OHIO VOLUNTARY ACTION PROGRAM
PROPERTY-SPECIFIC RISK ASSESSMENT
FORMER GM MANSFIELD STAMPING PLANT
ONTARIO, RICHLAND COUNTY, OHIO

REVISED

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ACRONYMS AND ABBREVIATIONS

μg/L	=	Micrograms per liter
ABS	=	Dermal Absorption factor
ACBM	=	Asbestos-containing building material
ADD	=	Average daily dose
AF	=	Adherence factor
AT	=	Averaging time
ATSDR	=	Agency for Toxic Substances and Disease Registry
bgs	=	Below ground surface
BCDC	=	Brownfield Communities Development Company
BUSTR	=	Bureau of Underground Storage Tank Regulations
BW	=	Body weight
C	=	Chemical concentration
Cal/EPA	=	California Environmental Protection Agency
CNS	=	Covenant Not to Sue
COC	=	Chemical of concern
CR	=	Contact rate
CSM	=	Conceptual site model
ED	=	Exposure duration
EF	=	Exposure frequency
ELCR	=	Excess lifetime cancer risk
EPA	=	U.S. Environmental Protection Agency
EPC	=	Exposure point concentration
ESA	=	Environmental Site Assessment
GM	=	General Motors
GNS	=	Generic numerical standard
HEAST	=	Health Effects Assessment Summary Tables
HI	=	Hazard index
HQ	=	Hazard quotient
I	=	Intake
IA	=	Identified area
IRIS	=	Integrated risk information system
J&E	=	Johnson and Ettinger
LADD	=	Lifetime average daily dose
LOAEL	=	Lowest observed adverse effect level
m	=	Meters
m^3/hour	=	Cubic meters per hour
m^3/kg	=	Cubic meters per kilogram
MCL	=	Maximum contaminant level
mg/kg-day	=	Milligrams per kilogram per day
msl	=	Mean sea level datum
NCEA	=	National Center for Environmental Assessment
NOAEL	=	No observed adverse effect level
NPDES	=	National Pollutant Discharge Elimination System
OAC	=	Ohio Administrative Code
OERR	=	Office of Emergency and Remedial Response
Ohio EPA	=	Ohio Environmental Protection Agency
ORD	=	Office of Research and Development
OSWER	=	Office of Solid Waste and Emergency Response

ACRONYMS AND ABBREVIATIONS (Continued)

PCB	=	Polychlorinated biphenyls
PEF	=	Particulate emission factor
PPRTV	=	Provisional Peer-Reviewed Toxicity Values
PSRA	=	Property-Specific Risk Assessment
PWS	=	Public Water Supply
RACER	=	Revitalizing Automotive Communities Environmental Response Trust
RAGS	=	Risk Assessment Guidance for Superfund
RAP	=	Remedial action plan
RfD	=	Reference dose
RME	=	Reasonable maximum exposure
RO	=	Remedial Objective
RSL	=	Regional Screening Level
SCDMTSC	=	Site Characterization and Monitoring Technical Support Center
sf	=	Square foot
SF	=	Slope factor
Tetra Tech	=	Tetra Tech Inc.
UAW	=	United Auto Workers
95 UCL	=	95 percent upper confidence limit
VAP	=	Voluntary Action Program
VDEQ	=	Virginia Department of Environmental Quality
VF	=	Volatilization factor
VI	=	Vapor intrusion
VISL	=	Vapor Intrusion Screening Level
VOC	=	Volatile organic chemical
WWTP	=	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Introduction

The former General Motors (GM) Mansfield Stamping Plant (henceforth known as the Subject Property) in Ontario, Richland County, Ohio, is pursuing a (No Further Action Letter) NFA with a Covenant-not-to-sue (CNS) under the Ohio Voluntary Action Program (VAP) MOA track. On behalf of the Volunteer, Revitalizing Automotive Communities Environmental Response Trust (RACER), Tetra Tech, Inc. (Tetra Tech) completed a property-specific risk assessment (PSRA) 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 Subject Property. The specific 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. The property-specific risk assessment was conducted in accordance with the procedures specified in the Ohio Administrative Code (OAC) 3745-300-09.

Background

The Subject Property is located in Ontario, several miles west of the city of Mansfield, in Richland County, Ohio. The Subject Property consists of approximately 266-acres made up of five parcels surrounded predominately by commercial/industrial and agricultural properties west of the Richland Mall, north of State Highway 309, and south of West Fourth Street (Lincoln Highway).

Manufacturing operations took place at the Subject Property from the time the Main Plant was constructed in 1955 through 2010. The RACER Trust was created in March 2011 by the U.S. Bankruptcy Court to facilitate the management of properties formerly owned by the bankrupted GM. Upon its creation, the RACER Trust owned a large amount of industrial space, including the Subject Property. In December 2012, RACER sold the Subject Property to Brownfield Communities Development Company (BCDC).

As presented in the 2015 revised VAP Phase II, 14 identified areas (IA) have been recognized within the Subject Property as follows:

IA No.	IA Description
1a, 1b, 1c	Snow Staging (IAs -1a and -1b)/Rack Wash Area (IA-1c) (west of the main plant building)
2	Former UST Farm (adjacent to the southwest corner of the main plant building)
3	Missing/Miss-Identified USTs (various locations)
4	Former Wastewater Treatment Plant (WWTP) (south of the Baler House and west of existing WWTP [see IA-9])
5	Artificial Fill/Slope Area (southern side of the main plant building)
6	Coal Storage Area (eastern side of the main plant building)
7	Original Switch House (east of northeast corner of main plant building)
8	Stained sumps, stains, and floor drains (various locations in the main plant building)
9	Existing WWTP (east side of main plant building)
10	Hazardous Waste Storage Area (southwest corner of the main plant building)
11	Asbestos Containing Building Materials ("out buildings" at the site)
12	Wood Block Flooring (various locations in the main plant building)
13	South Field Lower Terrace Fill (south of the main plant building)
14	Eastern Raw Material Storage Area

Risk Assessment Scope and Approach

The following five IAs were identified as having one or more chemicals in either or both soil (less than or equal to 10 feet bgs) and groundwater at concentrations above medium-specific generic numerical standard (GNS) values: IA-2, IA-4, IA-5, IA-10, and IA-14. Additional information for those IAs not addressed further in this property-specific risk assessment (IAs 1, 3, 6, 7, 8, 9, 11, 12, and 13) is presented below:

- IA-1 (IA-1a, -1b, and -1c) – The primary concern at IA-1 was a potential release from the snow melting system beneath the parking lot in that area (IAs -1a and -1b). Only one chemical of concern (COC), ethylene glycol, was identified for shallow soil in IA-1 in accordance with OAC 3745-300-06. Ethylene glycol was not detected in any soil sample collected at IA-1. The only exception was soil boring IA1-6which was extended to address the potential impact of the Rack Wash building (IA-1c) located immediately upgradient of the boring location and thus sampled for VOCs. The sample from soil boring IA1-6 was collected from 15 feet bgs which is deeper than the range of subsurface soil (0 to 10 feet bgs) considered for potential direct contact for human receptors. It should be noted that all VOCs were detected at concentrations less than their respective medium-specific GNS values. Also, groundwater samples were not collected from IA-1. Therefore, IA-1 was not considered further.

- IA-3 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Therefore, IA-3 was not considered further.

- IA-6 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 2 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1.

Similar groundwater results were not added to the Table 2 soil results because the only chemicals detected in IA-6 groundwater (monitoring well MW6-1) were gasoline range organics (GRO) and the C20-C34 petroleum fraction. Therefore, IA-6 was not considered further.

- IA-7 – Wipe sampling for polychlorinated biphenyls (PCB) were all nondetect (see Table E6 in Appendix E). Therefore, IA-7 was not considered further.

- IA-8 – Information regarding IA-8 includes the results of a geophysical survey conducted within the Main Plant Building and analysis of samples from soil boring IA4-10 (Tetra Tech 2015), – the closest soil boring to the Main Plant Building. IA4-10 was installed to evaluate the horizon corresponding to the "marriage station" as an additional investigative tool to support the geophysical investigation of that feature. The sample depth was targeted to correspond with the elevation of the feature as described in the Site-Specific Work Plan and the Phase II ESA (Tetra Tech 2015). As a result, no soil samples were collected within 25 feet bgs. Therefore, no potential for direct contact with site-related chemicals in soil was identified. Further, all chemical concentrations in soil (sample collected 25 to 27.5 feet bgs) were less than commercial/industrial and construction/excavation GNS values – see Appendix E). Also, groundwater samples were not collected from IA-8. Therefore, IA-8 was not considered further.

- IA-9 – The waste water treatment system is a closed loop and no evidence of a release was identified in association with this feature. In addition, the IA was limited to the footprint of the building. As a result, no Phase II PA activities were conducted in this area. This IA is considered resolved. The raw materials storage area to the east that was formerly included in IA-9 has been separated from the WWTP and now represents IA-14.

- IA-11 – Information regarding IA-11 was requested by Ohio EPA to support cost estimation for demolition of the building. Asbestos-containing building material (ACBM) is outside the scope of the VAP and the abatement was conducted under Ohio EPA oversight. Therefore, IA-11 was not considered further.

- IA-12 – Wood block flooring at various locations in the Main Plant Building has been removed. Analytical results were collected at Ohio EPA's request only to characterize the building materials for disposal purposes. Building materials (such as wood block flooring) are not eligible for inclusion under VAP. Therefore, IA-12 was not considered further.

- IA-13 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 4 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1. Also, groundwater samples were not collected from IA-13. Therefore, IA-13 was not considered further.

Similarly, as documented in Appendix E (see Table E-6), no chemical-specific exceedances of residential soil GNS values (see OAC 3745-300-08 (H) (2) (a)) were exceeded for the single sediment sample (SD12-LAN-0411) from Beer Road Ditch. Therefore, potential exposure by human receptors (recreationalists) to sediment in Beer Road Ditch was not considered further.

Therefore, the property-specific risk assessment includes evaluation of potential location-specific exposures, risks, and hazards only at IA-2, IA-4, IA-5, IA-10, and IA-14. In addition to evaluating potential human exposures to contaminants present in soil and groundwater at these IAs, the scope of the risk assessment also includes an evaluation of potential off-property, but potentially property-related human and ecological exposures. The conclusions of the property-specific risk assessment will be used to focus remediation of the remaining IAs and off-property locations (as required) and, to the extent necessary, design appropriate on-property work restrictions.

Risk assessment is typically conducted in four basic steps: (1) data evaluation and identification of COCs, (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 Subject Property will be used for commercial/industrial operations. Consistent with a future commercial/industrial land use, the risk assessment evaluated potential exposures to two groups of on-property receptors: commercial/industrial workers and construction/excavation workers. The risk assessment included evaluation of potential location-specific exposures, risks, and hazards at IA-2, IA-4, IA-5, IA-10, and IA-14. The property-specific risk assessment evaluated the potential indoor air pathway because the IAs listed above overlie volatile organic chemical (VOC) contamination in soil and groundwater. The vapor intrusion pathway (whether originating in soil or groundwater) is a pathway for which there are no generic standards (OAC 3745-300-09(A)(3)(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 (A) (3)(e) () is limited for two primary reasons:

1. There are no complete exposure pathways to important ecological receptors other than surface water and sediment (see OAC 3745-300-09 (A) (3) (e)). The northern portion of the Subject Property is dominated by the former Main Plant Building and related paved parking and operational areas. The southern portion of the Subject Property is covered in grass and contains no unique ecological habitat or features, including natural surface water bodies.

2. Storm water collection in drainage features on the Subject Property, including the Storm Water Retention Pond and discharge to a ditch along the west side of the southern part of Beer Road (referred to in the revised PSRA as "the Beer Road Ditch"), is covered by NPDES permit 21S00045*GD. Surface water samples were collected for informational purposes only as part of the due diligence for the Subject Property and are not subject to VAP applicable standards.

Therefore, potential exposures to chemicals in surface water and on-property sediment and associated risks and hazards were not addressed in this revised PSRA.

However, potential ecological exposures to sediment in the Beer Road Ditch were evaluated. A single sediment sample (SD12-LAN-0411) was located in this ditch. Also, potential human exposures to off-property groundwater were evaluated qualitatively.

Results

All chemicals that were positively detected in at least one sample from a medium (soil, groundwater, and sediment [off-property only]) including chemicals with no qualifiers and chemicals with data qualifiers indicating known identities but uncertain concentrations (for example, J-qualified data) were retained as COCs for that medium. The soil (46 total, including those present at depths greater than 10 feet below ground surface [bgs] and therefore included for vapor intrusion only), groundwater (28 total), and sediment (21 total) COCs identified and carried through the risk assessment are identified in Table ES-1.

TABLE ES-1
CHEMICALS OF CONCERN[a]

Chemical	Soil	Groundwater	Sediment
Acetone	X	X	X
Benzene	X		
Bromodichloromethane		X	
Bromomethane	X	X	
2-Butanone	X	X	X
Carbon disulfide	X	X	
Chloroethane	X	X	
Chloroform		X	
1,1-Dichloroethane	X	X	
1,2-Dichloroethane	X		
1,1-Dichloroethene		X	
cis-1,2-Dichloroethene		X	
trans-1,2-Dichloroethene		X	
Ethyl benzene	X		
2-Hexanone	X		
Isopropylbenzene	X		
Methylene chloride	X		X
4-Methyl-2-pentanone	X		
Tetrachloroethene		X	
Toluene	X	X	
1,2,4-Trichlorobenzene	X		
1,1,1-Trichloroethane		X	
Trichloroethene		X	
Vinyl chloride		X	
Xylenes (total)	X		
Acenaphthene	X	X	
Acenaphthylene	X		X
Anthracene	X		
Benzo(a)anthracene	X		X
Benzo(b)fluoranthene	X	X	X
Benzo(k)fluoranthene	X		X
Benzo(g,h,i)perylene	X		X
Benzo(a)pyrene	X		X
Chrysene	X	X	X
Dibenzo(a,h)anthracene	X		
Fluoranthene	X	X	X
Fluorene	X	X	X
Indeno(1,2,3-cd)pyrene	X		X
Isopropylbenzene	X		
1-Methylnaphthalene	X		
2-Methylnaphthalene	X		
Naphthalene	X	X	
Phenanthrene	X	X	X
Pyrene	X	X	X
Aroclors 1242, -1254, and -1260	X		
C6-C12	X		
C20-C34	X	X	
C10-C20	X	X	
Gasoline Range Organics (GRO)		X	
Arsenic	X		X
Cadmium	X		X
Chromium	X		X
Lead	X		X
Mercury	X	X	X
Selenium	X		X

Note: [a] The COCs represent those chemicals detected at least once in a particular medium.

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

- Risks and hazards associated with the IA-2, IA-10, and IA-14 are less or equal to receptor-specific target cumulative risks and hazards. Therefore, remediation at these IAs is not required.

- Risks and hazards associated with IA-5 are less than or equal to receptor-specific target cumulative risks and hazards with one exception. The total HI for construction/excavation workers was calculated as 2, which exceeds the target hazard of 1. This total HI is driven by potential exposure to trichloroethene in trench air. However, trichloroethene was detected in only 1 of 4 monitoring wells at IA-5. The HI for trichloroethene (1.6) based on the maximum detected concentration of trichloroethene from monitoring well MW5-2S (11 μg/L) was reduced to 1.1 (and the total HI reduced from 1.6 to 1.2) when the trichloroethene concentration (7.7 μg/L) measured in a second sample collected two months later from MW5-2S is used. The revised total HI of 1.2 reduces to 1 at one significant figure.

- Risks and hazards at IA-4 exceed the target cumulative risk and hazard for commercial/industrial workers and for construction/excavation workers. These risks and hazards are driven by potential exposure to carcinogenic PAHs in soil. Excavation of PAH-contaminated soils at IA-4 will be required.

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

Risk Assessment Outcome for Commercial/Industrial Worker Scenario

Area	Risk	Hazard	Recommended Action
IA-2	Pass	Pass	No Action Required
IA-4	Fail	Fail	Excavation of PAH-contaminated soil
IA-5	Pass	Pass	No Action Required
IA-10	Pass	Pass	No Action Required
IA-14	Pass	Pass	No Action Required

Risk Assessment Outcome for Construction/Excavation Worker Scenario

Area	Risk	Hazard	Recommended Action
IA-2	Pass	Pass	No Action Required
IA-4	Fail	Fail	Excavation of PAH-contaminated soil
IA-5	Pass	Pass	No Action Required*
IA-10	Pass	Pass	No Action Required
IA-14	Pass	Pass	No Action Required

* See text for more discussion.

Risk Assessment Outcome for Off-Property Exposure Scenarios

Area	Risk	Hazard	Recommended Action
Off-Property – General (inhalation of fugitive dust and vapors and potable groundwater use)	Pass	Pass	No Action Required

Risk Assessment Outcome for Off-Property Ecological Exposure Scenario

Area	Risk	Recommended Action
Beer Road Ditch	Fail	No Action Required* [1] Verified a documented historical release from an off-property source of PAHs to the Beer Road Ditch and portions of the site drainage network, [2] No known on site releases of hazardous substances or petroleum products to the drainage system on-property

* See text for more discussion.

Potential off-property human health risks related to COC exposures from the Subject Property are less than a target cumulative risk of 1E-05 and a target cumulative hazard of 1 (OAC 3745-300-09 (B)(1)(b)(ii)) based on (1) insubstantial exposures (inhalation of particulates and vapors from on-property soils) and (2) measured and modeled groundwater concentrations at the Subject Property boundaries less than 1E-05.

Potential off-property ecological exposures may be associated with elevated risks. The cumulative risk ratios based on potential exposure by ecological receptors to sediments in the Beer Road Ditch beyond the Property's NPDES-permitted discharge point exceed 1. These ecological risks are driven by potential exposure to PAHs (including acenaphthene, benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, and pyrene), and the VOC acetone. These ecological risks are expected to be overestimated based on the following criteria: (1) PAHs in Beer Road Ditch are likely the result (at least partially) of off-property sources such as the historical release at 815 Beer Road and traffic traffic along Beer Road and upgradient commercial/industrial operations and (2) there are no reported releases of hazardous substances or petroleum products to the on-property drainage system from on-site sources. The PAH concentrations in Beer Road Ditch while exceeding threshold effects concentrations (TEC) are less than probably effects concentrations (PEC).

Based on the summary and conclusions and consistent with VAP response requirements specified in OAC 3745-300-09 for commercial/industrial properties, voluntary actions are recommended at IA-4.. At IA-4, excavation of PAH-contaminated soil is required. In Beer Road Ditch, the source of the PAHs and VOC are associated with a historical release of diesel fuel from the former Bender & Loudon Freight facility at 815 Beer Road. This incident marks the only known release to the stormwater drainage network at the site.

1.0 INTRODUCTION

On behalf of the Ohio Environmental Protection Agency (Ohio EPA) and the Revitalizing Automotive Communities Environmental Response Trust (RACER), Tetra Tech, Inc. (Tetra Tech), have completed a series of Phase I and Phase II reports for the former General Motors (GM) Mansfield Stamping Plant (henceforth known as the Subject Property) in Ontario, Richland County, Ohio (see Figure 1). The Subject Property sits on five parcels of land (0386015206000, 0386015205000, 0386015204000, 0386015202000, and 0386015203000) totaling 266 acres located between West Fourth Street and State Route 309 in Ontario. The Subject Property is bound by commercial properties to the north, additional commercial properties including the Richland Mall to the east, a rail yard and State Route 309 to the south, and Beer Road followed by light industry (Burner Systems, Invensys, Universal Refrigeration, Yellow Trucking, and Shearer Equipment) and farmland to the west (see Figure 2). The Subject Property was developed in 1955 as a GM metal stamping plant. GM ceased operations at the Subject Property in February 2010; the Subject Property is not currently in use. In December 2012, RACER sold the Subject Property to Brownfield Communities Development Company (BCDC). The Phase I and Phase II reports were prepared in accordance with Ohio EPA Voluntary Action Program (VAP) rules set forth in Ohio Administrative Code (OAC) 3745-300-06 and 3745-300-07, also known as VAP Rules 6 and 7 and include: a Phase I Environmental Site Assessment (ESA) (Tetra Tech 2011) and a Phase II ESA (Tetra Tech 2015).

The 2011 Phase I and 2015 Phase II reports identify potential adverse environmental impacts associated with surface and subsurface media in selected identified areas at the Subject Property (Tetra Tech 2011, Tetra Tech 2015). The overall purpose of the property-specific risk assessment (PSRA) is to support the no further action (NFA) letter with a covenant not to sue (CNS) from Ohio EPA sought by RACER. To this end, the specific purposes of the risk assessment are to (1) assess and characterize potential human health and ecological exposures and risks, (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 Subject Property location and layout (Section 1.1.1), summarizes Subject 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 2011, Tetra Tech 2015).

1.1.1 Subject Property Location and Description

The Subject Property is located in Ontario, several miles west of the city of Mansfield, in Richland County, Ohio. The Subject Property consists of approximately 266-acres made up of five parcels surrounded predominately by commercial-industrial and agricultural properties west of the Richland Mall, north of State Highway 309, and south of West Fourth Street (Lincoln Highway) (see Figures 1 and 2). The Subject Property and surrounding land are nearly level, with a surface elevation of approximately 1,400 feet mean sea level datum (msl). Surface water features on the Subject Property include a storm water pond and a series of drainage ditches comprising the surface drainage network. The surface drainage network eventually discharges to a ditch along Beer Road in the southwest corner of the site (see Figure 4D); this surface water feature is referred to in this revised PSRA as the Beer Road Ditch. Storm water discharge from the Subject Property is covered by an existing National Pollutant Discharge Elimination System (NPDES) permit 21S00045*GD. As a result, issues related to storm water discharge and the surface water and sediment in the surface drainage network upgradient of the discharge point fall under the purview of the NPDES permit. Issues that pertain to other regulatory programs such as NPDES are not eligible for inclusion in the VAP. Therefore, contaminant concentrations in surface water and on-property sediments were collected for informational purposes only as part of the due diligence for the Subject Property and are not subject to VAP applicable standards. However, potential human health and ecological exposures to potentially property-related chemical concentrations in a single off-property sediment sampled collected in the Beer Road Ditch were evaluated in this revised PSRA.

Primary features at the Subject Property included the following (see Figure 2):

- Main Plant Building
- Original Switch House
- New Switch House
- Electrical Substation
- Press Prep Building
- Powerhouse
- Former Wastewater Treatment Plant (WWTP)
- Existing WWTP
- Compressor Building

- Baler House
- Former Coal Storage Area
- Coil Steel Rack Building
- Rack Wash Building
- Oil Crib
- Snow Staging Area
- Storm water Retention Pond (and related drainage ditches)
- Artificial Fill/Slope Area
- Two water towers

Note: with the exception of the Press Prep Building, the Compressor Building, and the Rack Wash Building, all structures have been razed by the BCDC; only slabs remain.

The parcel was dominated by the Main Plant Area with its 2.9 million-square-foot (sf) footprint. Paved parking and operational areas are located west and east of the Main Plant Building. Grass and unpaved areas are located along the far northern and eastern boundaries of the Subject Property, and all land south of the Main Plant Building (see Figure 2). A chain-link fence completely surrounds the Subject Property. Access to the Subject Property is through a security gate along Stumbo Road on the east side of the Subject Property. Adjoining properties and respective orientations are the United Auto Workers (UAW) Hall, the ABC Warehouse, Red Lobster, and the Bookery north of the Subject Property along the north side of West Fourth Street; the Richland Mall to the east; the Ontario Police Department to the southeast; and Burner Systems, Invensys, Universal Refrigeration, Lucas Tool Grinding, Yellow Trucking, and Shearer Equipment to the west (see Figure 2).

1.1.2 Subject Property Operations and Ownership

Prior to GM purchasing the land in 1955, historical records and files reviewed indicate that the Subject Property was farmland. GM built the plant which began operations in 1955. The plant was built to produce automotive body components out of steel; the steel was "stamped" in various press machines. During the height of production at the plant, it contained 18 transfer presses, 21 major press lines with 134 conventional presses, 43 metal assembly lines, and 14 blanking presses. Presses were located in pits, with the hydraulic components below the machines. When production at the facility ceased in February 2010, several of the presses and various other machinery were removed; the remainder were auctioned off. The plant processed over 750 tons of steel per day; scrap metal from the presses was collected via a system of conveyors and sent to the baler house where it was baled for off-site removal. In 2002, the baler operation was terminated when a loose scrap system was instituted. The powerhouse was also built in 1955 to supply power and compressed air to the plant. When operational, the powerhouse burned up to 100 tons of coal per day and included three coal-fired boilers, one steam air compressor, and seven electric air compressors. Coal entered the powerhouse through the basement, and an elevator was used to transport it to the top floor of the building where it entered a bunker; the coal was then weighed out and transferred to the boilers. Ash residue from the boilers was vacuumed out and collected in an adjoining silo, where it was periodically emptied into a cinder truck. The ash was re-used for salting the roads in winter or disposed of. A 42,000 square foot area south of the powerhouse, including the waste water treatment plant, was used to store the coal. The powerhouse was shut down in 2001 when gas-fired boilers were installed at the main plant.

The RACER Trust was created in March 2011 by the U.S. Bankruptcy Court. Upon its creation, the RACER Trust owned a large amount of industrial space, including the Subject Property. In December 2012, RACER sold the Subject Property to BCDC. After acquiring the property, BCDC has razed the majority of the buildings on site. Only the Prep Press, Rack Wash, and Compressor buildings remain. The slabs associated with the other structures remain in place.

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 revised 2015 Phase II ESA, releases of hazardous substances and petroleum have occurred on, underlying, and in the case of groundwater, are emanating from the Subject Property (Tetra Tech 2015). As presented in the revised 2015 Phase II ESA, 14 IAs have been recognized at the Property, as follows (see Figure 2):

IA No.	IA Description
1a, 1b, 1c	Snow Staging (IAs -1a and -1b)/Rack Wash Area (IA-1c) (west of the main plant building)
2	Former UST Farm (adjacent to the southwest corner of the main plant building)
3	Missing/Mis-Identified USTs (various locations)
4	Former Wastewater Treatment Plant (WWTP) (south of the Baler House and west of existing WWTP [see IA-9])
5	Artificial Fill/Slope Area (southern side of the main plant building)
6	Coal Storage Area (eastern side of the main plant building)
7	Original Switch House (east of northeast corner of main plant building)
8	Stained sumps, stains, and floor drains (various locations in the main plant building)
9	Existing WWTP (east side of main plant building)
10	Hazardous Waste Storage Area (southwest corner of the main plant building)
11	Asbestos Containing Building Materials ("out buildings" at the site)
12	Wood Block Flooring (various locations in the main plant building)
13	South Field Lower Terrace Fill (south of the main plant building)
14	Eastern Raw Material Storage Area

In addition to evaluating potential human exposures to contaminants present in soil and groundwater at these IAs, the scope of the revised PSRA also includes an evaluation of potential off-property, but potentially Property-related human health and ecological exposures. As noted in Section 1.1.1, storm water discharge from the Subject Property is covered by NPDES permit 21S00045*GD. Contaminant concentrations in surface water and on-property sediments were collected for informational purposes only as part of the due diligence for the Subject Property and are not subject to any VAP applicable standards. However, potential human health and ecological exposures to potentially Property-related chemical concentrations in a single off-property sediment sample (SD12-LAN-0411) collected in the Beer Road Ditch beyond the Property's NPDES-permitted discharge point (see Figure 4D) were evaluated.

Figure 3 summarizes the exposure scenarios (human and ecological 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 Subject Property is continued commercial and industrial operations. Therefore, for preliminary screening purposes, the appropriate soil direct contact generic numerical standards (GNS) are those associated with a commercial or industrial land use. With regard to groundwater, land use restrictions will be put into place prohibiting future use of Property groundwater. Also, the depth to groundwater is ≥ 12 feet below ground surface (bgs). Specifically, the Property is divided into two zones with regards depth to groundwater: (1) the upper terrace (where IAs 2, 4, 10, and 14 are located) – the depth to groundwater is about 25 feet bgs, and (2) the lower terrace (where IA-5 is located) – the depth to groundwater is about 12 feet bgs. Since construction/excavation trenches are typically ≤10 feet bgs in depth, the trenches are not expected to intersect the water table and groundwater is not expected to accumulate in these trenches. Therefore, no direct contact exposure with groundwater is anticipated. However, receptors may be exposed to volatile chemicals that migrate from groundwater to air within buildings (indoor air) or construction/excavation trenches (trench air). For the purposes of the revised PSRA, the point of compliance (POC) for construction/excavation activities is 10 feet bgs.

The following five IAs were identified as having one or more chemicals in either or both soil (less than or equal to 10 feet bgs) and groundwater at concentrations above medium-specific GNS or VISL values: IA-2, IA-4, IA-5, IA-10, and IA-14. Additional information for those IAs not addressed further in this property-specific risk assessment (IAs 1, 3, 6, 7, 8, 9, 11, 12, and 13) is presented in Appendix E, Tables 2 and 4, and summarized below:

- IA-1 (IAs -1a, -1b, and -1c) – The primary concern at IA-1 was a potential release from the snow melting system beneath the parking lot in that area (IAs -1a and -1b). Only one chemical of concern (COC), ethylene glycol, was identified for shallow soil in IA-1 in accordance with OAC 3745-300-06. Ethylene glycol was not detected in any soil sample collected at IA-1. The only exception was soil boring IA1-6 which was extended to address the potential impact of the Rack Wash building (IA-1c) located immediately upgradient of the boring location and thus sampled for VOCs. The sample from soil boring IA1-6 was collected from 15 feet bgs which is deeper than the range of subsurface soil (0 to 10 feet bgs) considered for potential direct contact for human receptors. It should be noted that all VOCs were detected at concentrations less than their respective medium-specific GNS values. Also, groundwater samples were not collected from IA-1. Therefore, IA-1 was not considered further.

- IA-3 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Therefore, IA-3 was not considered further.

- IA-6 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 2 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1. Similar groundwater results were not added to the Table 2 soil results because the only chemicals detected in IA-6 groundwater (monitoring well MW6-1) were gasoline range organics (GRO) and the C20-C34 petroleum fraction. The Property was given a NFA by the Ohio BUSTR (ODC 2003). Therefore, IA-6 was not considered further.

- IA-7 – Wipe sampling for polychlorinated biphenyls (PCB) were all nondetect (see Table E6 in Appendix E). Therefore, IA-7 was not considered further.

- IA-8 – Information regarding IA-8 includes the results of a geophysical survey conducted within the Main Plant Building and analysis of samples from soil boring IA4-10 (Tetra Tech 2015), – the closest soil boring to the Main Plant Building. IA4-10 was installed to evaluate the horizon corresponding to the "marriage station" as an additional investigative tool to support the geophysical investigation of that feature. The sample depth was targeted to correspond with the elevation of the feature as described in the Site-Specific Work Plan and the Phase II ESA (Tetra Tech 2015). As a result, no soil samples were collected within 25 feet bgs. Therefore, no potential for direct contact with site-related chemicals in soil was identified. Further, all chemical concentrations in soil (sample collected 25 to 27.5 feet bgs) were less than commercial/industrial and construction/excavation GNS values – see Appendix E). Also, groundwater samples were not collected from IA-8. Therefore, IA-8 was not considered further.

- IA-9 – The waste water treatment system is a closed loop and no evidence of a release was identified in association with this feature. In addition, the IA was limited to the footprint of the building. As a result, no Phase II PA activities were conducted in this area. This IA is considered resolved. The raw materials storage area to the east that was formerly included in IA-9 has been separated from the WWTP and now represents IA-14.

- IA-11 – Information regarding IA-11 was requested by Ohio EPA to support cost estimation for demolition of the building. Asbestos-containing building material (ACBM) is outside the scope of the VAP and the abatement was conducted under Ohio EPA oversight. Therefore, IA-11 was not considered further.

- IA-12 – Wood block flooring at various locations in the Main Plant Building has been removed. Analytical results were collected at Ohio EPA's request only to characterize the building materials for disposal purposes. Building materials (such as wood block flooring) are not eligible for inclusion under VAP. Therefore, IA-12 was not considered further.

- IA-13 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 4 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1. Also, groundwater samples were not collected from IA-13. Therefore, IA-13 was not considered further.

Similarly, as documented in Appendix E (see Table E-6), no chemical-specific exceedances of residential soil GNS values (see OAC 3745-300-08 (H) (2) (a)) were exceeded for the single sediment sample (SD12-LAN-0411) from Beer Road Ditch. Therefore, potential exposure by human receptors (recreationalists) to sediment in Beer Road Ditch was not considered further.

Therefore, the revised PSRA includes evaluation of potential location-specific exposures, risks, and hazards at IA-2, IA-4, IA-5, IA-10, and IA-14 (see Figure 2). The revised PSRA also includes an evaluation of potential off-property, but potentially property-related ecological exposures to sediment in the Beer Road Ditch (see Figure 4D).

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). A PSRA is also required at the Subject Property to evaluate the indoor air pathway in portions of the Subject Property that overlie or are located adjacent to groundwater containing volatile organic chemicals (VOC) at concentrations greater than Vapor Intrusion Screening Levels (VISL), a pathway for which there are no generic standards (OAC 3745-300-09(A)(3)(a)).

The risk assessment also addresses the requirement to evaluate the cumulative cancer risk to off-property human receptors under an industrial site remedy (OAC 3745-300-9(B) (1) (b) (i)) (see Section 5.3).

Finally, the revised PSRA includes a limited ecological risk assessment component for two primary reasons:

1. There are no complete exposure pathways to important ecological receptors other than surface water and sediment (see OAC 3745-300-9 (A)(3)(e)). The northern portion of the Subject Property is dominated by the former Main Plant Building and related paved parking and operational areas. The southern portion of the Subject Property is covered in grass and contains no unique ecological habitat or features, including natural surface water bodies.

2. As discussed in Section 1.1.1, storm water collection in drainage features on the Subject Property (including the Storm Water Retention Pond)) and discharge from the Subject Property is covered by NPDES permit 21S00045*GD. Surface water samples were collected for informational purposes only as part of the due diligence for the Subject Property and are not subject to any VAP applicable standards. Therefore, potential exposures to chemicals in surface water and on-property sediment and the associated risks and hazards are not addressed in this revised PSRA.

However, potential off-property ecological exposures to sediment in Beer Road Ditch were evaluated (see Section 5.4).

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 (COC), (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 Concern (COC)**, summarizes data collection and evaluation activities and identifies COCs.
- **Section 3.0, Exposure Assessment**, identifies potential human exposure pathways, estimates environmental concentrations of COCs 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 COC-specific toxicity criteria used in the risk assessment.
- **Section 5.0, Risk and Hazard Characterization**, presents estimates of carcinogenic risks and non-carcinogenic hazards, general conclusions regarding potential risks and hazards associated with exposures to COCs, 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 COC remediation or target performance standards.

References cited in this report are listed in Section 9.0. 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 six 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 medium-specific summary tables of Phase 2 ESA sampling results used as the basis for this Property-specific risk assessment. Finally, Appendix F presents an evaluation of off-property groundwater exposures.

2.0 DATA EVALUATION AND IDENTIFICATION OF COCS

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 COCs. COCs are chemicals carried through the entire risk assessment process for which carcinogenic risks and non-carcinogenic hazards are estimated. Section 2.1 discusses data collection and evaluation, and Section 2.2 summarizes the COC 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 at the Subject Property. 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.

- Phase I ESA (Tetra Tech 2011)
- Phase II ESA (Tetra Tech 2015)

Each of these data sources is summarized below.

Phase I ESA (Tetra Tech 2011)

The Phase I ESA was performed in general accordance with the Ohio VAP guidelines specified in Ohio Administrative Code (OAC) 3745-300-06. The objective of the Phase I ESA was to identify recognized, obvious, and likely on-site or off-site potential sources of contamination. Subsurface investigations were not conducted as part of the Phase I ESA. In fact, no medium-specific sampling was conducted as part of the Phase I ESA.

The evaluation of the Subject Property and the information contained in the Phase I ESA was based on conditions existing on the date of the site reconnaissance. The evaluation was conducted only for the Subject Property with limited visual observations of the adjacent properties. To the extent feasible, the Phase I ESA included an evaluation of past and present land uses at the Subject Property. Tetra Tech has based its conclusions and recommendations on the limited information available during the study.

The Phase I ESA included five types of information or activities as listed below:

- Information regarding the owner, property manager, and occupant(s)
- Summary of prior assessments. At the Subject Property, there were two:
  - Phase I ESA of Baler House (April 2008)
  - Phase I ESA of Subject Property (April 2011)
- Records review
- Site reconnaissance – conducted by Tetra Tech in January 2011
- Interviews

Based on these five sources of information, Tetra Tech identified 14 IAs (numbered IA-1 through IA-14 as presented in Section 1.2.1. Recommendations led to the identification of additional Ias as discussed as part of the Phase II ESA (see below).

Phase II ESA Report (Tetra Tech 2015)

The Phase II ESA was conducted under the Ohio VAP as codified by Ohio Administrative Code (OAC) 3745-300-07. The investigation was based on the Ias identified in the Phase I ESA conducted in 2011 (see above). The purpose of the Phase II ESA was to conduct an investigation sufficient to determine whether all applicable standards were met or to determine that remedial activities conducted in accordance with rule OAC 3745-300-11 at the Subject Property meet or will achieve applicable standards.

Tetra Tech finished the first part of Phase II by June 2011. The second part of the Phase II investigation was conducted between October 2011 and November 2012. Following the transfer of the Subject Property to the BCDC, Tetra Tech returned to the Subject Property for additional Phase II activities in June 2013 (these additional activities focused on the South Field Lower Terrace area). The Phase II medium-specific sampling activities are summarized below by medium and type of investigation. The reader is directed to the full Phase II ESA for additional detail as required (Tetra Tech 2015).

Soil Borings

The distribution of chemical contamination throughout the Subject Property was determined by installing continuously sampled soil borings and test pits. The soil borings were initially distributed across 11 Ias (Ias 1a, 1b, 1c, 2, 3, 4, 5, 6, 10, 13, and 14), with locations and sampling depths biased toward areas in which the greatest chance for contamination may exist and/or in areas where hydrogeological data was necessary. Soil boring locations were selected to provide the most conservative representation of chemical contamination at the Subject Property.

- The initial subsurface investigation was conducted in April 2011 and included installation of shallow and deep soil borings in Ias 1, 2, 3, 4, 5, 6, 10, and 14

- In April and May 2011, Tetra Tech installed four additional soil borings and excavated 17 seven-foot deep test pits at IA-5.

- In May 2011, three additional borings were installed to delineate contamination detected at IA-4.

- In December 2011, Tetra Tech installed 20 shallow borings at IA-4 to investigate the extent of polynuclear aromatic hydrocarbon (PAH) concentrations, specifically naphthalene, exceeding VAP soil direct contact standards for the commercial/industrial and construction/excavation scenarios.

- In November 2012, Tetra Tech installed eight additional soil borings at IA-4 to further delineate the extent of PAH contamination.

- In June 2013, Tetra Tech installed 32 additional shallow soil borings in the South Field Lower Terrace (IA-13).

Groundwater Monitoring Wells

Tetra Tech installed 12 groundwater monitoring wells at the Subject Property. The 12 locations and depth ranges were selected where soil sampling was not previously completed, and continuous samples of the subsurface materials were collected.

- Monitoring well locations MW2-1, MW2-2, MW4-7, MW5-1, MW5-2S, MW5-2D, MW5-4, MW10-1, and MW14-1 were sampled in April 2011. Monitoring wells MW1-6, MW6-1, and MW10-2 did not contain sufficient water for sampling.

- A second round of groundwater samples was collected in June 2011. Monitoring wells MW1-6, MW6-1, and MW14-1 did not contain sufficient water for sampling; however, a groundwater sample was collected from MW10-2. A sample was not collected from MW10-1; however, no exceedances were observed in the first round sample from that location.

Surface Water Sampling

Tetra Tech collected two surface water samples (one from the intake and one from the outfall of the Subject Property's storm water retention pond). These samples were collected for screening purposes only, as the storm water retention system at the Subject Property is regulated under an existing NPDES permit. As a result, issues related to storm water discharge and the sediments in the surface drainage network up gradient of the discharge point fall under the purview of the NPDES permit. Therefore, contaminant concentrations in surface water and on-property sediments were collected for informational purposes only as part of the due diligence for the Subject Property and are not subject to VAP applicable standards.

Sediment Sampling

Ten sediment samples were obtained throughout the Subject Property from the storm water collection and conveyance (retention) system. One sediment sample (SD12-LAN-0411) was collected in Beer Road Ditch on the downstream side of the Property's NPDES-permitted discharge point (see Figure 4D). The storm water collection system is under the purview of the Property's NPDES permit. Accordingly, the ten on-property sediment samples were not evaluated further. However, potential exposures to off-property sediment in Beer Road Ditch were evaluated for ecological receptors.

PCB Wipe Sampling

Ten wipe samples were collected from surfaces throughout the original Switch House (IA-7) in order to evaluate potential presence of PCBs related to past operations in this building.

Wood Block Floor Sampling

Seven composite wood block floor samples were collected from several areas of the Main Plant collectively referred to as IA-12.

Other Sampling

A standing water sample was collected from the basement of the original Switch House (IA-7) in order to screen the media for PCBs.

The results of all the medium-specific sampling conducted throughout the Subject Property were considered in the risk assessment for the specific purpose of identifying all COCs.

2.1.2 Data Evaluation

Medium-specific samples were collected using similar methodologies and were analyzed using the same or similar analytical methods. 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).

2.2 COC IDENTIFICATION

Consistent with Ohio EPA and U.S. EPA guidance, the first step in the COC 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 uncertain 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 (including the East Ontario Lake Plain [EOLP] ecoregion [Ohio EPA 2008] for sediments)
- 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 Subject Property, the PSRA did not consider the first of these factors. (Note: EOLP sediment values were not considered in the identification of sediment COCs, but were considered in the evaluation of sediment COCs). Similarly, in order to be health protective, the risk assessment did not consider the second of these factors. 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. Finally, VAP does not allow use of a concentration-toxicity screen as recommended by EPA. Therefore, the risk assessment considered as COCs for a particular medium all chemicals positively detected in at least one sample from that medium as described above.

Table 6 presents the soil (46 total, including those present at depths greater than 10 feet below ground surface [bgs] and therefore included for vapor intrusion only), groundwater (28 total), and sediment (21 total) COCs identified and carried through 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 COCs in soil and groundwater from beneath and near the Subject Property. 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.

3.1 EXPOSURE SETTING CHARACTERIZATION

The exposure settings at and surrounding the Subject Property, as well as historical and intended future operations (commercial/industrial), 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.

- Institutional controls will be put in place to limit the Subject Property to commercial/industrial use.
- Institutional controls will be put in place to prohibit potable groundwater use at the Subject Property.
- Groundwater at the Subject Property has been determined to be "Class B". Therefore, potable groundwater use (ingestion and dermal contact, as well as inhalation of volatiles released from potable groundwater use [e.g., showering] on site is considered incomplete; hence, there are no receptors at or in the direction of groundwater flow (see 3745-300-07(F)(7)(d) and 3745-300-10(B)(2)(c)(i)).

3.2 CONCEPTUAL SITE MODEL

The CSM links potential or actual contaminant releases to potential human and ecological exposures. As discussed in Section 1.1.2, future land use is expected to be commercial/industrial. In addition to potential exposures by commercial/industrial workers, the risk assessment also considers potential exposures by workers involved in construction and excavation activities. Potential residential development of the Subject Property will be prohibited using institutional controls, therefore, the risk assessment does not quantitatively evaluate potential residential exposures. Members of the general public may also be exposed off-property to a limited extent via inhalation of ambient air, potable groundwater use, and inhalation of indoor air (from groundwater). In addition, members of the general public engaged in recreational activities (referred to as recreationalists) off-property in Beer Road Ditch may be exposed to sediment via incidental ingestion and dermal contact. As discussed in Section 1.2.1, no exceedances of residential soil direct contact GNS values were observed in the single sediment sample from Beer Road Ditch; therefore, potential exposure by human receptors to sediment in Beer Road Ditch was not evaluated further.

Finally, ecological receptors (including, but not limited to, benthic invertebrates, amphibians, birds, and mammals) may be exposed to sediment in Beer Road Ditch.

Figure 3 shows the CSM, illustrating potential exposure pathways for future commercial/industrial and construction/excavation workers. Specifically, Figure 3 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

Three primary release/transport mechanisms were identified at the Subject Property. Each of these properties and the related IAs are listed below:

- Surface disposal – IAs 1, 6, and 13
- Spills and leaks – IAs 2, 3, 4, 5, 7, 8, 9, 10, 12, 14, and Beer Road Ditch
- Subsurface disposal – IA-5

These primary contaminant release and transport mechanisms resulted or potentially resulted in the contamination of surface and subsurface soil, as well as internal plant surfaces (including floors and walls), and sumps. Through mechanisms including the generation of fugitive dust, volatilization, leaching by percolation, and runoff/erosion, certain contaminants have migrated from the primary affected media into ambient air, groundwater, and the storm water system (including drainage ditches). Tertiary release and transport mechanisms including subsurface vapor transport have resulted or may in the future result in contamination of indoor air. It should be noted that the PSRA also considered potential preferential pathways (e.g., utilities and sumps). All sumps have been removed from the Subject Property as the result of demolition activities. The only utilities at the Subject Property are the process water sewer, sanitary sewer, and storm sewer lines. Samples were collected adjacent to the process water sewer and the effluent line from the Property's Waste Water Treatment Plant to the discharge into the Mansfield Municipal Waste Water System. Those sample locations are IA4-2, IA4-3, IA4-5, IA6-4, IA6-5, and IA6-6. Results from these sample locations were considered in the PSRA.

In addition to the exposure characterization assumptions described in Section 3.1, the risk assessment also assumes that potential human exposures to floors, walls, and other surfaces, as well as sumps at IAs 7, 8, and 12 are insubstantial for the following reasons: (1) PCBs were not detected in the wipe samples collected at the Old Switch House (see Table E6 in Appendix E), (2) the stained flooring and sumps at IA-8 were determined to require no further evaluation (based on the result of a geophysical survey conducted within the Main Plant Building and soil boring IA4-10 [all chemical concentrations in soil less than commercial/industrial and construction/excavation GNS values – see Appendix E] [Tetra Tech 2015]), (3) the wood block flooring at IA-12 has been removed and disposed of (analytical results were collected only to characterize the building materials for disposal purposes; building materials [such as wood block flooring] are not eligible for inclusion under VAP), and (4) the main plant building has been demolished and the building materials disposed, mitigating risk from building material issues within the main plant.

Finally, property-related contaminants may have discharged off-property through the Subject Property's NPDES-permitted discharge point (see Figure 4D). Any contaminants in surface water are under the purview of the NPDES permit and are not subject to VAP regulation. However, this is the location impacted by a diesel fuel release from an off-site source in the 1990s. As a result, sediment contamination in a single sample (SD12-LAN-0414) was evaluated, but only in terms of potential exposure by ecological receptors.

3.2.2 Potential Receptors and Exposure Pathways

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

Potential Receptors

Human exposures at the Subject Property are expected to occur almost exclusively as a result of work-related activities. Receptors are expected to include commercial/industrial workers employed at future commercial/industrial operations located at the Subject Property and construction/excavation workers hired as needed to perform construction/excavation activities such as utility installation and repair. Members of the general public and living off-property may also be exposed to Property-related contaminants released to groundwater, ambient air, and indoor air (from groundwater).

Exposure Pathways

Receptors are expected to be exposed to COCs in soil and groundwater at the Subject Property through a variety of exposure pathways as shown in the CSM (see Figure 3). The potentially complete exposure pathways evaluated in the risk assessment include the following:

- Incidental ingestion of, direct contact with, and inhalation of fugitive dusts and volatile contaminants from surface and subsurface soil (Note: commercial/industrial workers are expected to be exposed to subsurface soil only if intrusive construction/excavation activities result in subsurface soil [to a depth of 10 feet bgs] being brought to the surface and mixed with surface soil). As discussed in Section 1.2.1, the POC for construction/excavation activities is 10 feet bgs.

- Inhalation of VOCs from groundwater in a construction trench (construction/excavation workers only). (Note: as discussed in Section 1.2.1, the depth to groundwater at the Subject Property is ≥ 12 feet bgs. Since the POC for construction/excavation activities is 10 feet bgs, excavations are not expected to intersect the water table and therefore groundwater is not expected to directly enter excavated areas.. While there is potential for "leakage" from the confined layer in situations where an excavating operation overlies the confined unit, it is not expected that the excavation would be inundated and the volume of groundwater entering an excavation would be limited. Therefore, direct exposures [ingestion and dermal contact] will be negligible and was not evaluated).

- Inhalation of indoor air (commercial/industrial workers only). It should be noted that because ground water encountered in the glacial till unit at the Subject Property is classified as "Class B", potable groundwater use (ingestion and dermal contact, as well as inhalation of volatiles released from potable groundwater use) onsite is not considered complete (see Section 3.1 above). Therefore, the only potential exposure to groundwater by commercial/industrial workers that was evaluated in the property-specific risk assessment is inhalation of indoor air impacted via the vapor intrusion pathway.

Medium-specific analytical results form the basis for soil exposures. COC 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. At the Subject Property, potentially complete exposure scenarios are identified in the CSM (see Figure 3) and are associated with the following receptors:

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

Exposure scenarios for these receptors are discussed below.

Adult Commercial/industrial Workers

Adult commercial/industrial workers are expected to be employed either helping to build or providing support services related to manufacturing. Specifically, in December 2012, RACER sold the Subject Property to BCDC. Adult commercial/industrial workers are expected to be potentially exposed through the inhalation of VOCs originating from groundwater and through incidental ingestion of, direct contact with, and inhalation of fugitive dusts and volatile contaminants from surface and subsurface soil near the current main plant building.

Adult Construction/Excavation Workers

Adult construction/excavation workers are expected to be hired on an as-needed basis to perform limited construction and utility 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 the air within a construction/excavation trench, or through incidental ingestion of, direct contact with, and inhalation of fugitive dusts and volatile contaminants from surface and subsurface soil.

Adult and Child Residents

A limited number of residences are located north of the site along or just north of West Fourth Street (Lincoln Highway). Off-site residents may potentially be exposed at their homes only via inhalation of fugitive dusts and volatile chemicals from surface soil and potable groundwater use; however, prevailing winds in the area of the site are predominantly from the west. IA-4 is the northernmost IA at which chemical concentrations in soil were found to be greater than industrial soil GNS values. IA-4 is about 1,000 feet south-southeast of the closest current residential location along the north side of West Fourth Street. As documented in EPA's Regional Screening Levels (RSL) User's Guide (EPA 2014b), the inhalation exposure pathway (inhalation of fugitive dusts and volatile chemicals from soil) contributes much less to total chemical exposure as compared to potential exposure via incidental ingestion and dermal contact. Therefore, chemicals present in soil on the Subject Property present insubstantial risks and hazards to off-site residents.

As noted in the Phase I ESA, one federal public water supply (PWS) system and 57 state registered wells are located within one mile of the Subject Property. The federal PWS is a well field located between one-half and one mile east-southeast and is owned by the City of Ontario. In order to assess the potential for groundwater contamination measured in on-site wells to migrate off-site, chemical concentrations in the wells located closest to the perimeter of the Subject Property were evaluated in Section 5.4.

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 COC 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." Equations 3-1 and 3-2 are generic equations for calculating chemical intakes for the oral and dermal and inhalation exposure routes, respectively (EPA 1989, 2009).

$$I \text{ (oral or dermal)} = (C \times CR \times EF \times ED)/(BW \times AT) \tag{3-1}$$

$$I \text{ (inhalation)} = \frac{C \times ET \times EF \times ED}{AT} \tag{3-2}$$

where

I	=	Intake: 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 referred 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 Equations 3-1 and 3-2 were used to calculate pathway-specific worker exposure to COCs. The equations and parameter values used for each exposure pathway are presented in Table 8. 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 exposure 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 through various medium-specific exposure pathways (see Figure 3). Section 3.3.4 summarizes the medium-specific exposure scenarios that were summed in order to calculate total exposures for adult commercial/industrial and construction/excavation workers at each exposure point.

3.3.1 EPC Calculations

The EPC is defined as the concentration of a COC 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

When the Subject Property is redeveloped in the future, buildings may be constructed as slab-on-grade construction with limited intrusive excavation or with basements requiring more extensive intrusive excavation. Assuming slab-on-grade construction, commercial/industrial workers are assumed to be exposed to surface soil (defined as 0 to 2 feet bgs). Separate surface soil EPCs were calculated for IAs 2, 4, 5, 10, and 14. Consistent with EPA guidance, surface soil EPCs for industrial workers were 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 in a manner consistent with EPA guidance, including EPA's ProUCL Version 5.0 software package (EPA 2002b, 2013a). The specific procedures used for evaluation of the Subject Property-specific ProUCL results may be summarized as follows:

- When preparing the input file to calculate the EPC from the ProUCL 5.0 program, there must be at least 6 detected results. When there were fewer than six detected results, the default EPC was identified as the maximum detected concentration. When there were six or more samples with detected results, the recommended EPC was selected. If multiple EPCs were recommended, the higher concentration was used. Once an EPC was selected from a sample size of six or more, it was then compared to the maximum detected concentration. The final EPC selected was the lesser of the maximum detected concentration and the suggested EPC.

IA-specific surface soil EPCs are presented in Table 7. ProUCL output supporting these EPCs is presented in Appendix A. The soil sample locations at which analytical results used to calculate the commercial/industrial worker surface soil EPCs are shown in Figures 4A, 4B, 4C, 4E, and 4F.

Subsurface Soil EPCs

Assuming basement construction during future redevelopment, the more extensive and intrusive excavation and associated site grading is assumed to bring soil from as deep as 10 feet bgs to the surface where it is assumed to become mixed with surface soil. Under these conditions, commercial/industrial workers are assumed to be exposed to soil from the entire 0 to 10 feet bgs soil column. Separate IA-specific subsurface soil EPCs were calculated for Ias 2, 4, 5, 10, and 14 and are presented in Table 7. ProUCL output supporting these EPCs is presented in Appendix A. The soil sample locations at which analytical results used to calculate the commercial/industrial worker surface soil EPCs are shown in Figure 4A, 4B, 4C, 4E, and 4F.

In contrast to commercial/industrial workers who are assumed to move freely throughout an exposure area, construction/excavation workers are assumed to be exposed in discrete locations in each exposure area (for example, in a construction trench). Also, construction/excavation workers are assumed to be exposed to subsurface soil only (0 to 10 feet bgs). Therefore, consistent with EPA and Ohio EPA guidance, subsurface soil EPCs for construction/excavation workers were set equal to the maximum concentration of each COC in subsurface at each IA. As noted for commercial/industrial workers, separate IA-specific subsurface soil construction/excavation worker EPCs were calculated for Ias 2, 4, 5, 10, and 14 and are presented in Table 7. ProUCL output supporting these EPCs is presented in Appendix A. The soil sample locations at which analytical results used to calculate the construction/excavation worker subsurface soil EPCs are shown in Figure 4A, 4B, 4C, 4E, and 4F.

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/excavation workers. COC-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 COCs from groundwater into a trench and a box model to estimate dispersion of the COCs from the air inside the trench into aboveground air (VDEQ 2014). VDEQ recommends the use of two separate models – the first model is for situations where the depth to groundwater is greater than 15 feet bgs (this applies to Ias 2, 4, 10, and 14 which are located in the Upper Terrace at the Subject Property where the depth to groundwater is about 25 feet bgs) and the second model is used for situations where the depth to groundwater is less than or equal to 15 feet (this applies to IA-5 which is located in the Lower Terrace at the Subject Property where the depth to groundwater is about 12 feet bgs). Appendix B further describes the modeling and presents the COC-specific construction trench air EPCs calculated using the VDEQ models. Area-specific construction trench air EPCs are presented in Table 7.

Groundwater- and Soil-to-Indoor Air EPCs

Commercial/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 Subject Property until such time as contaminant concentrations in groundwater are at acceptable levels. However, commercial/industrial workers may be exposed to VOCs that potentially migrate from groundwater to soil gas and then to indoor air within work spaces, therefore, EPA's Johnson and Ettinger model was used to estimate the concentration of volatile COCs in indoor air due to potential vapor intrusion encroachment. As input to EPA's GW-ADV-Feb04.xls spreadsheet, the groundwater concentration was set equal to the maximum concentration of each volatile COC detected in groundwater at each IA. The monitoring wells from which groundwater analytical results used to identify the groundwater concentrations used to calculate the groundwater-based indoor air EPCs are shown in Figure 4G.

In addition to volatile chemicals migrating via vapor intrusion from groundwater to indoor air, volatile chemicals may also migrate from soil to indoor air via a similar mechanism. EPA's SL-ADV-Feb04.xls spreadsheet model was used to calculate soil-based indoor air EPCs. As input to this model, the maximum concentration of each volatile chemical detected in soil (from any depth) was identified for each IA. The soil sample locations at which analytical results used to identify the soil concentrations used to calculate the soil-based indoor air EPCs are shown in Figures 4A, 4B, 4C, 4E, and 4F.

The assumptions and input parameter values used to model potential indoor air concentrations are discussed below under "Indoor Air EPCs."

Indoor Air EPCs

As discussed above under "Groundwater- an Soil-to-Indoor Air EPCs," indoor air EPCs were estimated from both groundwater and soil using EPA's Johnson and Ettinger models specifically EPA's GW-ADV-Feb04.xls and SL-ADV-Feb04.xls spreadsheets (EPA 2004a, 2004b). Model-specific inputs and results are presented in Appendix C. The model-specific indoor air concentrations were used as the indoor air EPCs for medium-specific (groundwater and soil) indoor air exposure scenarios for each IA. IA-specific groundwater- and soil-based indoor air concentrations were obtained from the "Intercalcs" page of the modeling results. For groundwater, the indoor air concentration is the "Infinite source building concentration". For soil, the indoor air concentration is the "Final finite source building concentration"; the soil-based indoor air concentration is identified as finite because a lower depth of contamination was identified at each IA.

To the maximum extent possible, input parameter values required by the spreadsheet were based on site-specific conditions. Tables C-1 and C-2 in Appendix C present the Johnson and Ettinger input parameters used in EPA's GW-ADV-Feb04.xls and SL-ADV-Feb04.xls spreadsheets, respectively. These input parameter values and calculated indoor air concentrations (see Tables C-3 through C-90 in Appendix C) were submitted as part of the Phase II ESA (Tetra Tech 2015). No comments were received on the indoor air EPCs. To be more specific, air modeling input parameters for Ias 2, 4, 5, 9, and 10 were based on expected future land use. However, because the future configuration of work spaces at these Ias are not know, the property-specific risk assessment employed default EPA- and Ohio EPA-recommended dimensions: length (10 meters [m]), width (10 m), and height (2.4 m) (EPA 2002a, Ohio EPA 2010). IA-specific groundwater- and soil-based indoor air concentrations are presented in Table 7.

3.3.2 Pathway-Specific Intake Equations and Exposure Parameters

Table 8 presents the pathway-specific intake equations and exposure parameter values used to estimate receptor-specific exposure under RME conditions for each exposure pathway. 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 2014) and EPA's RSL User's Guide (EPA 2014b).

Consistent with the intended future land use at the Subject Property (commercial/industrial), exposures were calculated for two receptor groups: adult commercial/industrial workers and adult construction/excavation workers. Table 8 summarizes the basis for each receptor-specific exposure parameter value for the potential exposure routes evaluated. Table 9 presents the COC-specific chemical factors used in the exposure calculations. Receptor-specific doses under RME conditions are presented in Tables D6.1 through D10.2 in Appendix D.

3.3.3 Fate and Transport Modeling

As discussed in Section 3.3.1, EPA's GW-ADV-Feb04.xls and SL-ADV-Feb04.xls spreadsheets (based on the Johnson and Ettinger models) were used to estimate indoor air EPCs from groundwater and soil, respectively.

EPA's Vapor Intrusion Screening Level (VISL) Calculator (EPA 2014c) was used to provide a second set of comparative indoor air EPCs, risks, and hazards based on the potential migration of volatile contaminants from groundwater to indoor air. (EPA's VISL Calculator does not address the soil to indoor air migration pathway). Inputs to EPA's VISL Calculator are more limited than the Johnson and Ettinger model-based spreadsheets discussed in Section 3.3.1. The only required inputs are: (1) receptor type (only commercial/industrial workers were evaluated via the off-property vapor intrusion pathway), (2) groundwater temperature (used the same temperature, 16° C as used in EPA's GW-ADV-Feb04.xls spreadsheet [see Table C-1 in Appendix C for documentation of this temperature]), and (3) groundwater concentration (used the same groundwater concentrations as used for inputs to EPA's GW-ADV-Feb04.xls [see Tables C-3 through C-29 in Appendix C]). It should be noted that some chemicals evaluated in EPA's GW-ADV-Feb04.xls spreadsheet are not included in EPA's VISL Calculator. Primarily, the absent chemicals are PAHs with limited volatility.

3.3.4 Calculation of Total Exposures

As discussed in Section 3.3, human receptors are expected to be exposed to COCs through various medium-specific exposure pathways. Exposures were evaluated for a series of five on-property exposure points – IAs 2, 4, 5, 10, and 14 (see Figure 2).

Commercial/industrial workers are assumed to be exposed through potential inhalation of VOCs in indoor air, as well as through incidental ingestion, dermal contact, and inhalation of fugitive dusts and volatile contaminants in soil at IAs 2, 4, 5, 10, and 14. The medium-specific exposure pathways that were summed to calculate exposure point-specific total exposures for commercial/industrial workers located at each IA are summarized below.

- **IA-2** – inhalation of indoor air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contamination from soil. (The maximum detected concentration of each chemical detected in soil from 0 to 10 feet [the POC for construction/excavation activities] was used to prepare a multiple chemical adjustment)..
- **IA-4** – inhalation of indoor air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contaminants from surface and subsurface soil (two separate totals were prepared – one with indoor air and surface soil and a second with indoor air and subsurface soil).
- **IA-5** – inhalation of indoor air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contaminants (two separate totals were prepared – one with indoor air and surface soil and a second with indoor air and subsurface soil).
- **IA-10** – inhalation of indoor air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contamination from soil. (The maximum detected concentration of each chemical detected in soil from 0 to 10 feet [the POC for construction/excavation activities] was used to prepare a multiple chemical adjustment).
- **IA-14** – inhalation of indoor air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contamination from soil. (The maximum detected concentration of each chemical detected in soil from 0 to 10 feet [the POC for construction/excavation activities] was used to prepare a multiple chemical adjustment).

Construction/excavation workers are assumed to be exposed through potential inhalation of VOCs in trench air and incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile contaminants in subsurface soil at IAs 2, 4, 5, 10, and 14.

4.0 TOXICITY ASSESSMENT

This section identifies the toxicity values used to quantify potential adverse effects on human health associated with potential exposures to COCs in soil, groundwater, and air. These toxicity factors include slope factors (SF) for carcinogenic COCs and reference doses (RfD) for noncarcinogenic COCs. Sections 4.1 and 4.2 discuss the toxicity factors used to assess the carcinogenic and noncarcinogenic effects of COCs, respectively.

4.1 TOXICITY FACTORS FOR CARCINOGENIC COCS

For regulatory purposes, it is conservatively assumed that carcinogenic chemicals do not exhibit a response threshold (EPA 1986). However, recent scientific evidence clearly indicates that this assumption is an oversimplification of carcinogenic responses. A growing number of chemicals have been shown to elicit carcinogenic effects in experimental animals via mechanisms that are either not relevant to human biological processes or not expected to occur in humans at significantly lower, environmentally relevant doses (James and Saranko 2000). The EPA has revised the Guidelines for Carcinogen Risk Assessment (2005b), in which EPA recognizes these issues and provides alternative approaches for addressing them within the regulatory framework for cancer risk assessment.

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).

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 Ohio EPA's VAP Chemical Information Database and Applicable Regulatory Standards (CIDARS) (Ohio EPA 2014b). 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 National Center for Environmental Assessment (NCEA) Provisional Peer Reviewed Toxicity Values (PPRTV)
- Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles
- California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment, Toxicity Criteria Database
- Health Effects and Assessment Summary Tables (HEAST) toxicity information
- 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.

In cases where SFs were not available from Ohio EPA-recommended sources (Ohio EPA 2014b), SFs were selected from EPA's RSL tables (EPA 2014a), as recommended by Ohio EPA (Tetra Tech 2014). Finally, in some instances, SFs were not available from either Ohio EPA or EPA sources. In these instances, appropriate surrogates were identified based on chemical-similarity.

Table 10 presents COC-specific oral and inhalation SF values used in the risk assessment.

4.2 TOXICITY FACTORS FOR NONCARCINOGENIC COCS

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 COC was assessed by comparing an exposure estimate for intake (ADD) to an RfD. The RfD represents an estimated daily intake rate for a noncarcinogenic COC 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 commercial/industrial worker exposures and subchronic RfDs were used to characterize hazards associated with construction/excavation worker exposures. These RfDs were identified for Table 2 of Ohio EPA's VAP CIDARS (Ohio EPA 2014b) as supplemented by EPA's RSL Table (EPA 2014a) 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 10 presents COC-specific oral and inhalation chronic and subchronic RfD values used in the risk assessment.

4.3 TOXICITY FACTORS FOR ECOLOGICAL RECEPTORS

Potential exposures by ecological receptors to off-property sediment were evaluated by comparing sediment concentrations to ecological standards/benchmarks as per OAC 3745-300-08 (I) as discussed in Section 5.4.

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 COCs 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 qualitatively evaluates the risks and hazards associated with potential off-site exposures to Subject Property-related chemicals by members of the general public (residents and recreationalists). This evaluation is intended to meet the requirements of OAC 3745-300-09 (B)(1)(b)(i).

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 used to evaluate risks to ecological receptors to sediment at an off-property location (Beer Road Ditch).

5.1.1 Carcinogenic Risks

For carcinogenic COCs, risk estimates represent the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to the COC (EPA 1989). These ELCRs are calculated as shown in Equation 5-1 below:

$$\text{Upper-Bound ELCR (Risk)} = \text{LADD} \times \text{SF} \qquad (5\text{-}1)$$

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 Subject Property will be commercial/industrial. Therefore, a cumulative carcinogenic target risk level of 1E-05 for commercial/industrial and construction/excavation workers is applicable, per OAC 3745-300-09 (B) (1) (b) (i). The additional requirement that the cumulative cancer risk to off-property receptors, attributable to COCs, is less than 1E-05 (OAC 3745-300-09 (B) (1) (a)) is demonstrated in Section 5.4.

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 5-2.

$$Risk_{(EP)} = Risk_1 + Risk_2 + \ldots + Risk_i \tag{5-2}$$

where

$Risk_{(EP)}$ = Total risk for a given exposure pathway

$Risk_i$ = Risk estimate for the ith COC

At particular exposure points, receptors may be exposed through a number of exposure pathways (see the CSM in Figure 3). 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 5-3.

$$\text{Total Risk} = \text{Risk}\ (EP_1) + \text{Risk}\ (EP_2) + \ldots + \text{Risk}\ (EP_j) \tag{5-3}$$

where

Total Risk = Risk resulting from multiple exposure pathways

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 COCs can be estimated as the sum of the carcinogenic risks posed by individual COCs (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 5-4.

$$HQ = ADD/RfD \tag{5-4}$$

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 Subject Property (commercial/industrial) a cumulative target hazard of 1 is applicable per OAC 3745-300-09 (B) (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 COCs 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 COCs through a single pathway was calculated as shown in Equation 5-5.

$$HI_{(EP)} = HQ_1 + HW_2 + \ldots + HQ_i \tag{5-5}$$

where

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

HQ_i = Hazard quotient for the ith COC

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

As discussed in Section 5.1.1 for carcinogenic COCs, 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 5-6.

$$\text{Total HI} = \text{HI (EP1)} + \text{HI (EP2)} + \ldots + \text{HI (EPj)} \qquad (5\text{-}6)$$

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 COC with an HQ exceeding 1 or (2) several COCs 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 COCs 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 Ecological Risks

.In accordance with OAC 3745-300-08 (I) (2), sediment sampling results were compared to the following reference values, when available, in the following hierarchy:

1. Ohio EPA's "Guidance for Conducting Ecological Risk Assessments," Attachment H (Ohio EPA 2008).
2. MacDonald, Ingersoll, and Berger. 2000. "Development and Evaluation of Consensus-based Sediment Quality Guidelines for Freshwater Ecosystems."
3. U.S. EPA Region 5 Ecological Screening Levels (EPA 2003).

One sediment sample, SD12-LAN-0411, was collected downgradient of the NPDES-permitted discharge point (see Figure 4D). Analytical results from this sample were compared to the reference values, and the results are included in Table 5. For one contaminant of concern, ethylene glycol, reference values were not available in any of the sources listed above. In this case, a reference value from the National Oceanic and Atmospheric Administration's (NOAA) Screening Quick Reference Tables (SQuiRT) was used (NOAA 2008).

5.2 ON-PROPERTY 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 commercial/industrial workers (Section 5.2.1) and construction/excavation workers (Section 5.2.2). Each section summarizes the exposure scenarios and receptors evaluated. For each receptor, risks are discussed first, followed by hazards.

COCs contributing significantly to potentially significant risks and hazards are identified. 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 not considered further. Total risks are compared to a cumulative target risk of 1E-05 for commercial/industrial and construction/excavation workers, based on the intended future commercial/industrial use of the Subject Property (OAC 3745-300-09 (B) (1) (a)). 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 commercial/industrial use of the Subject Property (OAC 3745-300-09 (B) (2).

Table 11 summarizes the risks and hazards for each of the IAs and for the two worker exposure scenarios.

5.2.1 Commercial/Industrial Workers

This section discusses risks and hazards calculated for commercial/industrial workers for each of the IAs evaluated in the risk assessment: IA-2, IA-4, IA-5, IA-10, and IA-14. Risks are discussed in Section 5.2.1.1, and hazards are discussed in Section 5.2.1.2.

5.2.1.1 Risks

This section discusses risks calculated for commercial/industrial workers for IA-2, IA-4, IA-5, IA-10, and IA-14. It should be noted that risks specific to IAs 2, 10, and 14 are calculated and presented in two places – risks based on potential exposure through inhalation of indoor air are presented in Tables D1.1, D4.1, and D5.1 in Appendix D and risks associated with potential exposure through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile COCs in soil are presented in Tables 1 and 3 for IAs 2 and 10. No direct contact exposures were evaluated for IA-14 because all soil samples were collected deeper than 10 feet, the POC for construction/excavation activities. Risks specific to IAs 4 and 5 based on potential exposure through incidental ingestion of, dermal contact with, inhalation of fugitive dusts and volatile COCs associated with surface soil, and inhalation of indoor air are presented in Tables D2.1 and D3.1 in Appendix D.

IA-2

The IA-specific total risk for commercial/industrial workers based on inhalation of indoor air at IA-2 is 2E-09 (see Table D6.1 in Appendix D). The IA-specific total risk for commercial/industrial workers based on direct contact soil exposures is 2E-10 (see Table 1). The overall total IA-specific risk is 2E-09. This result is less than the cumulative target risk of 1E-05 for commercial/industrial workers identified for commercial/industrial land use, with consideration of off-site exposures (OAC 3745-300-09 (B) (1) (a))commercial/industrial; and less than 1E-06. EPC calculations in IA-2 are shown on Tables D1.1 through D1.4 in Appendix D.

IA-4

The IA-specific total risk for commercial/industrial workers at IA-4 is 4E-04 based on direct exposure to surface soil (that is, assuming no extensive intrusive excavation or grading activity [e.g., slab-on-grade construction]) and 2E-04 based on direct exposure to subsurface soil (brought to the surface as the result of extensive intrusive excavation and grading activities [e.g., construction of buildings with basements]) (see Table D7.1 in Appendix D). In both cases, the total risks are driven by potential exposure to carcinogenic PAHs in soil. Potential exposure via inhalation of indoor air contaminated as a result of volatile chemicals migrating via vapor intrusion from subsurface soil contributes a pathway-specific total risk of 1.4E-05 (entirely driven by naphthalene, another PAH). However, risks associated with inhalation of indoor air contaminated as a result of volatile chemicals migrating via vapor intrusion from groundwater contributes only a limited amount of risk (4.8E-09).

Both surface soil-based and subsurface soil-based total IA-specific risks exceed both the cumulative target risk of 1E-05 for commercial/industrial workers identified for commercial/industrial land use, considering off-site exposures (OAC 3745-300-09 (B)(1)(a))commercial/industrial. EPC calculations in IA-4 are shown on Tables D2.1 through D2.5 in Appendix D.

IA-5

The IA-specific total risk for commercial/industrial workers at IA-5 is 1E-05 based on direct exposure to surface soil or subsurface soil (see Table D8.1 in Appendix D). These results are equal to the cumulative target risk of 1E-05 for commercial/industrial workers identified for industrial land use, considering off-site exposures (OAC 3745-300-09 (B)(1)(a)).). The risks are driven by potential direct exposure to arsenic (1E-05) in soil. It should be noted that the EPC for arsenic in both surface and subsurface soil is 15 milligrams per kilogram (mg/kg), which is similar to the concentration of arsenic (13.8 to 14 mg/kg) measured in soil samples collected at two locations judged to be insignificantly impacted by property activities (see Table E2 in Appendix E). It is recognized that these two locations do not meet the VAP background requirements (OAC 3745-300-07 (H)). The results from these two soil samples are only presented to provide context. EPC calculations in IA-5 are shown on Tables D3.1 through 3.5 in Appendix D.

IA-10

The IA-specific total risk for commercial/industrial workers based on inhalation of indoor air at IA-10 is 1E-05 (see Table D10.1 in Appendix D). The IA-specific total risk for commercial/industrial workers based on direct contact soil exposure is 3E-06 (see Table 3). The overall total IA-specific risk is 1E-05. This result is equal to the cumulative target risk of 1E-05 for commercial/industrial workers identified for industrial land use, considering consideration of off-site exposures (OAC 3745-300-09 (B)(1)(a))commercial/industrial. The total risks are driven by potential direct exposure to arsenic (1.2E-05) in soil. It should be noted that the EPC for arsenic in both surface and subsurface soil is 18 mg/kg, which is similar to the concentration of arsenic (13.8 to 14 mg/kg) measured in soil samples collected at two locations judged to be insignificantly impacted by property activities (see Table E2 in Appendix E). It is recognized that these two locations do not meet the VAP background requirements (OAC 3745-300-07 (H)). The results from these two soil samples are only presented to provide context. EPC calculations in IA-10 are shown on Tables D5.1 through 5.4 in Appendix D.

IA-14

The IA-specific total risk for commercial/industrial workers based on inhalation of indoor air at IA-14 is 1E-08 (see Table D9.1 in Appendix D). This result is less than the cumulative target risk of 1E-05 for commercial/industrial workers,, with consideration of off-site exposures (OAC 3745-300-09 (B) (1) (a))commercial/industrial and less than 1E-06. EPC calculations in IA-14 are shown on Tables D4.1 through 4.3 in Appendix D.

5.2.1.2 Hazards

This section discusses hazards calculated for commercial/industrial workers for IA-2, IA-4, IA-5, IA-10, and IA-14. It should be noted that hazards specific to IAs 2, 10, and 14 are calculated and presented in two places – risks based on potential exposure through inhalation of indoor air are presented in Tables D1.1, D4.1, and D5.1 in Appendix D and hazards associated with potential exposure through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile COCs are presented in Tables 1 and 3. Direct contact exposures to soil at IA-14 were not calculated because soil samples were collected deeper than 10 feet, the POC for construction/excavation activities. Hazards specific to IAs 4 and 5 are based on potential exposure through incidental ingestion of, dermal contact with, inhalation of fugitive dusts and volatile COCs associated with surface soil, and inhalation of indoor air (see Tables D2.1 and D3.1 in Appendix D).

IA-2

The IA-specific total HI for commercial/industrial workers based on inhalation of indoor air at IA-2 is 7E-03 (see Table D6.1in Appendix D). The IA-specific total HI for commercial/industrial workers based on direct contact soil exposure is 2E-02 (see Table 1). The overall IA-specific total HI is 3E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (B) (2)).

IA-4

The IA-specific total HI for commercial/industrial workers at IA-4 is 5E-01 based on direct exposure to surface soil and 2 based on direct exposure to subsurface soil (see Table D7.1in Appendix D). The surface soil result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (C) (2)). The subsurface soil result exceeds the than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (B) (2)). However, all COC-specific HIs are less than 1. The largest COC-specific HI is 0.92 for the petroleum fraction C20-C34. The next two highest COC-specific HIs are 0.38 for naphthalene and 0.16 for the petroleum fraction C10-C20. Assuming that the two petroleum fractions cause adverse health effects via similar mechanisms, the segregated HI based on the two petroleum fractions (C20-C34 and C10-C20) is 1.08 or 1 (rounded to one significant figure as recommended by Ohio's VAP (OAC 3745-300-09 (B)(3)).

IA-5

The IA-specific total HIs for commercial/industrial workers at IA--5 based on potential exposure to surface and subsurface soil are 8E-02 and 5E-02 (see Table D8.1in Appendix D). These results are less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (B) (2)).

IA-10

The IA-specific total HI for commercial/industrial workers based on inhalation of indoor air at IA-10 is 5E-02 (see Table D10.1in Appendix D). The IA-specific total HI for commercial/industrial workers based on direct contact soil exposure is 2E-02 (see Table 3). The overall IA-specific total HI is 7E-02. This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (B) (2)).

IA-14

The IA-specific total HI for commercial/industrial workers based on inhalation of indoor air at IA-14 is 7E-04 based on exposure to subsurface soil (see Table D9.1in Appendix D). This result is less than the cumulative target hazard of 1 identified for industrial land use (OAC 3745-300-09 (B) (2)). (Note: no surface soil samples were collected at IA-14).

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-2, IA-4, IA-5, IA-10, and IA-14. 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. Table 11 summarizes IA-specific risks and hazards for construction/excavation workers.

5.2.2.1 Risks

This section discusses risks calculated for construction/excavation workers for IA-2, IA-4, IA-5, IA-10, and IA-14 (see Tables D6.2 through D10.2 in Appendix D and Tables 1 and 3). It should be noted that risks specific to IAs 2, 10, and 14 are calculated and presented in two places – risks based on potential exposure through inhalation of trench air are presented in Tables D6.2, D8.2, and D9.2 in Appendix D and risks associated with potential exposure through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile COCs in soil are presented in Tables 1 and 3. Direct contact exposures to soil were not calculated for IA-14 because all soil samples were collected deeper than 10 feet, the POC for construction/excavation activities. Risks specific to IAs 4 and 5 based on potential exposure through incidental ingestion of, dermal contact with, inhalation of fugitive dusts and volatile COCs associated with subsurface soil, and inhalation of trench air are presented in Tables D7.2 and D8.2 in Appendix D.

IA-2

The total risk for construction/excavation workers based on inhalation of trench air at IA-2 is 2E-08 (see Table D6.2 in Appendix D). The total risk for construction/excavation workers based on direct contact soil exposure is 9E-12 (see Table 1). The overall total risk is 2E-08. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B)(1)(a)) and is less than 1E-06.

IA-4

The total risk for construction/excavation workers at IA-4 is 2E-05 (see Table D7.2 in Appendix D). This result exceeds the cumulative target risk of 1E-05 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (1) (a)). The total risk is driven by potential exposure to carcinogenic PAHs in subsurface soil.

IA-5

The total risk for construction/excavation workers at IA-5 is 8E-06 (see Table D8.2 in Appendix D). This result exceeds 1E-06, but is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (1) (a)).

IA-10

The total risk for construction/excavation workers based on inhalation of trench air at IA-10 is 9E-06 (see Table D10.2 in Appendix D). The total risk for construction/excavation workers based on direct contact soil exposure is 2E-07 (see Table 3). The overall total risk for construction/excavation workers is 9E-06. This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (1) (a)).

IA-14

The total risk for construction/excavation workers based on inhalation of trench air at IA-14 is 2E-12 (see Table D9.2 in Appendix D). This result is less than the cumulative target risk of 1E-05 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (1) (a)) and is less than 1E-06.

5.2.2.2 Hazards

This section discusses hazards calculated for construction/excavation workers for IA-2, IA-4, IA-5, IA-10, and IA-14 (see Tables D1.2 through D5.2 in Appendix D). It should be noted that hazards specific to IAs 2, 10, and 14 are calculated and presented in two places – hazards based on potential exposure through inhalation of trench air are presented in Tables D6.2, D8.2, and D9.2 in Appendix D and risks associated with potential exposure through incidental ingestion, dermal contact, and inhalation of fugitive dust and volatile COCs in soil are presented in Tables 1 and 3. Direct contact exposures to soil were not calculated for IA-14 because all soil samples were collected deeper than 10 feet bgs, the POC for construction/excavation activities. Hazards specific to IAs 4 and 5 based on potential exposure through incidental ingestion of, dermal contact with, inhalation of fugitive dusts and volatile COCs associated with subsurface soil, and inhalation of trench air are presented in Tables D7.2 and D8.2 in Appendix D.

IA-2

The total HI for construction/excavation workers based on inhalation of trench air at IA-2 is 1E-02 (see Table D6.2 in Appendix D). The total HI for construction/excavation workers based on direct contact soil exposure is 2E-02 (see Table 1). The overall total HI for construction/excavation workers is 3E-02. This result is less than the cumulative target hazard of 1 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (2)).

IA-4

The total HI for construction/excavation workers at IA-4 is 1 (see Table D7.2 in Appendix D). This result equals the cumulative target hazard of 1 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (2)).

IA-5

The total HI for construction/excavation workers at IA-5 is 2 (see Table D8.2 in Appendix D). This result exceeds the cumulative target hazard of 1 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (2)). This result is driven by potential exposure to trichloroethene in construction trench air. The concentration of trichloroethene in the air within a construction trench was estimated based on the maximum detected concentration in groundwater at IA-5. In fact, trichloroethene was detected at only a single well (MW5-2S) out of a total of four wells (MW5-1, MW5-2S, MW5-2D, and MW5-4). The maximum detected concentration measured at well MW5-2S in April 2011 was 11 micrograms per liter (µg/L). However, a second sample was collected from MW5-2S in June 2011 and trichloroethene was detected at a concentration of 7.7 µg/L. Using this second concentration, the hazard index (HI) for trichloroethene was reduced to 1.1 and the total HI was reduced from 1.6 (which rounds to 2 at one significant figure) to 1.2 (which rounds to 1 at one significant figure) (see OAC 3745-300-09 (B) (3)).

IA-10

The total HI for construction/excavation workers based on inhalation of trench air at IA-10 is 5E-02 (see Table D10.2 in Appendix D). The total HI for construction/excavation workers based on direct contact soil exposure is 3E-02. The overall total HI for construction/excavation workers is 8E-02. This result is less than the cumulative target hazard of 1 identified for construction/excavation workers under commercial/industrial land use (OAC 3745-300-09 (B) (2)).

IA-14

No hazard was able to be calculated for construction/excavation workers based on inhalation of trench air at IA-14 because none of the identified COCs had noncancer volatile inhalation toxicity factors (see Tables 7, 11, and Table D9.2 in Appendix D).

5.2.3 HAZARD SEGREGATION

As discussed in Section 5.2, with a few identified exceptions, all IA-specific total hazards are less than or equal to the target hazard of 1. At IA-4 for commercial/industrial workers (Section 5.2.1.2) a total hazard greater than 1 was identified, with no COC-specific HI >1. In this case, the total HI (calculated as the sum of all COC-specific HIs regardless of the mechanism(s) of toxicity [see Section 5.1.2]) was reevaluated (or segregated) based on COCs that cause adverse health effects via similar mechanisms. The highest segregated HI (based on the petroleum fractions C10-C20 and C20-C34) was determined to be equal to 1.

5.3 POTENTIAL OFF-SITE EXPOSURES

Members of the general public may be exposed at off-site locations to Subject Property-related chemicals via a variety of exposure pathways. Under VAP requirements at OAC 3745-300-09 (B)(1)(a), when using a target cumulative risk of 1E-05 for a commercial/industrial land use, it must be demonstrated that potential off-site exposures are not associated with a cumulative cancer risk of 1E-05. As discussed in Section 3.2, any potential exposure via inhalation of Subject Property-related soil contaminants that have migrated off-site via volatilization and/or particulate emissions is expected to be insubstantial. Members of the general public may also be exposed via potential potable groundwater use and via direct contact with sediments. Potential risks and hazards associated with these potential off-site exposure pathways are discussed below.

Members of the general public, primarily nearby residents, could also theoretically be exposed through potable use of groundwater. As noted in Section 3.2.3, 1 PWS and 57 state-registered wells are located within 1 mile of the Subject Property. The potential for off-property migration and subsequent exposure via potable groundwater use is expected to be small for a number of reasons. First, while multiple state-registered wells are located within 1 mile of the Subject Property, this entire area is serviced by City water; all residents and businesses receive potable water from the public water supply. Second, groundwater monitoring well MW9-1 is located on the southeast boundary of the Subject Property. All chemicals detected in groundwater samples from this well are at concentrations less than their respective VAP UPUS values (see Appendix E). Finally, groundwater modeling was conducted from groundwater monitoring wells (MW2-1, MW2-2, MW5-2S/D, MW5-4, and MW10-1) at the Subject Property where chemicals (arsenic and trichloroethene) have been detected at concentrations exceeding their respective VAP UPUS values to the boundaries of the Subject Property (see Appendix F). The modeling results show that all modeled concentrations at the boundaries of the Subject Property are less than their respective VAP UPUS.

5.4 ECOLOGICAL RISK CHARACTERIZATION

This section discusses the risks to ecological receptors associated with potential exposure to COCs in sediment from Beer Road Ditch as explained in Section 5.1.4 (see Table 1). The total HI is 19; in all, 24 constituents were detected of which seven had a concentration that resulted in an HQ greater than 1, indicating potential for ecological effects. Constituents identified as COCs (and their maximum HQs) include:

- Acetone (1.7)
- Acenaphthene (2.2)
- Benzo(a)anthracene (1.7)
- Benzo(a)pyrene (1.1)
- Chrysene (1.5)
- Fluoranthene (1.4)
- Pyrene (2.3)

For COCs compared to reference values developed by MacDonald, Ingersoll, and Berger (2000), the threshold effect concentration (TEC) was used. However, all of the COC concentrations were less than their respective probable effect concentrations (PEC). The individual HQs and total HI are expected to be driven by off-property sources rather than the subject Property for the following reasons: (1) no releases of hazardous substances or petroleum products have been reported to the on-property drainage system and (2) viable off-property sources of PAHs are readily apparent and include traffic along Beer Road and various upgradient commercial/industrial operations. As identified in the Phase I ESA report (Tetra Tech 2011), documents provided by the Ohio EPA indicated a spill of diesel fuel originating from 815 North Beer Road (adjacent to the Subject Property's western border). The spill report pertains to an excess of oil and grease first observed in the permitted storm water effluent. Analytical results of discharge water sampled for oil and grease in October 1990 indicated an exceedance of acceptable levels. Ohio EPA and General Motors personnel investigated the source of the petroleum and discovered the probable source was a diesel fuel release at Bender & Loudon Freight at 815 Beer Road. Subsequent to the spill, petroleum was observed entering the drainage network at the subject property, and ultimately making its way through the stormwater pond to the Beer Road Ditch. Absorbent socks were put into place where two drainage ditches flow onto the Subject Property; however, the socks reportedly became tangled allowing the spill to flow onto the Subject Property and into the storm retention pond and beyond.

6.0 UNCERTAINTY ANALYSIS

Uncertainties are associated with all elements of the risk assessment process, from selection of COCs 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. Some of the potentially most significant areas of uncertainty are discussed in greater detail below.

- 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 COCs 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.

- The risk assessment assumes an institutional control will be implemented prohibiting potable groundwater use at the Subject Property. If such an institutional control is not implemented, potential groundwater exposures may have been underestimated. It should be noted that groundwater beneath the Subject Property is not currently used as a source of potable water.

- The risk assessment used modeling to estimate the concentrations of VOCs in indoor air (Johnson and Ettinger models) 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.

- Ohio EPA currently recommends that an ER value of 1 hr^{-1} be used (Tetra Tech 2006a, 2007a, OEPA 2007). However, it is not unreasonable to assume that future commercial/industrial buildings constructed on-property will meet 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 Subject Property. However, in order to be health-protective, an ER value of 1 hr^{-1} was assumed for commercial/industrial space (about equal to one-fourth of the ASHRAE-recommended value for future Subject Property 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}.

- Indoor air concentrations from groundwater were estimated primarily using EPA's GW-ADV-Feb04.xls spreadsheet (see Tables C-3 through C-29 in Appendix C). As discussed in the text and shown in Tables D.6.1 through D.9.1 in Appendix D, risks and hazards associated with potential inhalation of indoor air do not contribute significantly to total IA-specific risks and hazards. As a second line of evidence, indoor air concentrations (and associated risks and hazards) were also estimated using EPA's VISL Calculator (see Tables C-97 to C-100 in Appendix C). As summarized in Table 12, the indoor air concentrations estimated using EPA's VISL Calculator are between 6 and 416 times higher than indoor air concentrations estimated using EPA's GW-ADV-Feb04.xls spreadsheet. Even so, all estimated risks and hazards associated with inhalation of indoor air remain insubstantial. For example, the indoor air concentration of tetrachloroethene in groundwater at IA-5 showed the greatest increase based on the use of EPA's VISL Calculator as compared to EPA's GW-ADV-Feb04.xls spreadsheet – an increase of 416 times. Nonetheless, the risk associated with inhalation of indoor air using the VISL-based indoor air concentration resulted in a risk of only 7.8E-09 and a HQ of 2.1E-03. These results indicate that even using EPA's VISL Calculator, risks and hazards associated with inhalation of indoor air are not associated with significant risks and hazards and does not contribute significantly to total risks and hazards.

(Note: there are currently no basements left on the Subject Property as a result of the razing of site structures by the BCDC).

- 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 and EPA-recommended toxicity factors may introduce both some degree of under- and overestimation into the risk assessment.

- The total HI for construction/excavation workers at IA-5 was conservatively calculated as 2, which exceeds the target hazard of 1. However, as described in Section 5.2.2.2 this result can best be characterized as marginally significant and may actually be ≤ 1.

- The HQs calculated for ecological receptors in Beer Road Ditch are expected to be overestimated as discussed in Section 5.4.

7.0 SUMMARY AND CONCLUSIONS

This section summarizes the procedures used to complete and the results of the risk assessment (Section 7.1), reports, and 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. It is assumed that in the future the Subject Property will be used to support various commercial/industrial operations. Consistent with a future commercial/industrial land use, the risk assessment focused on potential exposures to two groups of receptors: commercial/industrial workers and construction/excavation workers. However, the risk assessment also evaluated off-property general public (primarily residential and recreational) exposures in a semi-quantitative 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 and construction/excavation activities. Additional information for those IAs not addressed further in this property-specific risk assessment (IAs 1, 3, 6, 7, 8, 9, 11, 12, and 13) is presented below:

- IA-1 (IA-1a, -1b, and -1c) – The primary concern at IA-1 was a potential release from the snow melting system beneath the parking lot in that area. Only one COC, ethylene glycol, was identified for shallow soil in IA-1 in accordance with OAC 3745-300-06. Ethylene glycol was not detected in any soil sample collected at IA-1 (IAs -1a and -1b). The only exception was soil boring IA1-6 which was extended to address the potential impact of the Rack Wash building (IA-1c) located immediately upgradient of the boring location and thus sampled for VOCs. The sample from soil boring IA1-6 was collected from 15 feet bgs which is deeper than the range of subsurface soil (0 to 10 feet bgs) considered for potential direct contact for human receptors. It should be noted that all VOCs were detected at concentrations less than their respective medium-specific GNS values. Also, groundwater samples were not collected from IA-1. Therefore, IA-1 was not considered further.

- IA-3 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Therefore, IA-3 was not considered further.

- IA-6 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 2 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1. Similar groundwater results were not added to the Table 2 soil results because the only chemicals detected in IA-6 groundwater (monitoring well MW6-1) were gasoline range organics (GRO) and the C20-C34 petroleum fraction. The Property was given a NFA by the Ohio BUSTR (ODC 2003). Therefore, IA-6 was not considered further.

- IA-7 – Wipe sampling for polychlorinated biphenyls (PCB) were all nondetect (see Table E6 in Appendix E). Therefore, IA-7 was not considered further.

- IA-8 – Information regarding IA-8 includes the results of a geophysical survey conducted within the Main Plant Building and analysis of samples from soil boring IA4-10 (Tetra Tech 2015), – the closest soil boring to the Main Plant Building. IA4-10 was installed to evaluate the horizon corresponding to the "marriage station" as an additional investigative tool to support the geophysical investigation of that feature. The sample depth was targeted to correspond with the elevation of the feature as described in the Site-Specific Work Plan and the Phase II ESA (Tetra Tech 2015). As a result, no soil samples were collected within 25 feet bgs. Therefore, no potential for direct contact with site-related chemicals in soil was identified. Further, all chemical concentrations in soil (sample collected 25 to 27.5 feet bgs) were less than commercial/industrial and construction/excavation GNS values – see Appendix E). Also, groundwater samples were not collected from IA-8. Therefore, IA-8 was not considered further.

- IA-9 -- The waste water treatment system is a closed loop and no evidence of a release was identified in association with this feature. In addition, the IA was limited to the footprint of the building. As a result, no Phase II PA activities were conducted in this area. This IA is considered resolved. The raw materials storage area to the east that was formerly included in IA-9 has been separated from the WWTP and now represents IA-14.

- IA-11 – Information regarding IA-11 was requested by Ohio EPA to support cost estimation for demolition of the building. Asbestos-containing building material (ACBM) is outside the scope of the VAP and the abatement work was conducted under Ohio EPA oversight. Therefore, IA-11 was not considered further.

- IA-12 – Wood block flooring at various locations in the Main Plant Building has been removed. Analytical results were collected at Ohio EPA's request only to characterize the building materials for disposal purposes. Building materials (such as wood block flooring) are not eligible for inclusion under VAP. Therefore, IA-12 was not considered further.

- IA-13 – As documented in Appendix E, no chemical-specific exceedances of medium-specific GNS values were identified for this IA. Table 4 presents the results of the cumulative adjustment for multiple chemicals (OAC 3745-300-08 (F)) for soil. The cumulative cancer and noncancer risk ratios for commercial/industrial and construction/excavation workers are all less than 1. Also, groundwater samples were not collected from IA-13. Therefore, IA-13 was not considered further.

Similarly, as documented in Appendix E (see Table E-6), no chemical-specific exceedances of residential soil GNS values (see OAC 3745-300-08 (H) (2) (a)) were exceeded for the single sediment sample (SD12-LAN-0411) from Beer Road Ditch. Therefore, potential exposure by human receptors (recreationalists) to sediment in Beer Road Ditch was not considered further.

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

- IA-2
- IA-4
- IA-5

- IA-10
- IA-14

All chemicals positively detected in at least one medium-specific sample (soil and groundwater) were considered COCs for that medium. The 46 soil, 28 groundwater, and 21 sediment COCs identified and carried through the risk assessment are listed in Table 3.

Risks and hazards were evaluated separately for human receptors -- commercial/industrial and construction/excavation workers and off-property members of the general public (qualitatively) (Section 7.1.1) and ecological receptors (Section 7.1.2). These results are summarized Tables 11 (human receptors) and 5 (ecological receptors) and below.

7.1.1 Human Receptors

Commercial/industrial Workers

Based on the intended future commercial/industrial use of the Subject Property, risks and hazards calculated for commercial/industrial workers were compared to a target cumulative risk of 1E-05 (OAC 3745-300-09 (B) (1) (a)) and a target cumulative hazard of 1 (OAC 3745-300-09 (B) (2). The additional requirement that the cumulative cancer risk to off-property receptors, attributable to COCs, is less than 1E-05 (OAC 3745-300-09 (B) (1) (a)) is discussed in Section 5.4 and summarized below.

Risks

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

- Total IA-specific risks for IA-2 (2E-09) and IA-14 (1E-08) are less than 1E-06.

- Total IA-specific risks for IA-5 (1E-05) and IA-10 (1E-05) are equal to the target cumulative risk of 1E-05 (OAC 3745-300-09 (B) (1) (a)). Also, total risks at both IAs are driven by potential exposure to arsenic in soil. The EPCs for arsenic in soil at IA-5 (15 mg/kg) and IA-10 (18 mg/kg) are similar to the concentration of arsenic (13.8 to 14 mg/kg) measured in soil samples collected at two locations judged to be insignificantly impacted by property activities (see Table E2 in Appendix E). It is recognized that these two locations do not meet the VAP background requirements (OAC 3745-300-07 (H)) and are presented for context only.

- Total IA-specific risks for IA-4 based on direct exposure to surface soil (4E-04) and direct exposure to subsurface soil (2E-04) exceed both a target cumulative risk of 1E-05 (OAC 3745-300-09 (B) (1) (a)). These total risks are driven by potential exposure to carcinogenic PAHs.

Hazards

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

- Total IA-specific HIs for IA-2 (7E-03), IA-5 (8E-02 – surface soil and 5E-02 – subsurface soil),- IA-10 (5E-02), and IA-14 (7E-04)are less than 1.

- Total IA-specific HIs for IA-4 are 0.5 (surface soil) and 2 (subsurface soil). The surface soil result is less than 1. The subsurface soil result was further evaluated based onsegregation based on similar toxicity mechanism(s) and the highest segregated total HI was 1 based on petroleum fractions C10-C20 and C20-C34. Therefore, the IA-4 hazards for commercial/industrial workers are likely to be insubstantial. However, as discussed in Section 7.2, the total HI for IA 4 is still considered to exceed 1.

Construction/Excavation Workers

Based on the intended future commercial/industrial use of the Subject Property, 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 (B) (1) (a) and 3745-300-09 (B) (2)).

Risks

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

- Total risk for IA-2 (2E-08) and IA-14 (1E-12) are less than or equal to 1E-06.

- Total risks for IA-5 (8E-06) and IA-10 (2E-06) are less than the target cumulative risk of 1E-05 (OAC 3745-300-09 (B) (1) (a)).

- Total risk for IA-4 (2E-05) exceeds the target cumulative risk of 1E-05 (OAC 3745-300-09 (B) (1) (a)) and is driven by potential exposure to carcinogenic PAHs.

Hazards

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

- Total HIs for IA-2 (1E-02), IA-4 (1),IA-10 (5E-02), IA-14 (not applicable – no COCs with noncarcinogenic toxicity factors for inhalation) are less than or equal to 1.

- Total HI for IA-5 (2) exceeds the cumulative target hazard of 1 and is driven by potential exposure to trichloroethene in trench air. However, this result is judged only marginally significant because trichloroethene was detected in only 1 of 4 wells at IA-5. When the most recent trichloroethene concentration is considered, the HI for trichloroethene was reduced from 1.6 to 1.1 and the total HI was reduced from 1.6 to 1.2 (which rounds to 1 at one significant figure).

General Public

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 (B)(1)(a) and 3745-300-09 (B) (2)).

- Potential exposures via off-site inhalation of particulates and volatiles are insubstantial.

- Potential exposure to COCs in off-site potable groundwater is less than 1E-05 based on a variety of lines of evidence:
    - All potential nearby off-property receptors receive potable water from the public water supply (e.g., the city).
    - The groundwater concentrations measured in groundwater monitoring well MW9-1, located on the southeast Subject Property boundary, are all less than residential groundwater GNS values.
    - Groundwater concentrations modeled from the on-property groundwater monitoring wells (MW2-1, MW2-2, MW5-2S/D, MW5-4, and MW10-2) to the boundaries of the Subject Property are all less than their respective residential groundwater GNS values.

7.1.2 Ecological Receptors

Potential risks to ecological receptors were evaluated in accordance with OAC 3745-300-08 (I) (see Section 5.1.4). A total HI of 19 was calculated. Seven constituents contributed HQs > 1, including PAHs (acenaphthene, benzo[a]anthracene, benzo[a]pyrene, chrysene, fluoranthene, and pyrene), as well as acetone. As discussed above for human exposure to sediment in Beer Road Ditch, ecological hazards should be considered in the context of (1) likely contributions of PAH contamination from off-property sources such as and the documented release from an upgradient industrial/commercial operation along Beer Road and (2) no evidence of on-site releases of hazardous substances or petroleum products to the on-property drainage system. Finally, as discussed in Section 5.4, for most constituents a TEC was used in the HQ calculations. For these constituents all concentrations were less than their respective PECs.

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 IA-2, IA-10, and IA-14 are less or equal to receptor-specific target cumulative risks and hazards. Therefore, remediation at these IAs is not required.
- Risks and hazards associated with IA-5 are less than or equal to receptor-specific target cumulative risks and hazards with one exception. The total HI for construction/excavation workers was calculated as 2, which exceeds the target hazard of 1. This total HI is driven by potential exposure to trichloroethene in trench air. However, trichloroethene was detected in only 1 of 4 monitoring wells at IA-5. The HI for trichloroethene (1.6) based on the maximum detected concentration of trichloroethene from monitoring well MW5-2S (11 μg/L) was reduced to 1.1 (and the total HI reduced from 1.6 to 1.2) when the trichloroethene concentration (7.7 μg/L) measured in a second sample collected two months later from MW5-2S is used. The revised total HI of 1.2 reduces to 1 at one significant figure.
- Risks and hazards at IA-4 exceed the target cumulative risk and hazard for commercial/industrial workers and for construction/excavation workers. These risks and hazards are driven by potential

exposure to carcinogenic PAHs in soil. Excavation of PAH-contaminated soils at IA-4 (see Figure 5) will be required.

- Potential off-property risks related to COC exposures from the Subject Property are less than a target cumulative risk of 1E-05 and a target cumulative hazard of 1 (OAC 3745-300-09 (B)(1)(a) and 3745-300-09 (B) (2), respectively) based on (1) insubstantial exposures (inhalation of particulates and vapors) and (2) measured and modeled groundwater concentrations at the Subject Property boundaries less than 1E-05.Potential off-property risks to ecological receptors from the Subject Property exceed a target hazard of 1 associated with potential exposures to constituents (primarily PAHs) in sediment in Beer Road Ditch. This result suggests a potential excess risk to ecological receptors in Beer Road Ditch. However, as noted in Section 7.1.2, these risks are associated with impacts from a documented off-property release of diesel fuel from an adjacent property and other potential sources of contamination (such as traffic along Beer Road and industrial/commercial operations upgradient of Beer Road Ditch) and the fact that no known on-site releases of petroleum or fuel into the on-property drainage system were identified.

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

Risk Assessment Outcome for Commercial/Industrial Worker Scenario

Area	Risk	Hazard	Recommended Action
IA-2	Pass	Pass	No Action Required
IA-4	Fail	Fail	Excavation of PAH-contaminated soil
IA-5	Pass	Pass	No Action Required
IA-10	Pass	Pass	No Action Required
IA-14	Pass	Pass	No Action Required

Risk Assessment Outcome for Construction/Excavation Worker Scenario

Area	Risk	Hazard	Recommended Action
IA-2	Pass	Pass	No Action Required
IA-4	Fail	Fail	Excavation of PAH-contaminated soil
IA-5	Pass	Pass	No Action Required*
IA-10	Pass	Pass	No Action Required
IA-14	Pass	Pass	No Action Required

* See text for more discussion.

Risk Assessment Outcome for Off-Property Exposure Scenarios

Area	Risk	Hazard	Recommended Action
Off-Property – General (inhalation of fugitive dust and vapors and potable groundwater use)	Pass	Pass	No Action Required

Risk Assessment Outcome for Off-Property Ecological Exposure Scenario

Area	Risk	Recommended Action
Beer Road Ditch	Fail	No Action Required ([1] Documented Release by off-property source of PAHs, [2] No known on-site releases of hazardous substances or petroleum products to on-property drainage system)

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 commercial/industrial properties, excavation of PAH-contaminated soil at IA-4 is required. Figure 5 presents a preliminary layout of the area where excavation is expected to be necessary.

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Figures

FIGURES