-03	--	3.9E-04	3.9E-03	5.6E-06	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	5.6E-03	--	8.1E-05	--	1.2E-05	6.2E-05	1.8E-07	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	7.2E-04	--	1.0E-05	6.1E-08	2.8E-06	4.6E-05	4.0E-08	4.4E-10	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	8.4E-03	2.9E-01	1.2E-04	3.7E-06	1.0E-05	3.5E-03	1.5E-07	2.1E-07	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	2.3E-05	3.8E-01	3.3E-07	6.5E-07	1.4E-05	2.3E-01	2.0E-07	4.0E-07	3.2E-07	--	4.6E-09	1.6E-09
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		2.9E-01		7.3E-06		8.0E-03		2.5E-07		3.8E-01		6.5E-07		2.3E-01		4.0E-07		--		1.6E-09

Total Risk = 7.E-06
Total Hazard = 3.E-01

Total Risk = 1.E-06
Total Hazard = 6.E-01

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

TABLE D-7

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
OFF-PROPERTY (North)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Industrial Worker								**Industrial Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	4.2E-07	2.1E-02	1.5E-07	3.0E-07	1.5E-07	7.6E-03	5.4E-08	1.1E-07	9.2E-09	--	3.3E-09	1.1E-09
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		2.1E-02		3.0E-07		7.6E-03		1.1E-07		--		1.1E-09

Total Hazard	--	Total Hazard	3.E-02
Total Risk	--	Total Risk	4.E-07

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

TABLE D-7

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
OFF-PROPERTY (North)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk	ADD	Hazard	LADD	Risk
	Construction Worker								Construction Worker											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	7.9E-04	--	1.1E-05	2.0E-06	2.7E-06	3.0E-04	3.9E-08	2.3E-08	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	1.7E-01	--	2.4E-03	--	3.8E-04	3.8E-03	5.4E-06	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	2.9E-02	--	4.2E-04	--	6.4E-05	3.2E-04	9.1E-07	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	4.3E-02	--	6.2E-04	3.7E-06	1.7E-04	2.8E-03	2.4E-06	2.6E-08	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	3.2E-03	1.1E-01	4.6E-05	1.4E-06	4.0E-06	1.3E-03	5.6E-08	7.9E-08	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	1.3E-06	2.2E-02	1.9E-08	3.8E-08	8.2E-07	1.4E-02	1.2E-08	2.3E-08	1.9E-08	--	2.6E-10	9.3E-11
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		1.1E-01		7.1E-06		8.5E-03		1.3E-07		2.2E-02		3.8E-08		1.4E-02		2.3E-08		--		9.3E-11

Total Hazard	1.E-01	Total Hazard	4.E-02
Total Risk	7.E-06	Total Risk	6.E-08

Notes:

Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)

-- = Not applicable or not calculated for this medium

TABLE D-8

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
OFF-PROPERTY (South)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Industrial Worker								**Industrial Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	1.2E-06	6.2E-02	4.4E-07	8.8E-07	4.5E-07	2.2E-02	1.6E-07	3.2E-07	2.7E-08	--	9.6E-09	3.4E-09
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		6.2E-02		8.8E-07		2.2E-02		3.2E-07		--		3.4E-09

Total Hazard --
Total Risk --

Total Hazard 8.E-02
Total Risk 1.E-06

Notes:
Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

TABLE D-8

EXPOSURES, RISKS, AND HAZARDS FOR INDUSTRIAL AND CONSTRUCTION WORKERS
OFF-PROPERTY (South)
PROPERTY-SPECIFIC RISK ASSESSMENT
AKRON AIR DOCK
AKRON, OHIO

	Groundwater								Soil											
	Inhalation - Trench Air				Dermal Contact				Dermal Contact				Ingestion				Inhalation			
Chemical	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**	**ADD**	**Hazard**	**LADD**	**Risk**
	Construction Worker								**Construction Worker**											
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
t-1,2-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene (PCE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs	--	--	--	--	--	--	--	--	2.6E-06	4.3E-02	3.7E-08	7.4E-08	1.6E-06	2.7E-02	2.3E-08	4.6E-08	3.6E-08	--	5.2E-10	1.8E-10
Arsenic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total		--		--		--		--		4.3E-02		7.4E-08		2.7E-02		4.6E-08		--		1.8E-10

Total Hazard	--	Total Hazard	7.E-02
Total Risk	--	Total Risk	1.E-07

Notes:
Average Daily Dose (ADD) and Lifetime Average Daily Dose (LADD) are presented in units of milligrams per kilogram per day (mg/kg - day)
-- = Not applicable or not calculated for this medium

Memorandum

Date: January 25, 2008

To: Jennifer Krueger, URS Project Manager – Cincinnati Office

Copy: Eric Morton, Tetra Tech EM Inc. Senior Risk Assessor – Chicago Office

From: John Priebe, P.E., URS Senior Engineer – Cincinnati Office
Alicia Shull, EIT, URS Staff Engineer – Cincinnati Office

Subject: **APPENDIX E - Draft**
WATER QUALITY AND SEDIMENT LOADING EVALUATION UNDER POST-REMEDIATION CONDITIONS
AKRON AIRDOCK PROPERTY
AKRON, OHIO

Project: 14947615.02000

OBJECTIVE

This evaluation of potential water quality and sediment loading to Haley's Ditch was performed for post-remediation areas of the Akron Airdock Property (Property) located in Akron, Ohio. The evaluation considered the potential impacts of stormwater emanating from unpaved areas of the property following remediation of the Airdock, specifically the Southeast Area and the unpaved areas of the On-Property (non-IA-Specific) Area (see Figure E-1). The objectives of this evaluation were to estimate the potential maximum water quality and sediment impact on Haley's Ditch from erosion of residual soils impacted by polychlorinated biphenyls (PCB) and stormwater runoff from the Airdock Property following completion of remedial activities. The intent of this exercise was to evaluate attainment of applicable standards under the Ohio Environmental Protection Agency Voluntary Action Program (VAP).

ASSUMPTIONS

The assumptions for this evaluation were:

- The areas of the Property considered were the unpaved portions of the Southeast Area, excluding the area of the soil excavation and the unpaved portions of the On-Property (non-1A- specific) Area (see Figure E-1).

- All soils containing residual low-level PCBs that erode from the Property are ultimately conveyed to Haley's Ditch through the storm drainage system, with no allowance for redeposition of soil on the Property or within the storm sewer system. It is noted that sediment and debris are scheduled to be removed from the existing storm sewer system in the near future. Following this activity, it could be assumed that some sediment deposition will occur within the system until a "steady state" of deposition/suspension is reached. In reality, an allowance for the deposition that will occur could be deducted from the water quality and sediment loading assessment because this soil will not reach Haley's Ditch. However, in order to be conservative it is assumed that all eroded soil reaches the storm drainage system and remains suspended as sediment throughout the storm drainage system to discharge at Haley's Ditch.

- The residual PCB concentrations in soil following remediation activities consist of Aroclor 1268, which is relatively insoluble in water. Therefore, residual PCBs were assumed to remain as solids, with no factors for attenuation, degradation or partitioning. The principal fate and transport mechanisms considered in the analysis were erosion and dilution.

- For the purposes of this evaluation, the "discharge point" was defined as Outfall 001. Outfall 001 forms the headwater discharge to Haley's Ditch immediately downstream of the steel culvert north of Triplett Boulevard. The storm sewer system from the Airdock Property and other industrial properties including the airport drain to Outfall 001. An estimate of the unpaved drainage area of Outfall 001 is approximately 158 acres.

- The Lake Erie drainage basin water quality criteria for protection of human health and wildlife apply to Haley's Ditch. The Human Health and Wildlife Outside Mixing Zone Average water quality criteria for PCBs (total) are 0.026 nanograms per liter (ng/L) (human health) and 0.12 ng/L (wildlife), respectively (OAC 3745-1-33, Table 33-2).

METHODOLOGY

This evaluation included the following activities:

- **Estimating the Maximum Water Quality Load** – This portion of the analysis involved estimating the amount of annual soil loss from the areas of the Property containing residual low-level PCB concentrations following remediation activities (soil removal). The two unpaved areas subject to this analysis are shown on Figure E-1. The unpaved portion of the On-Property (Non-IA-specific) Area has a residual PCB concentration of 1.5 milligrams per kilogram (mg/Kg). The portion of the Southeast Area that is not subject to remediation has a residual PCB concentration of 4.9 mg/Kg. These residual concentrations were calculated as the exposure point concentrations in the risk assessment (Section 3.3.1).

  The analysis modeled the potential l PCB mass within the annualized sediment runoff from the Property to the water flows at Outfall 001. Assessing the sediment load contribution on a single-storm-event basis would yield highly variable results. As a result, the evaluation sought to assess this potential loading on a longer-term, or annualized, basis. The maximum anticipated water quality load from the eroded soil with PCBs was calculated and compared to the applicable water quality standards.

- **Estimating the Maximum Sediment Load** – Following the estimate of the potential water quality load (described above), the maximum potential concentration of PCBs in sediment was estimated by considering the potential mass contribution of PCBs from the post-remediation Property areas and comparing that PCB mass to the modeled sediment loss for the entire

Outfall 001 drainage area. The estimated sediment PCB concentration was compared to the VAP Standard for Residential Direct Contact (OEPA, OAC 3745-300-08 (B)(3)(b)).

WATER QUALITY EVALUATION

This evaluation consisted of the following four steps:

1. Estimate the annual erosion potential of unpaved soils from the Property following remediation activities.
2. Estimate the annual mass of PCBs from erosion of residual impacted soils from the Property.
3. Estimate the annual flow to Outfall 001, the defined discharge point.
4. Estimate the maximum anticipated PCB concentration in water at Outfall 001 from suspended sediments that come from the Property.

Each of these steps is discussed as follows.

<u>Step 1 -- Estimate the annual erosion potential of subject soils following remedial activities</u>

The annual soil loss (erosion) was estimated using the Revised Universal Soil Loss Equation (RUSLE) (USDA 2000).

$A = R * K * LS * C * P$

where:

A = Annual Soil Loss (tons/acre/year)

R = Rainfall-Runoff Erosivity Factor (unitless)

K = Soil Erodibility Factor (tons/acre/year)

LS = Slope Length and Steepness Factor (unitless)

C = Cover Management Factor (unitless)

P = Practice Support Factor (unitless)

A -- Estimate R Factor

$R = 105$ for Summit County, Ohio (Reference 1)

B -- Estimate K Factor

“K” factors represent the susceptibility of erosion and the rate of runoff for a given soil type. K factors generally range from 0.05 to 0.15 tons/acre/year for predominantly clay soils, to 0.25 to 0.4 tons/acre/year for predominantly silty soils. For the On-Property (non-1A-specific) Area, a K factor of 0.15 tons/acre/year was assumed (consistent with silty clay based on a review of existing soil borings from previous subsurface investigations and the observations from the historic sampling program). For the Southeast Area soils outside the excavation area, a K factor of 0.15 tons/acre/year was assumed because the native soils are assumed similar to the On-Property (non-IA-specific) Area.

C -- Estimate LS Factor

The LS factor was developed by evaluation of the slope and distance of the longest drainage path for each subject area. From Table 5.1 (Reference 1), the LS factor was then estimated for each area.

D -- Estimate C Factor

The ground cover of existing unpaved areas is vegetative, and will be maintained in a similar condition in the future. Based on Table 6.2 of Reference 1, a C Factor of 0.001 was selected for a “high productivity” ground cover.

E -- Estimate P Factor

The Practice Factor accounts for deductions in erosion potential resulting from use of conservation practices such as contouring, terracing, vegetation breaks, etc. The Practice Factor can range from approximately 0.25 to 1 (no specific conservation practices). For the purposes of this calculation, no practice efforts were assumed. Therefore, a P factor of 1.0 was used.

F -- Calculate Annual Expected Erosion Rate

$A = R * K * LS * C * P$

This calculation was performed on the following spreadsheet. The rates of estimated annual soil loss from unpaved portions of the Southeast Area and On-Property (Non-IA-specific) Area were estimated as 0.004 tons/acre/year and 0.001 tons/acre/year, respectively.

Step 2 -- <u>Estimate the annual mass of PCBs from erosion of residual impacted soils</u>

A -- Calculate the amount of soil loss from the subject areas

The acreage for the unpaved portions of the Southeast Area and the On-Property (non-IA specific) Area was estimated in the attached spreadsheet based on Summit County Geographic Information System (GIS) data (Reference 2) and the boundaries shown in the attached Figure E-1.

Mass of Soil Loss = Erosion Rate * Area of Soil

Soil loss calculations are presented in the attached spreadsheet. The annualized soil losses were calculated as 0.8 kg/year and 3.2 kg/year for the Southeast Area and On-Property (non-1A-specific) Area, respectively.

B -- Calculate the annual mass of PCBs contained with soil eroding from the Property

A post-remediation soil PCB concentration of 4.9 mg/kg was calculated for the Southeast Area. A soil PCB concentration of 1.5 mg/kg was calculated for the On-Property (non-1A-specific) Area. These concentrations were based upon the 95 percent upper confidence limit (95UCL) of existing soil data sets (Table 5 in the Risk Assessment).

Annual Mass_{PCB} = Rate of Soil Loss * PCB Concentration

Based on the attached spreadsheet, the total annual PCB mass from soil loss and assumed runoff for the two post-remediation areas was calculated as 8.8 mg.

Step 3 -- <u>Estimate the annual flow to Outfall 001, the defined discharge point</u>

An average contributory flow of 356,000 gallons per day (gpd) was used for this analysis. This flow was based on two sources. First, the estimated stormwater flow (296,000 gpd) from the 1989 National Pollutant Discharge Elimination System (NPDES) permit application for Valley Association Corporation (Reference 3), permittee for the former Loral and Aircraft Braking Systems Corporation facility. Second, the estimated groundwater flow infiltration (on the order of 60,000 gpd) to the existing storm sewer system from the shallow water table. The groundwater infiltration flow was estimated using several available data sources, including groundwater elevations from monitoring activities and a sewer survey.

Step 4 -- <u>Estimate the maximum anticipated PCB Concentration in water at Outfall 001 from suspended sediments that come from the Property</u>

Concentration = mass/volume

Based on the calculations performed in the attached spreadsheet and the previously stated assumptions, a total maximum PCB concentration at Outfall 001 was estimated as 0.018 ng/L. This modeled concentration is an overstated result because it assumes an extreme condition where100 percent of the sediment loss from the Property is in the form of suspended sediment.

TOTAL SEDIMENT LOADING ANALYSIS

The estimate of total sediment PCB concentration at the discharge point was performed using a similar methodology to that described above, but is based on the opposite extreme condition that 100 percent of the sediment loss from the Property is deposited after discharging at Outfall 001. The total annual sediment load from the entire unpaved portion of the Outfall 001 drainage area was estimated using the RUSLE equation, again with no allowance for redeposition within the drainage area or within the storm sewer system. The total annualized sediment load was modeled as 203.5 kg/year. The PCB mass in the portion of eroded soil from the Property is the same as above (8.8 mg/year). Based on the calculation performed on the attached spreadsheet, an estimated PCB concentration in the sediment from the entire unpaved portion of the Outfall 001 drainage area was calculated as 0.04 mg/kg (8.8 mg/year ÷ 203.5 kg/year).

CONCLUSIONS

Based on the conservative assumptions described in the analysis, the maximum anticipated concentration of PCBs attributable to post-remediation conditions at the VAP Property in the waters at the Outfall 001 discharge point was estimated as 0.018 ng/L. This estimated value is less than the lowest of the Lake Erie drainage basin water quality criterion for protection of human health Outside Mixing Zone Average of 0.026 ng/L and significantly less that the water quality criterion for protection of wildlife Outside Mixing Zone Average of 0.120 ng/L.

The corresponding PCB concentration in sediment contributed by the VAP Property was estimated as 0.04 mg/kg. The concentration is significantly less than the VAP Standard for Residential Direct Contact of 1.1 mg/kg (OAC 3745-300-8 Generic Numerical Standards, Table II: Generic Direct-Contact Soil Standards for Carcinogenic and Noncarcinogenic Chemicals of Concern – Residential Land Use Category).

By simplistically assigning the entire modeled PCB mass to either medium (water or sediment), the calculated concentrations represent upper bound, overestimated results. In reality, the PCB load may be divided into multiple fractions by various chemical and physical partitioning mechanisms, factors that are beyond the scope of this exercise.

REFERENCES

1. U. S. Department of Agriculture (USDA). 2000. Predicting Rainfall Erosion Losses Using the Revised Universal Soil Loss Equation. Natural Resources Conservation Service. February.

2. Summit County, Ohio Engineering Department, Geographical Information System (GIS) Section. 2006.

3. Valley Association Corporation, 1989. National Pollutant Discharge Elimination System Permit Application OH 0002011, Outfall 001. November 30.

Attachments: Appendix E Table, Figure E-1

APPENDIX E
Water Quality and Sediment Loading Evaluation Under Post-Remediation Conditions
Akron Airdock Property
Akron, OH

Standards for Comparison:	PCB Concentration	Units	Reference
1	0.026	ng/L	Lake Erie Water Quality Criteria for Protection of Human Health Outside of Mixing Zone
2	0.12	ng/L	Lake Erie Water Quality Criteria for Protection of Wildlife Outside of Mixing Zone
3	1.1	mg/kg	VAP Standard for Residential Direct Contact (OEPA, OAC 3745-300-08 (B)(3)(b))

Table 1 - Haley's Ditch Water Quality Analysis

			Revised Universal Soil Loss Equation (RUSLE), Annual Soil Loss Equals (tons/ac/yr) = R*K*LS*C*P												
Area Description	**Total Area (acres)**	**Unpaved Area (acres)**	**R (rainfall-runoff erosivity)**	**K (Soil Erodibility, tons/acre)**	**LS (slope length/steepness)**	**C (cover management factor)**	**P (practice support factor)**	**Annual Soil Loss (tons/ac/yr)**	**Annual Soil Loss (kg/yr)**	**PCB Concentration after Remediation (mg/kg)**	**PCB Mass in Sediment (mg/year)**	**Flow to Haley's Ditch (gpd)**	**Flow to Haley's Ditch (Lpy)**	**Modeled PCB Concentration at Discharge Point (ng/L)**	**Comparison to Standard 1**
Southeast Area	0.6	0.2	105	0.15	0.26	0.001	1	0.004	0.8	4.9	3.9	356,000	4.9E+08	0.008	**31%**
On-Property (non-IA-specific)	9.1	2.5	105	0.15	0.09	0.001	1	0.001	3.2	1.5	4.9	356,000	4.9E+08	0.010	**38%**
TOTAL:		**2.7**									**8.8**			**0.018**	
												Compared to Standard 1		***69%***	
												Compared to Standard 2		***15%***	

Table 2 - Haley's Ditch Total Sediment Loading Analysis

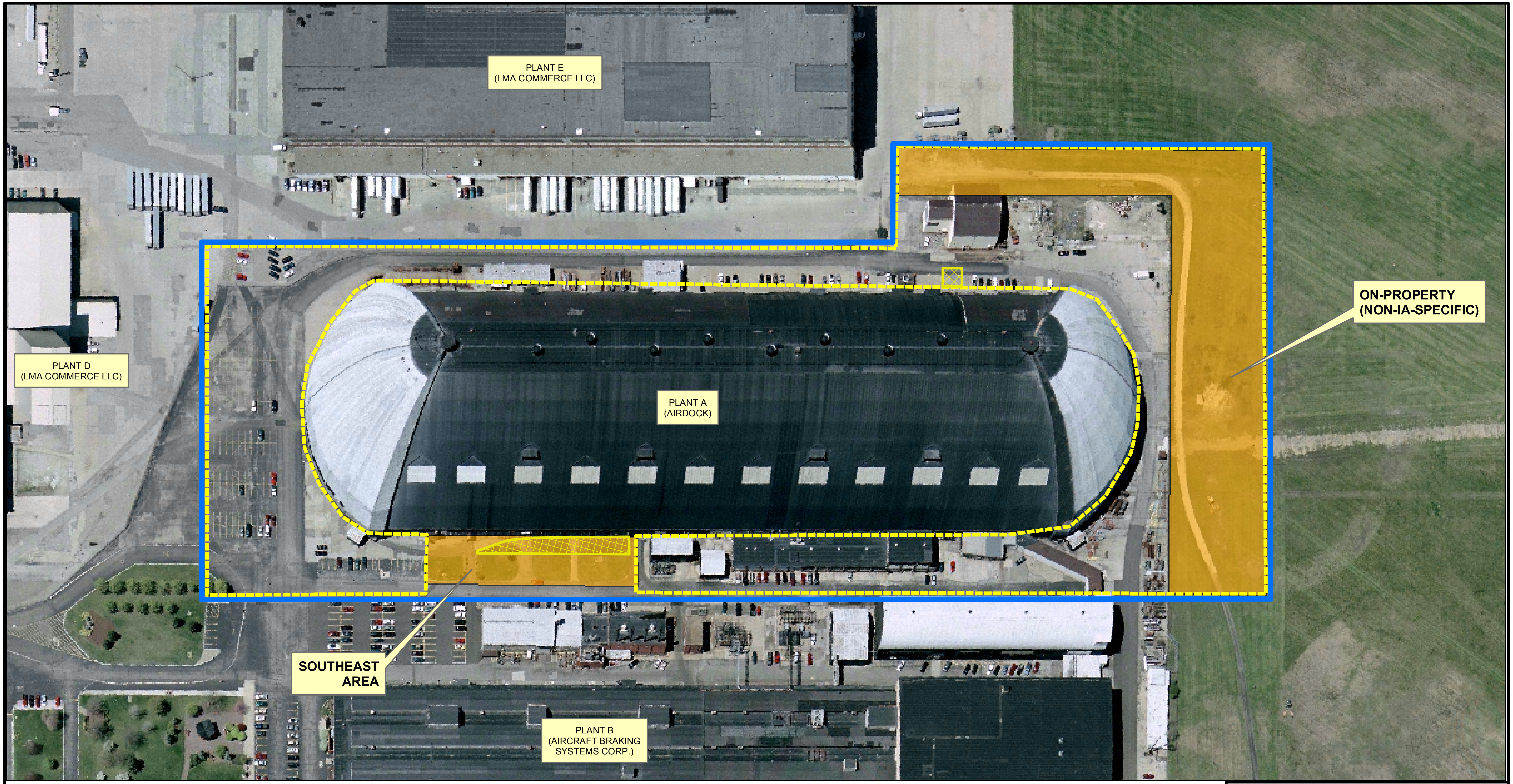
Area Description	Total Area (acres)	Unpaved Area (acres)	Total Sediment Load (kg/yr)	PCB Mass in Sediment from Property (mg/year)	Total PCB Sediment Loading (mg/kg)
Southeast Area	0.6	0.2	0.8	3.9	
On-Property (non-IA-specific)	9.1	2.5	3.2	4.9	
Total for Remedial Areas:		**2.7**	**4.0**	**8.8**	
Total Other Property Areas Draining to 001		155	199		
Total for All Areas Draining to 001:		**158**	**204**	**8.8**	**0.04**
			Compared to Standard 3		**4%**

Notes:

1. Total Area - Based on Summit County GIS data
2. Unpaved Area - Estimated from Figure 3
3. R - From Table 1, RUSLE, Ohio for Summit County
4. K - Estimated As Follows:
   Southeast Area - Silty clay (Weston, 2004)
   On-Property Non 1A Specific - Sandy Silt to Sand (existing boring logs)
5. LS - Different for each Area - As follows:
   Southeast Area - Length = 100, Slope = 2%
   On-Property Non 1A Specific - Length = 640', 0.4%
6. C - Assume "high productivity/maintained" ground cover for all areas
7. P - Assume no specific practice factors for any area
8. PCB Concentration After Remediation - Based on exposure point concentrations, Table 5 from Risk Assessment
9. Flow to Haley's Ditch - Based on Stormwater Only Flows from NPDES Permit (Valley Association Corporation 1989) and allowance for groundwater infiltration (on the order of 60,000 gpd)
10. Total Other Property Draining to 001 - This property area was estimated to be approximately 5 times greater than the sum of the unpaved areas for four discrete locations in the drainage basin (Southeast Area, On-Property Non IA Specific, Off-Property South and Off-Property North). The rate of sediment loss from the rest of the property is assumed to be similar to the conditions of that for the On-Property Non-1A Specific area.

Conclusions:

Two separate analysis were completed above - one for water quality and one for sediment loading. These analysis were then compared to three applicable standards - Lake Erie Water Quality and Ohio VAP for Residential Contact. The Water Quality Standards (Standards #1 and #2) are not exceeded The Ohio VAP Residential Direct Contact (Standard #3) is also not exceeded.



LEGEND

- ▨ Excavated Area - Remediation per LMC 2007c (See Section 2.1.2)
- □ Approximate Airdock Boundary
- ⬚ Evaluated Property Area
- 🟧 Unpaved Area

SOURCE: MODIFIED FROM SUMMIT COUNTY GIS, 2004.

AKRON AIRDOCK FACILITY
AKRON, OHIO

FIGURE E-1
UNPAVED AREAS EVALUATED FOR SOIL LOSS BY EROSION

TETRA TECH, INC.

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